ACTION PLAN FOR INDUSTRIAL CLUSTER IN SEVERLY POLLUTED AREA

Monitoring, sampling, analysis of Stack, Ambient Air Quality, Surface Water, Ground Water, Waste Water

पिंपरी-चिंचवाड़ Pimpri-Chinchwad

Maharashtra Pollution Control Board

Kalptaru Point, Sion East, Mumbai - 400022

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

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 analysing 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:

Rapid modernization and industrialization worldwide has not only uprooted to the economic development, but has increased pollution of land, air and water. This has also destroyed our habitat and environment too. Pollutants discharged from the industries have widespread implications and one of the unpleasant effects on water bodies and air.Long term exposure to the polluted air and water causes chronic health problems, making the issue industrial pollution into severe one. So, 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.

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. 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.

Pimpri-Chinchwad is part of Pune Metropolitan City in the state of Maharashtra, India. Pimpri-Chinchwad today is one of the major industrial hubs in Asia. Industrialization started in 1954 with the arrival of Hindustan Antibiotics Limited. PCMC is now home to the Indian operations of major automobile companies like Premier Limited, Mahindra & Mahindra Ltd., Mahindra Engineering services, Bajaj Auto, BEL Optronic Devices Limited, TATA Motors (formerly TELCO), Kinetic Engineering, Force Motors (formerly Bajaj Tempo) Daimler Chrysler, Thermax and Autoline Industries. In addition to this, several heavy industries such as Forbes-Marshall, Thyssen Krupp and GEAE coflex, AlfaLaval & Sandvik Asia have their manufacturing units in the town and also the German company KSB Pumps, Swedish bearing company SKF.

2. Scope of Work

The Scope of Work consisted of the following:

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

- At each of the 5 CPAs and 3 SPAs, 24 hourly ambient air quality monitoring to be carried out.

- Representative samples for surface water quality, waste water quality and ground water quality to be collected from prominent surface and ground water bodies located in and around the clusters/areas.

- Submission of complete monitoring, sampling and analysis reports including the summary of the parameters exceeding the prescribed standards/norms for all the 5 CPAs and 3 SPAs.

- Submission of 3 copies of final report with photographs at prominent locations and the CD (soft copy) on completion of the project for every critically polluted and severely polluted area separately.

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

- The sampling was carried out in 5 days i.e. on 4th June to 9th June 2017 for Pimpri-Chinchwad region.

- A total of 6 Stack Monitoring Samples, 6 Ambient Air Quality Monitoring Samples, 6 Waste Water Samples, 6 Ground Water Samples and 2 VOC Samples from Stack were collected and analyzed.

2.1 Stack Emission Parameters

The Stack Emissions were analyzed with the following parameters:

1. Acid Mist
2. Ammonia
3. Carbon Monoxide
4. Chlorine
5. Fluoride(gaseous)
6. Fluoride (particulate)
7. Hydrogen Chloride
8. Hydrogen Sulphide
9. Oxides of Nitrogen
10. Oxygen
11. Polyaromatic Hydrocarbons (Particulate)
12. Suspended Particulate Matter
13. Sulphur Dioxide
14. Benzene

15. Toluene
16. Xylene
17. Volatile Organic Compounds (VOCs)

2.2 Ambient Air Quality Parameters

The Ambient Air Quality was analyzed with the following parameters:

1. Sulphur Dioxide (SO_2)
2. Nitrogen Dioxide (NO_2)
3. Particulate Matter (PM10)
4. Particulate Matter (PM2.5)
5. Ozone (O_3)
6. Lead (Pb)
7. Carbon Monoxide (CO)
8. Ammonia (NH_3)
9. Benzene (C_6H_6)
10. Benzo (a) Pyrene (BaP) (Particulate Phase Only)
11. Arsenic (As)
12. Nickel (Ni)

2.3 Water/Waste Water Parameters

The Water/Waste Water wasanalyzed with the following parameters:

a. Prominent Surface Water bodies such as outfalls of CETPs, ETPs, treated effluent drainage, river, canal, ponds, lakes and other such water supply resources flowing through the area or flowing adjoining the CPA.

b. Ground Water Quality data of prominent ground water resources such as observation wells of Central Ground Water Board, drinking water wells, hand pumps, bore wells, hand pumps, bore wells and other such water supply resources located in the industrial cluster/area under consideration or in the peripheral areas.

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

i. Simple Parameters:

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

ii. Regular Monitoring Parameters:

7. pH
8. Oil & Grease
9. Suspended Solids
10. Dissolved Oxygen (% saturation) (Not applicable for ground waters)
11. Chemical Oxygen Demand
12. Biochemical Oxygen Demand
13. Electrical Conductivity
14. Nitrite-Nitrogen
15. Nitrate-Nitrogen
16. (NO_2 + NO_3)-Nitrogen
17. Free Ammonia
18. Total Residual Chlorine
19. Cyanide
20. Fluoride
21. Sulphide
22. Dissolved Phosphate
23. Sodium Absorption Ratio (SAR)

24. Total Coliforms (MPN/100 ml)
25. Faecal Coliforms (MPN/100 ml)

iii. Special Parameters:

26. Total Phosphorous
27. Total Kjeldahl Nitrogen(TKN)
28. Total Ammonia (NH_4 +NH_3)-Nitrogen
29. Phenols
30. Surface Active Agents
31. Organo Chlorine Pesticides
32. Polynuclear aromatic hydrocarbons (PAH)
33. Polychlorinated Biphenyls (PCB)and Polychlorinated Terphenyls (PCT)
34. Zinc
35. Nickel
36. Copper
37. Hexavalent Chromium
38. Chromium (Total)
39. Arsenic (Total)
40. Lead
41. Cadmium
42. Mercury
43. Manganese
44. Iron
45. Vanadium
46. Selenium
47. Boron

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

2.3 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. Water/Wastewater Sampling and Analysis Methodology - **Annexure III**

3. Result of Analysis:

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

***Kindly note:**

- NA specifies the sample is not analysed for the specific parameter.
- BDL specifies that the result obtained is below detection limit.

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

3.1 Stack Emission:

Stack Emission Monitoring Results are compared against The Environment (Protection) Rules, 1986 General Emission Standard - Part D.

Sr.	Name of Industry	Stack Identity	Table No.
1.	Alfa Laval (India) Ltd.	Paint Booth	**I**
2.	Amphinol Interconnect	Scrubber	**I**
3.	Alicon Castalloy Ltd.	Melting Furnace	**I**
4.	Exide Industries	Stack No. 24	**II**
5.	Exide Industries	Stack No. 1	**II**
6.	Tata Motor	Stack No. 17	**II**

***The VOC result of stack emission is provided in Table No. III**

Table No. I

Name of Industry			**Alfa Laval (India) Ltd.**	**Amphinol Interconnect**	**Alicon Castalloy Ltd.**
Date of Sampling			**05.06.17**	**05.06.17**	**07.0617**
Sr.	**Parameter**	**Unit**	**Results**		
1.	Particulate Matter (as PM)	mg/Nm^3	11	NA	23
	Std. Limit	**mg/Nm^3**	**150**	**-**	**150**
2.	Sulphur Dioxide (as SO_2)	mg/Nm^3	NA	5.33	5.51
		kg/day	NA	0.28	1.03
	Std. Limit	**mg/Nm^3**	**-**	**100**	**100**
3.	Nitrogen Dioxide (NO_2)	mg/Nm^3	NA	157	167
	Std. Limit	**mg/Nm^3**	**-**	**50**	**50**
4.	Acid Mist (as H_2SO_4)	mg/Nm^3	108	NA	NA
5.	Carbon Monoxide (CO)	mg/Nm^3	BDL	BDL	BDL
6.	Oxygen (O_2)	mg/Nm^3	NA	NA	NA

Table No. II

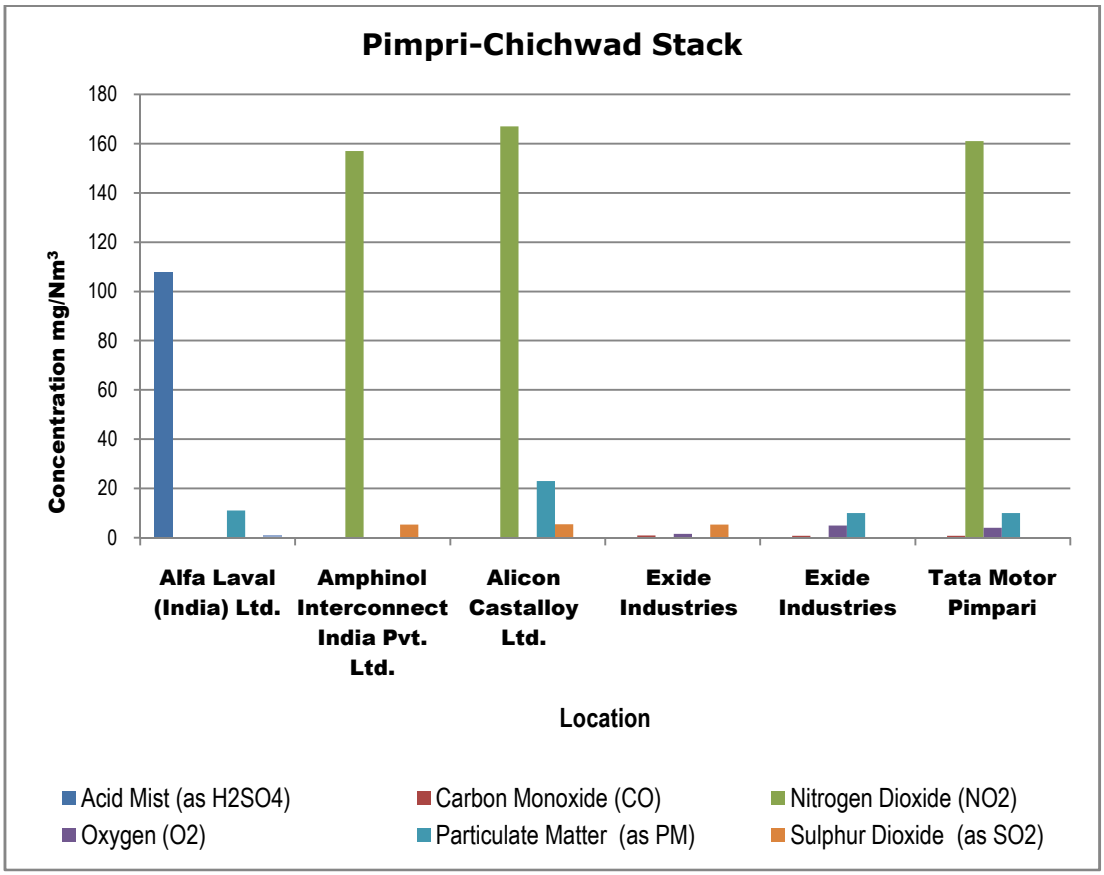
Name of Industry			**Exide Industries**	**Exide Industries**	**Tata Motor**
Date ofSampling			**08.06.17**	**08.06.17**	**09.0617**
Sr.	**Parameter**	**Unit**	**Results**		
1.	Particulate Matter (as PM)	mg/Nm^3	BDL	10	10
	Std. Limit	**mg/Nm^3**	**150**	**150**	**150**
2.	Sulphur Dioxide (as SO_2)	mg/Nm^3	5.33	BDL	BDL
		kg/day	0.13	BDL	BDL
	Std. Limit	**mg/Nm^3**	**100**	**100**	**100**

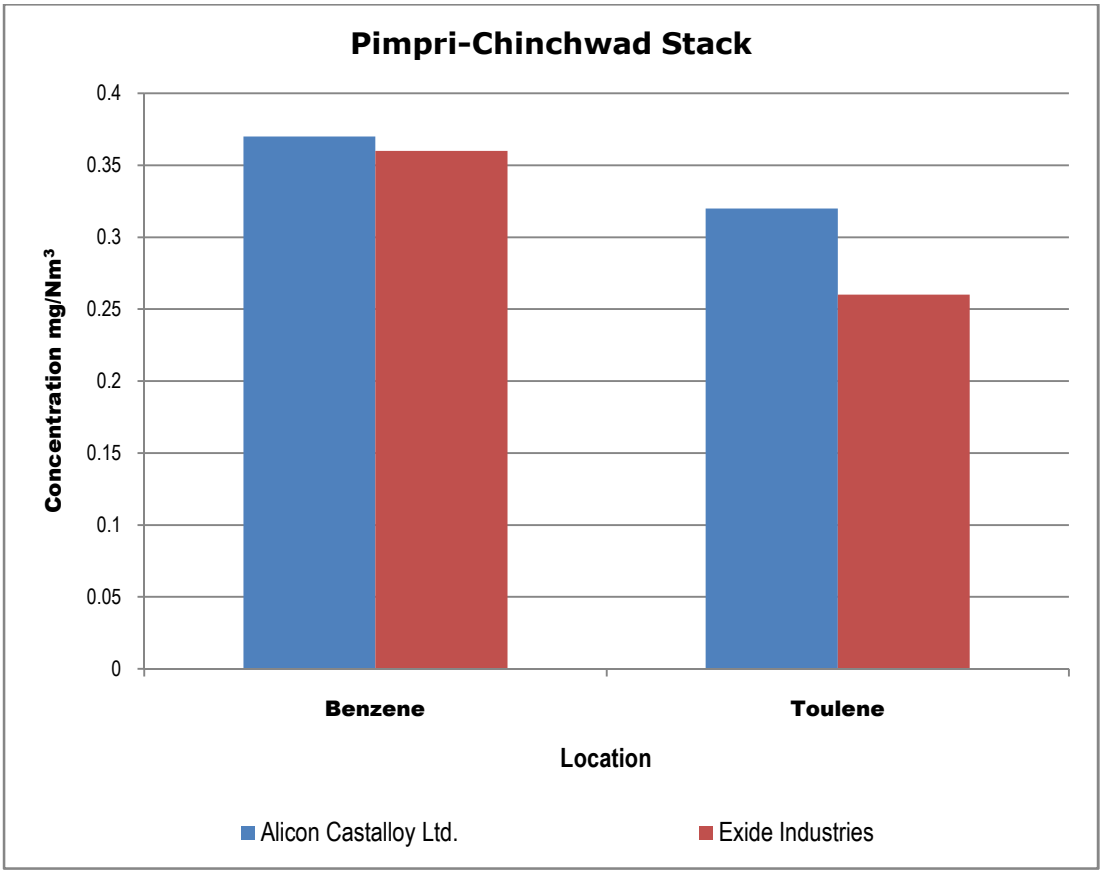
Name of Industry			**Exide Industries**	**Exide Industries**	**Tata Motor**
Date ofSampling			**08.06.17**	**08.06.17**	**09.0617**
Sr.	**Parameter**	**Unit**	**Results**		
3.	Nitrogen Dioxide (NO_2)	mg/Nm^3	NA	NA	161
	Std. Limit	**mg/Nm^3**	**50**	**50**	**50**
4.	Acid Mist (as H_2SO_4)	mg/Nm^3	NA	NA	NA
5.	Carbon Monoxide (CO)	mg/Nm^3	0.96	0.81	0.82
6.	Oxygen (O_2)	mg/Nm^3	1.6	5	4

Table No. III

Name of Industry			**Alicon Castalloy Ltd.**	**Exide Industries (Stack No. 1)**
Date of Sampling			**07.06.17**	**08.06.17**
Sr.	**Parameter**	**Unit**	**Results**	
1.	VOC			
I.	Methyl Isobutyl Ketone	mg/Nm^3	ND	ND
II.	Benzene	mg/Nm^3	0.37	0.36
III.	Toulene	mg/Nm^3	0.32	0.26
IV.	Xylene	mg/Nm^3	ND	ND
V.	Ethyl Benzene	mg/Nm^3	ND	ND
VI.	Ethyl Acetate	mg/Nm^3	ND	ND

Graphs: Stack Monitoring for Pimpri-Chinchwad:





3.2 Ambient Air Quality:

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

Sr.	Location	Location detail	Table No.
1.	Exide Industries	Assembly Point	**I**
2.	Rich Graviss Products Pvt. Ltd.	Near PSC	**I**
3.	Alfa Lava India Pvt. Ltd.	Near ETP	**I**
4.	Amphinol Inter connect India Pvt. Ltd.	Near Office	**II**
5.	Alicon Cast Alloy Ltd.	Near Main Gate	**II**
6.	SKF India Ltd.	Logistic Centre	**II**

Table No. I

Location				**Exide Industries**	**Rich Graviss Products Pvt. Ltd.**	**Alfa Lava India Pvt. Ltd.**
Date of Sampling				**04.06.17**	**04.06.17**	**06.06.17**
Sr.	**Parameters**	**Unit**	**Std. Limit (NAAQS 2009)**	**Results**		
1.	Sulphur Dioxide (SO_2)	$\mu g/m^3$	**80**	BDL	BDL	BDL
2.	Nitrogen Dioxide (NO_2)	$\mu g/m^3$	**80**	4.05	5.27	5.46
3.	Particulate Matter (size less than 10 µm) or PM_{10}	$\mu g/m^3$	**100**	16	39	28
4.	Particulate Matter (size less than 2.5 µm) or $PM_{2.5}$	$\mu g/m^3$	**60**	6	11	10
5.	Ozone (O_3)	$\mu g/m^3$	**180**	BDL	BDL	BDL
6.	Lead (Pb)	$\mu g/m^3$	**1**	0.021	0.021	0.021
7.	Carbon Monoxide (CO)	mg/m^3	**4**	1.14	0.7	1.29
8.	Ammonia (NH_3)	$\mu g/m^3$	**400**	BDL	BDL	BDL

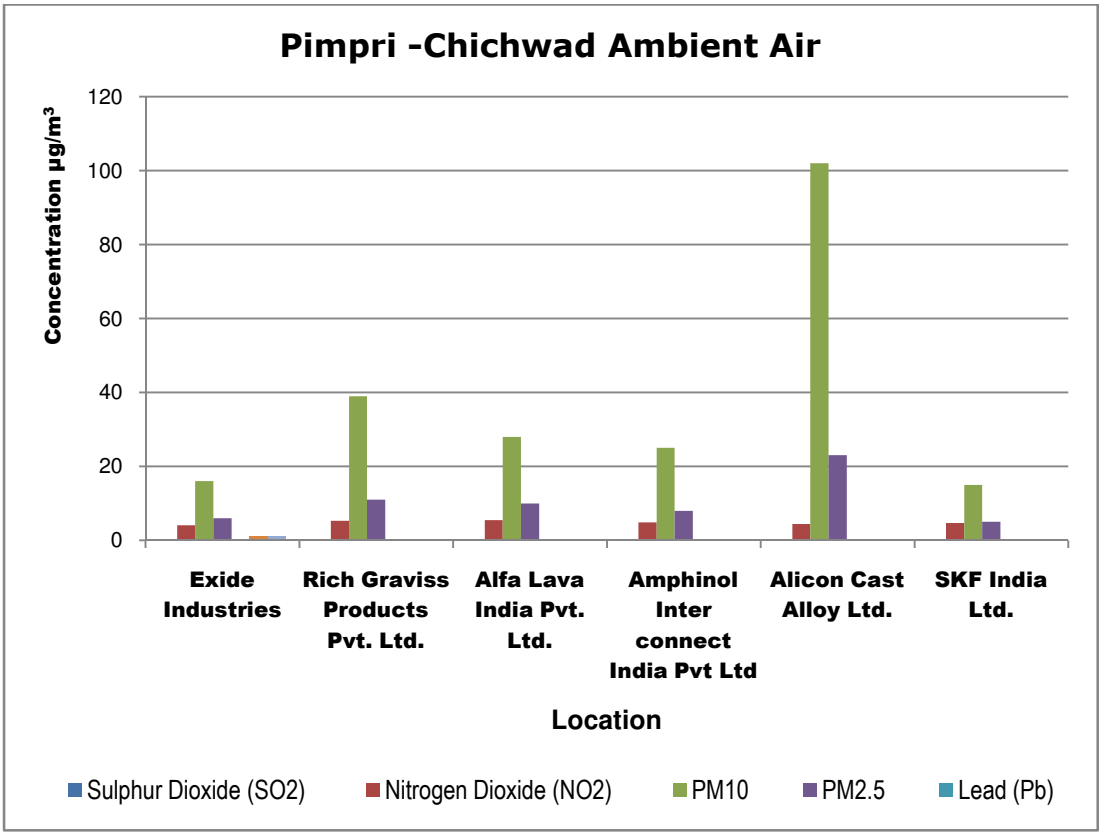
Location				Exide Industries	Rich Graviss Products Pvt. Ltd.	Alfa Lava India Pvt. Ltd.
Date of Sampling				04.06.17	04.06.17	06.06.17
Sr.	**Parameters**	**Unit**	**Std. Limit (NAAQS 2009)**	**Results**		
9.	Benzene (C_6H_6)	$\mu g/m^3$	**5**	BDL	BDL	BDL
10.	Benzo (a) Pyrene (BaP) – particulate phase only	ng/m^3	**1**	BDL	BDL	BDL
11.	Arsenic (As)	ng/m^3	**6**	BDL	BDL	BDL
12.	Nickel (Ni)	ng/m^3	**20**	3.09	3.13	BDL

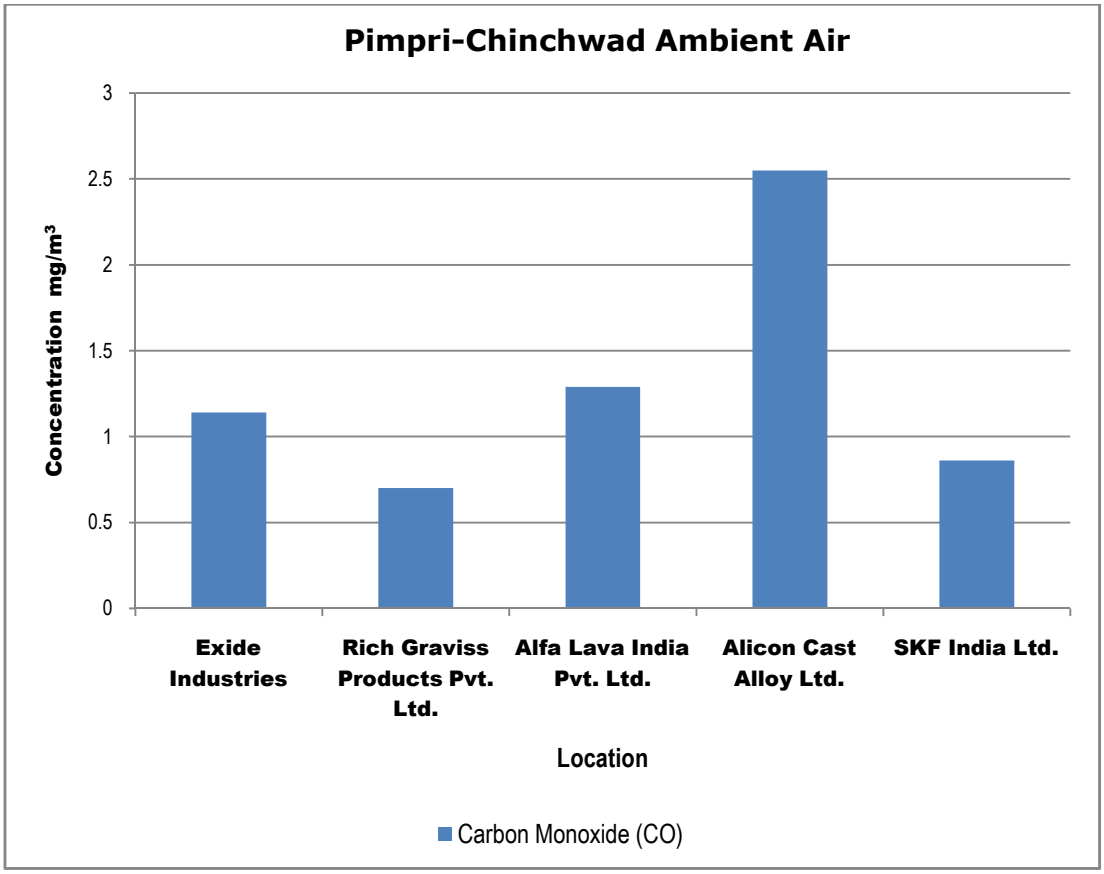
Table No. II

Location				Amphinol Inter connect India Pvt. Ltd.	Alicon Cast Alloy Ltd.	SKF India Ltd.
Date of Sampling				06.06.17	08.06.17	08.06.17
Sr.	**Parameters**	**Unit**	**Std. Limit (NAAQS 2009)**	**Results**		
1.	Sulphur Dioxide (SO_2)	$\mu g/m^3$	**80**	BDL	BDL	BDL
2.	Nitrogen Dioxide (NO_2)	$\mu g/m^3$	**80**	4.86	4.45	4.65
3.	Particulate Matter (size less than 10 µm) or PM_{10}	$\mu g/m^3$	**100**	25	102	15
4.	Particulate Matter (size less than 2.5 µm) or $PM_{2.5}$	$\mu g/m^3$	**60**	8	23	5
5.	Ozone (O_3)	$\mu g/m^3$	**180**	BDL	BDL	BDL
6.	Lead (Pb)	$\mu g/m^3$	**1**	0.021	BDL	BDL

Location				Amphinol Inter connect India Pvt. Ltd.	Alicon Cast Alloy Ltd.	SKF India Ltd.
Date of Sampling				06.06.17	08.06.17	08.06.17
Sr.	**Parameters**	**Unit**	**Std. Limit (NAAQS 2009)**	**Results**		
7.	Carbon Monoxide (CO)	mg/m^3	**4**	BDL	2.55	0.86
8.	Ammonia (NH_3)	$\mu g/m^3$	**400**	BDL	BDL	BDL
9.	Benzene (C_6H_6)	$\mu g/m^3$	**5**	BDL	BDL	BDL
10.	Benzo (a) Pyrene (BaP) – particulate phase only	ng/m^3	**1**	BDL	BDL	BDL
11.	Arsenic (As)	ng/m^3	**6**	BDL	BDL	BDL
12.	Nickel (Ni)	ng/m^3	**20**	BDL	BDL	BDL

Graphs: Ambient Air Quality Monitoring for Pimpri-Chinchwad:





3.3 Water/ Waste Water Quality:

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

Sr.	Location	Source	Table No.
1.	Rich Graviss Products Pvt. Ltd.	ETP Outlet	**I**
2.	Exide Indusries	ETP Outlet	**I**
3.	Amphinol Inter Connect India Pvt Ltd.	STP Outlet	**I**
4.	Alfa Laval (India) Ltd.	STP Outlet	**II**
5.	Tata Motor-Pimpri	STP Outlet	**II**
6.	Alicon Cast Alloy Ltd.	ETP Outlet	**II**

Table No.I

Location				**Rich Graviss Products Pvt. Ltd.**	**Exide Indusries**	**Amphinol Inter Connect India Pvt Ltd.**
Date of Sampling				**08.06.17**	**08.06.17**	**08.06.17**
Sr.	**Parameters**	**Unit**	**Std. Limit**	**Results**		
1.	Colour	Hazen		5	1	1
2.	Smell	-		Agreeable	Agreeable	Agreeable
3.	pH	-	**5.5 -9.0**	7.59	7.87	7.15
4.	Oil &Grease	mg/L	**10.0**	BDL	BDL	BDL
5.	Suspended Solids	mg/L	**100.0**	21	28	27
6.	Dissolved Oxygen (%Saturation)	%		65	60	65
7.	Chemical Oxygen Demand	mg/L	**250.0**	20	50	20
8.	Biochemical Oxygen Demand (3days,27^{o}C)	mg/L	**30.0**	7	18	7
9.	Electrical Conductivity (at25^{o}C)	µmho/cm		215	554	634
10.	Nitrite Nitrogen (asNO_2)	mg/L		BDL	BDL	BDL
11.	Nitrate Nitrogen (asNO_3)	mg/L	**10.0**	1.2	3.32	42.6
12.	(NO_2+NO_3)-Nitrogen	mg/L	**5.0**	1.2	3.32	42.6
13.	Free Ammonia (asNH_3-N)	mg/L	**5.0**	BDL	BDL	BDL

Location				**Rich Graviss Products Pvt. Ltd.**	**Exide Indusries**	**Amphinol Inter Connect India Pvt Ltd.**
Date of Sampling				**08.06.17**	**08.06.17**	**08.06.17**
Sr.	**Parameters**	**Unit**	**Std. Limit**	**Results**		
14.	Total Residual Chlorine	mg/L	**1.0**	BDL	BDL	BDL
15.	Cyanide (as CN)	mg/L	**0.2**	BDL	BDL	BDL
16.	Fluoride(as F)	mg/L	**2.0**	0.28	0.52	0.76
17.	Sulphide (as S_{2-})	mg/L	**2.0**	BDL	BDL	BDL
18.	Dissolved Phosphate (as P)	mg/L	**5.0**	BDL	BDL	BDL
19.	Sodium Absorption Ratio	mg/L		0.7	0.75	0.97
20.	Total Coliforms	MPNindex /100ml	**100.0**	BDL	79	13
21.	Faecal Coliforms	MPNindex /100ml	**1000.0**	BDL	14	4.5
22.	Total Phosphorous (as P)	mg/L	**1.0**	BDL	BDL	BDL
23.	Total Kjeldahl Nitrogen	mg/L	**100.0**	2.68	29.1	3.81
24.	Total Ammonia (NH_4+NH_3)-	mg/L	**5.0**	0.26	0.26	0.17
25.	Phenols (as C_6H_5OH)	mg/L	**3.0**	BDL	BDL	BDL
26.	Surface Active Agents (as MBAS)	mg/L	**3.0**	BDL	BDL	BDL

Location				**Rich Graviss Products Pvt. Ltd.**	**Exide Indusries**	**Amphinol Inter Connect India Pvt Ltd.**
Date of Sampling				**08.06.17**	**08.06.17**	**08.06.17**
Sr.	**Parameters**	**Unit**	**Std. Limit**	**Results**		
27.	Organo Chlorine Pesticides					
I.	Alachlor	µg/L	**2.0**	BDL	BDL	0.16
II.	Atrazine	µg/L	**0.2**	BDL	BDL	BDL
III.	Aldrin	µg/L	**0.1**	BDL	BDL	BDL
IV.	Dieldrin	µg/L	**2.0**	BDL	BDL	BDL
V.	Alpha HCH	µg/L	**0.01**	BDL	BDL	BDL
VI.	Beta HCH	µg/L	**2.0**	BDL	BDL	BDL
VII.	Delta HCH	µg/L	**3.0**	BDL	BDL	BDL
VIII.	Butachlor	µg/L		BDL	BDL	BDL
IX.	p,pDDT	µg/L	**0.2**	BDL	BDL	BDL
X.	o,pDDT	µg/L	**0.05**	BDL	BDL	BDL
XI.	p,pDDE	µg/L	**100.0**	BDL	BDL	BDL
XII.	o,pDDE	µg/L	**250.0**	BDL	BDL	BDL
XIII.	p,pDDD	µg/L	**30.0**	BDL	BDL	BDL
XIV.	o,pDDD	µg/L		BDL	BDL	BDL
XV.	Alpha Endosulfan	µg/L	**10.0**	BDL	BDL	BDL
XVI.	Beta Endosulfan	µg/L		BDL	BDL	BDL
XVII.	Endosulfan Sulphate	µg/L	**5.0**	BDL	BDL	BDL
XVIII.	YHCH (Lindane)	µg/L	**1.0**	BDL	BDL	BDL

Location				**Rich Graviss Products Pvt. Ltd.**	**Exide Indusries**	**Amphinol Inter Connect India Pvt Ltd.**
Date of Sampling				**08.06.17**	**08.06.17**	**08.06.17**
Sr.	**Parameters**	**Unit**	**Std. Limit**	**Results**		
28.	Polynuclear aromatic hydrocarbons (as PAH)	mg/L	**0.2**	0.0002	0.0001	0.0001
29.	Polychlorinated Biphenyls (PCB)	mg/L	**2.0**	BDL	BDL	BDL
30.	Zinc(as Zn)	mg/L	**5.0**	BDL	BDL	BDL
31.	Nickel(as Ni)	mg/L	**3.0**	BDL	BDL	0.974
32.	Copper(as Cu)	mg/L		BDL	BDL	BDL
33.	Hexavalent Chromium (as Cr^{6+})	mg/L	**0.1**	BDL	BDL	BDL
34.	Total Chromium (as Cr)	mg/L	**2.0**	BDL	BDL	BDL
35.	Total Arsenic(as As)	mg/L	**0.2**	BDL	BDL	BDL
36.	Lead(as Pb)	mg/L	**0.1**	BDL	BDL	BDL
37.	Cadmium (as Cd)	mg/L	**2.0**	BDL	BDL	BDL
38.	Mercury (as Hg)	mg/L	**0.01**	BDL	BDL	BDL
39.	Manganese (as Mn)	mg/L	**2.0**	0.028	BDL	BDL
40.	Iron(as Fe)	mg/L	**3.0**	BDL	BDL	BDL
41.	Vanadium (as V)	mg/L	**0.2**	BDL	BDL	BDL

Location				**Rich Graviss Products Pvt. Ltd.**	**Exide Indusries**	**Amphinol Inter Connect India Pvt Ltd.**
Date of Sampling				**08.06.17**	**08.06.17**	**08.06.17**
Sr.	**Parameters**	**Unit**	**Std. Limit**	**Results**		
42.	Selenium (as Se)	mg/L	**0.05**	BDL	BDL	BDL
43.	Boron(as B)	mg/L		BDL	0.113	BDL
44.	Bioassay Test on fish	% survival		80	70	70

Table No.II

Location				**Alfa Laval (India) Ltd.**	**Tata Motor**	**Alicon Cast Alloy Ltd.**
Date of Sampling				**08.06.17**	**08.06.17**	**09.06.17**
Sr.	**Parameters**	**Unit**	**Std. Limit**	**Results**		
1.	Colour	Hazen		1	1	1
2.	Smell	-		Agreeable	Agreeable	Agreeable
3.	pH	-	**5.5 -9.0**	7.75	7.58	7.13
4.	Oil &Grease	mg/L	**10.0**	BDL	BDL	BDL
5.	Suspended Solids	mg/L	**100.0**	38	22	8
6.	Dissolved Oxygen (%Saturation)	%		55	65	65
7.	Chemical Oxygen Demand	mg/L	**250.0**	60	20	20
8.	Biochemical Oxygen Demand (3days,27^{o}C)	mg/L	**30.0**	21	7	7

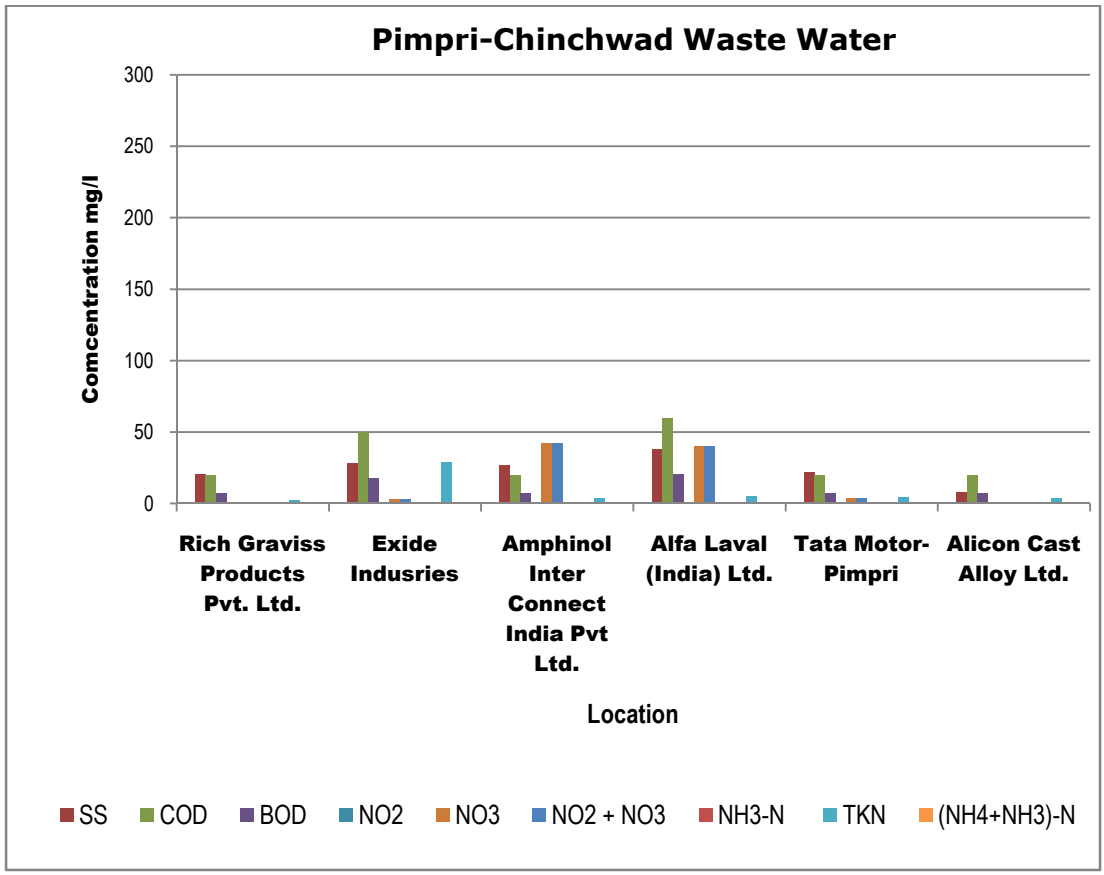
Location				**Alfa Laval (India) Ltd.**	**Tata Motor**	**Alicon Cast Alloy Ltd.**
Date of Sampling				**08.06.17**	**08.06.17**	**09.06.17**
Sr.	**Parameters**	**Unit**	**Std. Limit**	**Results**		
9.	Electrical Conductivity (at25^{o}C)	µmho/cm		413	315	260
10.	Nitrite Nitrogen (asNO_2)	mg/L		BDL	BDL	BDL
11.	Nitrate Nitrogen (asNO_3)	mg/L	**10.0**	40.3	3.6	1.08
12.	(NO_2+NO_3)-Nitrogen	mg/L	**5.0**	40.3	3.6	1.08
13.	Free Ammonia (asNH_3-N)	mg/L	**5.0**	BDL	BDL	BDL
14.	Total Residual Chlorine	mg/L	**1.0**	BDL	BDL	BDL
15.	Cyanide (as CN)	mg/L	**0.2**	BDL	BDL	BDL
16.	Fluoride(as F)	mg/L	**2.0**	0.08	BDL	0.5
17.	Sulphide (as S_{2-})	mg/L	**2.0**	BDL	BDL	BDL
18.	Dissolved Phosphate (as P)	mg/L	**5.0**	BDL	BDL	BDL
19.	Sodium Absorption Ratio	mg/L		0.91	0.79	0.64
20.	Total Coliforms	MPNindex /100ml	**100.0**	49	130	920
21.	Faecal Coliforms	MPNindex /100ml	**1000.0**	33	11	170

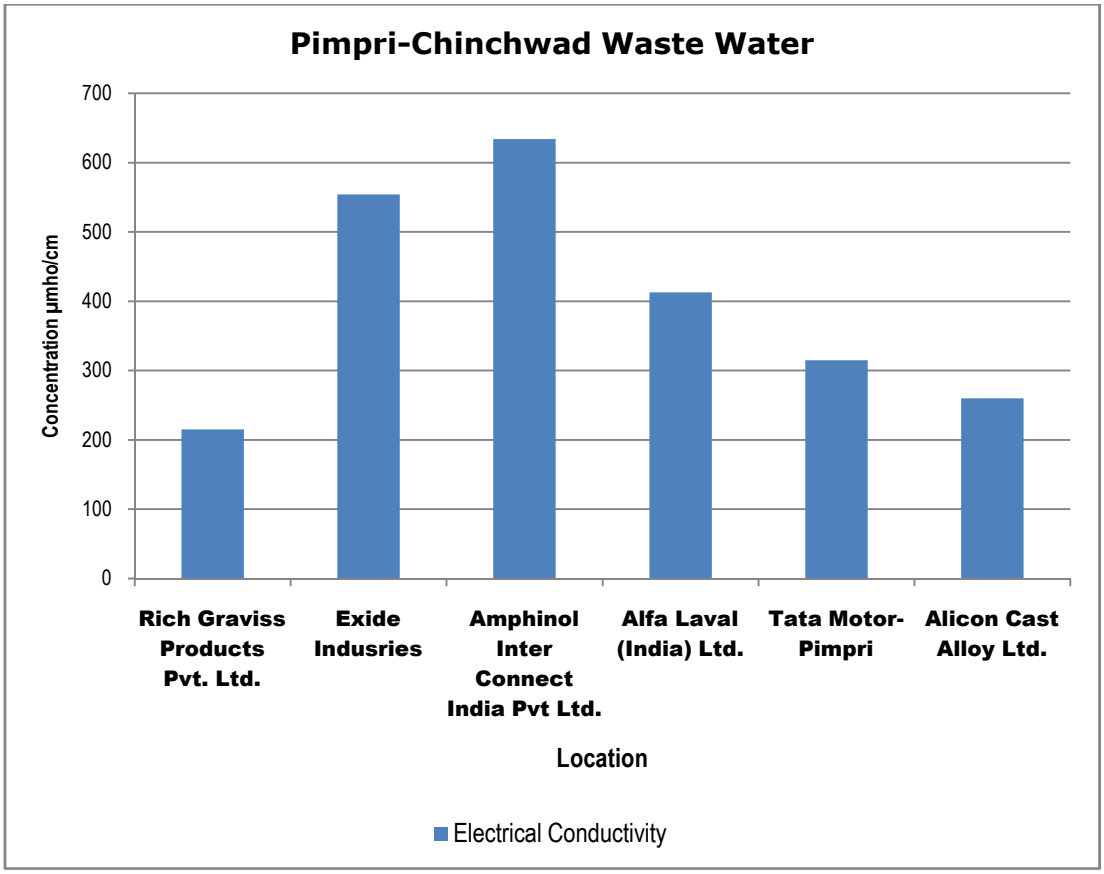
Location				**Alfa Laval (India) Ltd.**	**Tata Motor**	**Alicon Cast Alloy Ltd.**
Date of Sampling				**08.06.17**	**08.06.17**	**09.06.17**
Sr.	**Parameters**	**Unit**	**Std. Limit**	**Results**		
22.	Total Phosphorous (as P)	mg/L	**1.0**	BDL	BDL	BDL
23.	Total Kjeldahl Nitrogen	mg/L	**100.0**	5.26	4.78	3.92
24.	Total Ammonia (NH_4+NH_3)-	mg/L	**5.0**	0.2	0.59	BDL
25.	Phenols (as C_6H_5OH)	mg/L	**3.0**	BDL	BDL	BDL
26.	Surface Active Agents (as MBAS)	mg/L	**3.0**	BDL	BDL	BDL
27.	Organo Chlorine Pesticides					
I.	Alachlor	µg/L	**2.0**	BDL	BDL	BDL
II.	Atrazine	µg/L	**0.2**	BDL	BDL	BDL
III.	Aldrin	µg/L	**0.1**	BDL	BDL	BDL
IV.	Dieldrin	µg/L	**2.0**	BDL	BDL	BDL
V.	Alpha HCH	µg/L	**0.01**	BDL	BDL	BDL
VI.	Beta HCH	µg/L	**2.0**	BDL	BDL	BDL
VII.	Delta HCH	µg/L	**3.0**	BDL	BDL	BDL
VIII.	Butachlor	µg/L		BDL	BDL	BDL
IX.	p,pDDT	µg/L	**0.2**	BDL	BDL	BDL
X.	o,pDDT	µg/L	**0.05**	BDL	BDL	BDL
XI.	p,pDDE	µg/L	**100.0**	BDL	BDL	BDL
XII.	o,pDDE	µg/L	**250.0**	BDL	BDL	BDL

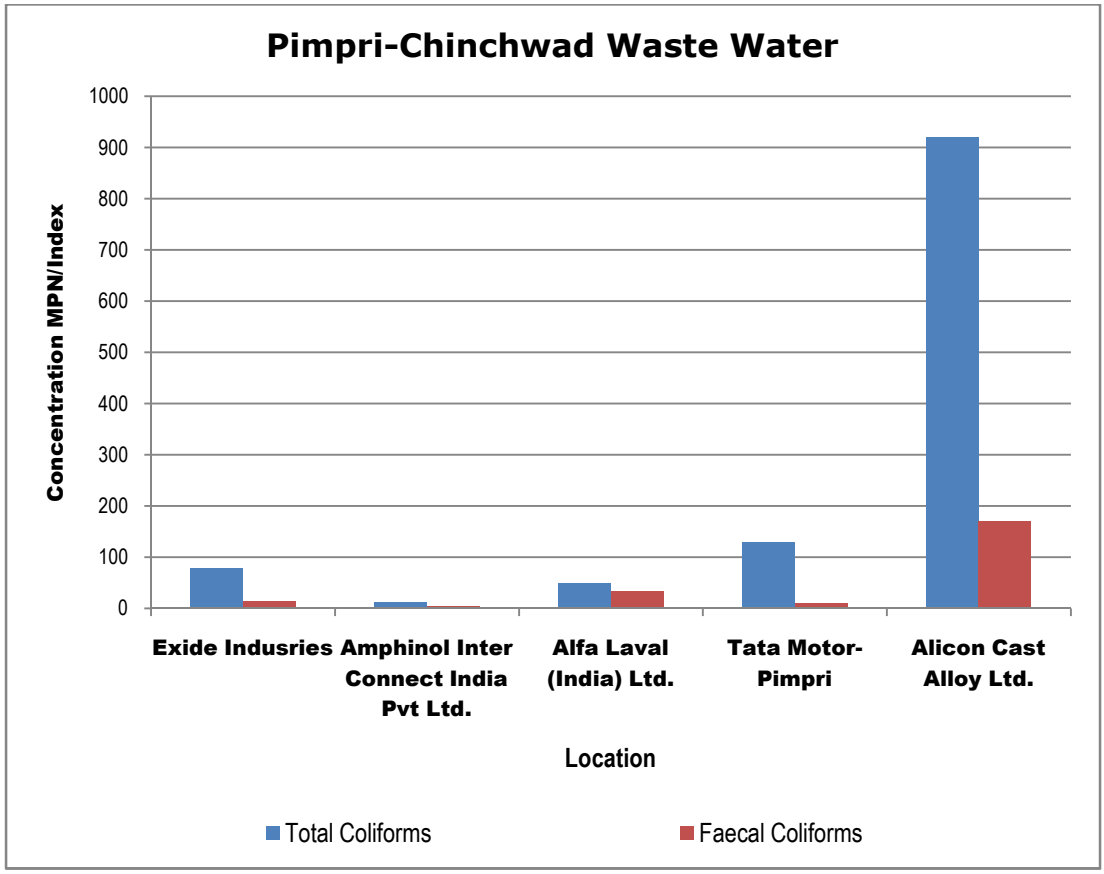
Location				**Alfa Laval (India) Ltd.**	**Tata Motor**	**Alicon Cast Alloy Ltd.**
Date of Sampling				**08.06.17**	**08.06.17**	**09.06.17**
Sr.	**Parameters**	**Unit**	**Std. Limit**	**Results**		
XIII.	p,pDDD	µg/L	**30.0**	BDL	BDL	BDL
XIV.	o,pDDD	µg/L		BDL	BDL	BDL
XV.	Alpha Endosulfan	µg/L	**10.0**	BDL	BDL	BDL
XVI.	Beta Endosulfan	µg/L		BDL	BDL	BDL
XVII.	Endosulfan Sulphate	µg/L	**5.0**	BDL	BDL	BDL
XVIII.	YHCH (Lindane)	µg/L	**1.0**	BDL	BDL	BDL
28.	Polynuclear aromatic hydrocarbons (as PAH)	mg/L	**0.2**	BDL	BDL	BDL
29.	Polychlorinated Biphenyls (PCB)	mg/L	**2.0**	BDL	BDL	BDL
30.	Zinc(as Zn)	mg/L	**5.0**	BDL	BDL	BDL
31.	Nickel(as Ni)	mg/L	**3.0**	0.106	BDL	BDL
32.	Copper(as Cu)	mg/L		BDL	BDL	BDL
33.	Hexavalent Chromium (as Cr^{6+})	mg/L	**0.1**	BDL	BDL	BDL
34.	Total Chromium (as Cr)	mg/L	**2.0**	BDL	BDL	BDL
35.	Total Arsenic(as As)	mg/L	**0.2**	BDL	BDL	BDL
36.	Lead(as Pb)	mg/L	**0.1**	BDL	BDL	BDL

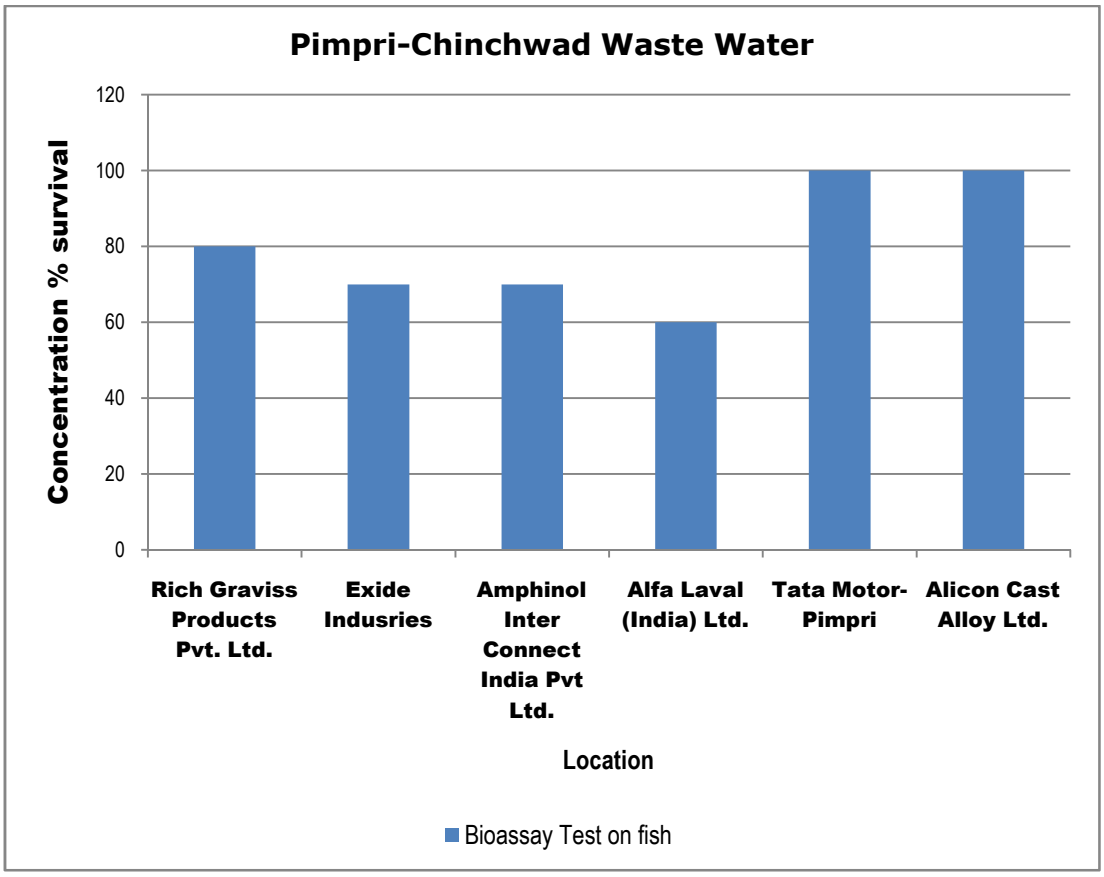
Location				**Alfa Laval (India) Ltd.**	**Tata Motor**	**Alicon Cast Alloy Ltd.**
Date of Sampling				**08.06.17**	**08.06.17**	**09.06.17**
Sr.	**Parameters**	**Unit**	**Std. Limit**	**Results**		
37.	Cadmium (as Cd)	mg/L	**2.0**	BDL	BDL	BDL
38.	Mercury (as Hg)	mg/L	**01**	BDL	BDL	BDL
39.	Manganese (as Mn)	mg/L	**2.0**	BDL	BDL	BDL
40.	Iron(as Fe)	mg/L	**3.0**	BDL	BDL	BDL
41.	Vanadium (as V)	mg/L	**0.2**	BDL	BDL	BDL
42.	Selenium (as Se)	mg/L	**0.05**	BDL	BDL	BDL
43.	Boron(as B)	mg/L		BDL	BDL	BDL
44.	Bioassay Test on fish	%survival		60	100	100

Graphs: Water/ Waste Water Quality Monitoring for Pimpri-Chinchwad:






Pimpri-Chinchwad Waste Water
Concentration MPN/Index
1000
900
800
700
600
500
400
300
200
100
0
Exide Indusries
Amphinol Inter Connect India Pvt Ltd.
Alfa Laval (India) Ltd.
Tata Motor-Pimpri
Alicon Cast Alloy Ltd.
Location
Total Coliforms
Faecal Coliforms


Pimpri-Chinchwad Waste Water
Concentration % survival
120
100
80
60
40
20
0
Rich Graviss Products Pvt. Ltd.
Exide Indusries
Amphinol Inter Connect India Pvt Ltd.
Alfa Laval (India) Ltd.
Tata Motor-Pimpri
Alicon Cast Alloy Ltd.
Location
Bioassay Test on fish

3.4 Ground Water Quality:

Sr.	Location	Source	Table No.
1.	Raju Saste-Bhosri	Well Water	**I**
2.	Baban Babulal Borate, Borate Wasti, Moshi	Well Water	**I**
3.	Kisan Dhondiba Borate, Borate Wasti	Well Water	**I**
4.	Shantaram Laximan Borate, Borate Wasti	Well Water	**II**
5.	Mohan Nagar, Pharma Educational Institute	Bore well	**II**
6.	Mula River	Surface Water	**II**

Table No. I

Location				**Raju Saste-Bhosri**	**Baban Babulal Borate, Borate Wasti, Moshi**	**Kisan Dhondiba Borate, Borate Wasti**
Date of Sampling				**09.06.17**	**09.06.17**	**09.06.17**
Sr.	**Parameters**	**Unit**	**Std. Limit**	**Results**		
1.	Colour	Hazen	**5**	1	1	1
2.	Smell	-		Agreeable	Agreeable	Agreeable
3.	pH	-	**6.5-8.5**	7.44	7.04	7.65
4.	Oil &Grease	mg/L		BDL	BDL	BDL
5.	Suspended Solids	mg/L	**100**	8	6	7
6.	Dissolved Oxygen (%Saturation)	%		65	48	45
7.	Chemical Oxygen Demand	mg/L	**250**	28	30	32
8.	Biochemical Oxygen Demand (3days,27°C)	mg/L	**30**	10	11	12

Location				Raju Saste-Bhosri	Baban Babulal Borate, Borate Wasti, Moshi	Kisan Dhondiba Borate, Borate Wasti
Date of Sampling				09.06.17	09.06.17	09.06.17
Sr.	**Parameters**	**Unit**	**Std. Limit**	**Results**		
9.	Electrical Conductivity (at25°C)	µmho/cm		705	1493	2130
10.	Nitrite Nitrogen ($asNO_2$)	mg/L		BDL	BDL	BDL
11.	Nitrate Nitrogen ($asNO_3$)	mg/L	**45**	11	16.1	18.1
12.	(NO_2+NO_3)-Nitrogen	mg/L		11	16.1	18.1
13.	Free Ammonia ($asNH_3$-N)	mg/L	**0.5**	BDL	BDL	BDL
14.	Total Residual Chlorine	mg/L	**0.2**	BDL	BDL	BDL
15.	Cyanide (as CN)	mg/L	**0.05**	BDL	BDL	BDL
16.	Fluoride(as F)	mg/L	**1.0**	0.42	0.28	0.18
17.	Sulphide (as S_{2-})	mg/L	**1.0**	BDL	BDL	BDL
18.	Dissolved Phosphate (as P)	mg/L	**0.05**	BDL	BDL	BDL
19.	Sodium Absorption Ratio	mg/L		0.49	0.53	0.58
20.	Total Coliforms	MPNindex/ 100ml		BDL	79	79
21.	Faecal Coliforms	MPNindex/ 100ml	**BDL**	BDL	BDL	49

Location				Raju Saste-Bhosri	Baban Babulal Borate, Borate Wasti, Moshi	Kisan Dhondiba Borate, Borate Wasti
Date of Sampling				09.06.17	09.06.17	09.06.17
Sr.	**Parameters**	**Unit**	**Std. Limit**	**Results**		
22.	Total Phosphorous (as P)	mg/L	**BDL**	BDL	BDL	BDL
23.	Total Kjeldahl Nitrogen	mg/L	**0.5**	0.4	BDL	0.11
24.	Total Ammonia (NH_4+NH_3)-	mg/L	**0.001**	BDL	BDL	BDL
25.	Phenols (as C_6H_5OH)	mg/L	**0.5**	BDL	BDL	BDL
26.	Surface Active Agents (as MBAS)	mg/L	**0.001**	BDL	BDL	BDL
27.	Organo Chlorine Pesticides					
I.	Alachlor	µg/L	**0.05**	BDL	BDL	BDL
II.	Atrazine	µg/L	**20**	BDL	BDL	BDL
III.	Aldrin	µg/L	**2**	BDL	BDL	BDL
IV.	Dieldrin	µg/L	**0.03**	BDL	BDL	BDL
V.	Alpha HCH	µg/L	**0.03**	BDL	BDL	BDL
VI.	Beta HCH	µg/L	**0.01**	BDL	BDL	BDL
VII.	Delta HCH	µg/L	**0.04**	BDL	BDL	BDL
VIII.	Butachlor	µg/L	**125**	BDL	BDL	BDL
IX.	p,pDDT	µg/L	**0.04**	BDL	BDL	BDL
X.	o,pDDT	µg/L	**1.0**	BDL	BDL	BDL
XI.	p,pDDE	µg/L	**1.0**	BDL	BDL	BDL
XII.	o,pDDE	µg/L	**1.0**	BDL	BDL	BDL

Location				Raju Saste-Bhosri	Baban Babulal Borate, Borate Wasti, Moshi	Kisan Dhondiba Borate, Borate Wasti
Date of Sampling				09.06.17	09.06.17	09.06.17
Sr.	**Parameters**	**Unit**	**Std. Limit**	**Results**		
XIII.	p,pDDD	µg/L	**1.0**	BDL	BDL	BDL
XIV.	o,pDDD	µg/L	**1.0**	BDL	BDL	BDL
XV.	Alpha Endosulfan	µg/L	**1.0**	BDL	BDL	BDL
XVI.	Beta Endosulfan	µg/L	**0.4**	BDL	BDL	BDL
XVII.	Endosulfan Sulphate	µg/L	**0.4**	BDL	BDL	BDL
XVIII.	YHCH (Lindane)	µg/L	**0.4**	BDL	BDL	BDL
28.	Polynuclear aromatic hydrocarbons (as PAH)	mg/L	**2.0**	BDL	BDL	BDL
29.	Polychlorinated Biphenyls (PCB)	mg/L	**0.0001**	BDL	BDL	BDL
30.	Zinc(as Zn)	mg/L	**0.0005**	BDL	BDL	BDL
31.	Nickel(as Ni)	mg/L	**5.0**	BDL	BDL	BDL
32.	Copper(as Cu)	mg/L	**0.02**	BDL	BDL	BDL
33.	Hexavalent Chromium (as Cr^{6+})	mg/L	**0.05**	BDL	BDL	BDL
34.	Total Chromium (as Cr)	mg/L	**1**	BDL	BDL	BDL
35.	Total Arsenic (as As)	mg/L	**0.05**	BDL	BDL	BDL
36.	Lead(as Pb)	mg/L	**0.01**	BDL	BDL	BDL
37.	Cadmium (as Cd)	mg/L	**0.01**	BDL	BDL	BDL

Location				Raju Saste-Bhosri	Baban Babulal Borate, Borate Wasti, Moshi	Kisan Dhondiba Borate, Borate Wasti
Date of Sampling				09.06.17	09.06.17	09.06.17
Sr.	**Parameters**	**Unit**	**Std. Limit**	**Results**		
38.	Mercury (as Hg)	mg/L	**0.003**	BDL	BDL	BDL
39.	Manganese (as Mn)	mg/L	**0.001**	BDL	0.039	0.7
40.	Iron(as Fe)	mg/L	**0.1**	0.084	BDL	BDL
41.	Vanadium (as V)	mg/L	**0.3**	BDL	BDL	BDL
42.	Selenium (as Se)	mg/L		BDL	BDL	BDL
43.	Boron(as B)	mg/L	**0.01**	BDL	BDL	0.227
44.	Bioassay Test on fish	%survival		100	100	100

TableNo. II

Location				Shantaram Laximan Borate, Borate Wasti	Mohan Nagar, Pharma Educational Institute	Mula River
Date of Sampling				09.06.17	09.06.17	09.06.17
Sr.	**Parameters**	**Unit**	**Std. Limit**	**Results**		
1.	Colour	Hazen	**5**	1	1	1
2.	Smell	-		Agreeable	Agreeable	Agreeable
3.	pH	-	**6.5-8.5**	7.38	8.07	7.72
4.	Oil & Grease	mg/L		BDL	BDL	BDL

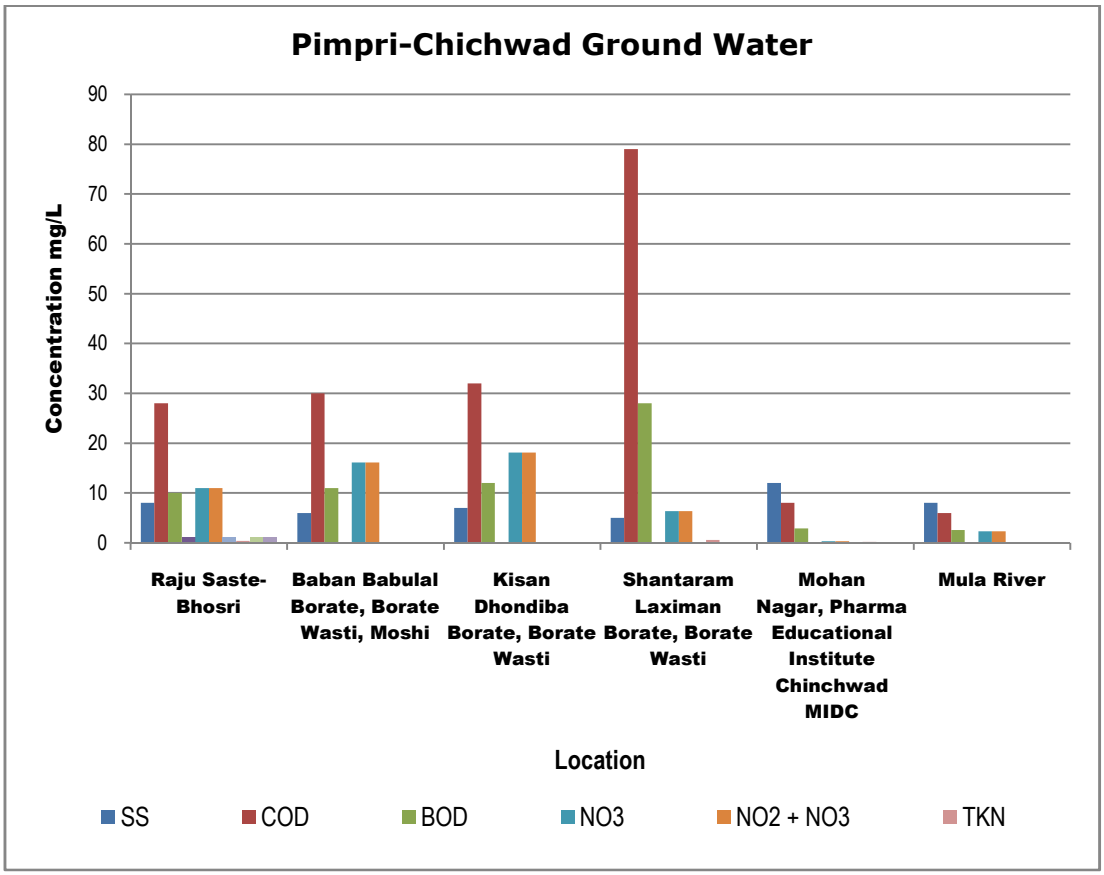
Location				**Shantaram Laximan Borate, Borate Wasti**	**Mohan Nagar, Pharma Education al Institute**	**Mula River**
Date of Sampling				**09.06.17**	**09.06.17**	**09.06.17**
Sr.	**Parameters**	**Unit**	**Std. Limit**	**Results**		
5.	Suspended Solids	mg/L	**100**	5	12	8
6.	Dissolved Oxygen (%Saturation)	%		35	85	120
7.	Chemical Oxygen Demand	mg/L	**250**	79	8	6
8.	Biochemical Oxygen Demand (3days,27°C)	mg/L	**30**	28	2.9	2.6
9.	Electrical Conductivity (at25°C)	µmho/cm		790	127	261
10.	Nitrite Nitrogen (asNO_2)	mg/L		BDL	BDL	BDL
11.	Nitrate Nitrogen (asNO_3)	mg/L	**45**	6.33	0.35	2.3
12.	(NO_2+NO_3)-Nitrogen	mg/L		6.33	0.35	2.31
13.	Free Ammonia (asNH_3-N)	mg/L	**0.5**	BDL	BDL	BDL
14.	Total Residual Chlorine	mg/L	**0.2**	BDL	0.05	BDL
15.	Cyanide (as CN)	mg/L	**0.05**	BDL	BDL	BDL
16.	Fluoride(as F)	mg/L	**1.0**	0.2	0.76	0.52
17.	Sulphide (as S_{2-})	mg/L	**1.0**	BDL	BDL	BDL

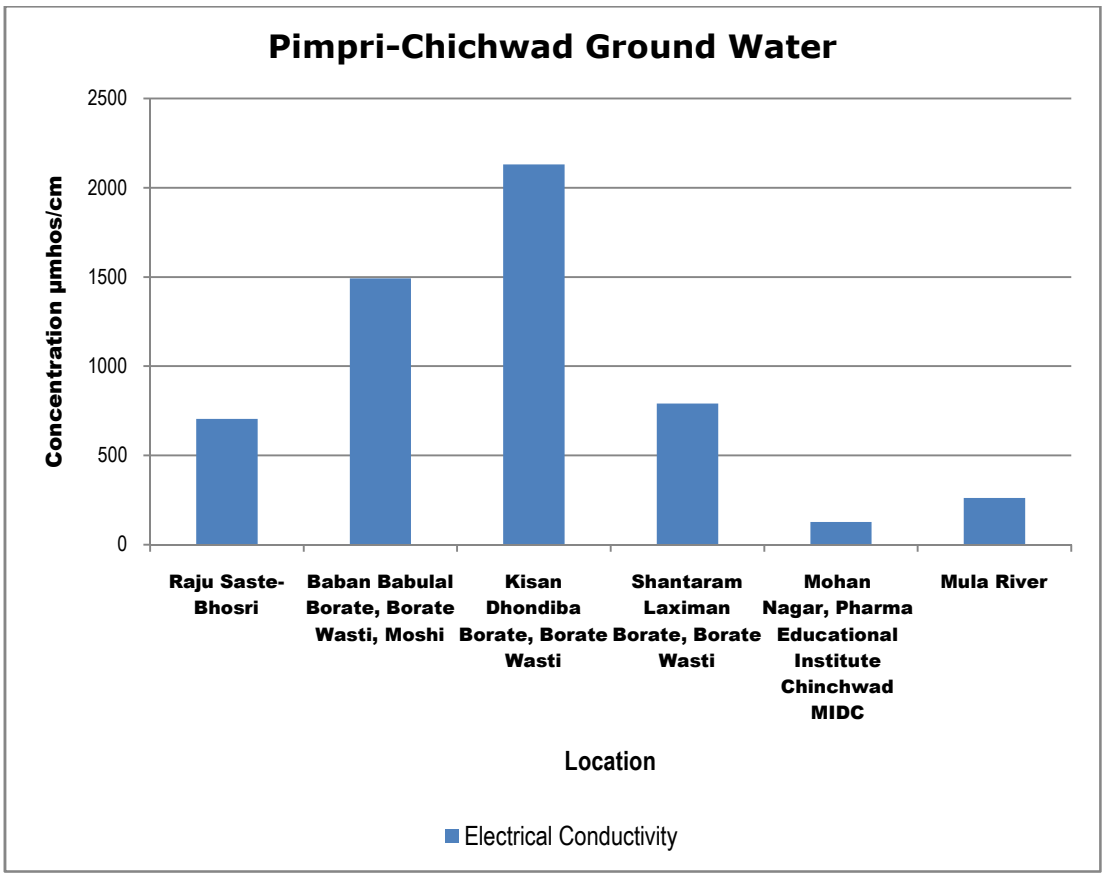
Location				**Shantaram Laximan Borate, Borate Wasti**	**Mohan Nagar, Pharma Education al Institute**	**Mula River**
Date of Sampling				**09.06.17**	**09.06.17**	**09.06.17**
Sr.	**Parameters**	**Unit**	**Std. Limit**	**Results**		
18.	Dissolved Phosphate (as P)	mg/L	**0.05**	BDL	BDL	BDL
19.	Sodium Absorption Ratio	mg/L		0.6	0.26	0.62
20.	Total Coliforms	MPNindex /100ml		920	7.8	140
21.	Faecal Coliforms	MPNindex /100ml	**BDL**	280	2	140
22.	Total Phosphorous (as P)	mg/L	**BDL**	BDL	BDL	BDL
23.	Total Kjeldahl Nitrogen	mg/L	**0.5**	0.56	0.2	0.11
24.	Total Ammonia (NH_4+NH_3)-	mg/L	**0.001**	BDL	BDL	BDL
25.	Phenols (as C_6H_5OH)	mg/L	**0.5**	BDL	BDL	BDL
26.	Surface Active Agents (as MBAS)	mg/L	**0.001**	BDL	BDL	BDL
27.	Organo Chlorine Pesticides					
I.	Alachlor	µg/L	**0.05**	BDL	BDL	BDL
II.	Atrazine	µg/L	**20**	BDL	BDL	BDL
III.	Aldrin	µg/L	**2**	BDL	BDL	BDL
IV.	Dieldrin	µg/L	**0.03**	BDL	BDL	BDL
V.	Alpha HCH	µg/L	**0.03**	BDL	BDL	BDL

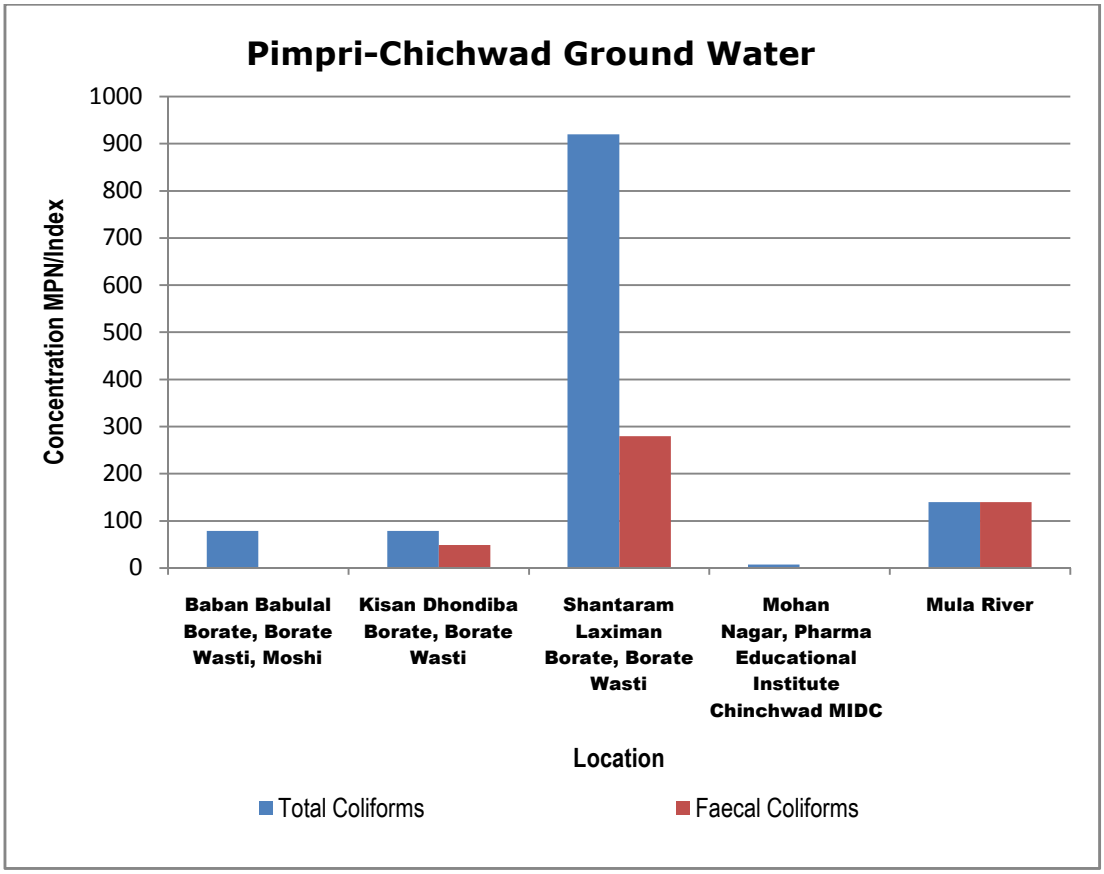
Location				Shantaram Laximan Borate, Borate Wasti	Mohan Nagar, Pharma Educational Institute	Mula River
Date of Sampling				09.06.17	09.06.17	09.06.17
Sr.	**Parameters**	**Unit**	**Std. Limit**	**Results**		
VI.	Beta HCH	µg/L	**0.01**	BDL	BDL	BDL
VII.	Delta HCH	µg/L	**0.04**	BDL	BDL	BDL
VIII.	Butachlor	µg/L	**125**	BDL	BDL	BDL
IX.	p,pDDT	µg/L	**0.04**	BDL	BDL	BDL
X.	o,pDDT	µg/L	**1.0**	BDL	BDL	BDL
XI.	p,pDDE	µg/L	**1.0**	BDL	BDL	BDL
XII.	o,pDDE	µg/L	**1.0**	BDL	BDL	BDL
XIII.	p,pDDD	µg/L	**1.0**	BDL	BDL	BDL
XIV.	o,pDDD	µg/L	**1.0**	BDL	BDL	BDL
XV.	Alpha Endosulfan	µg/L	**1.0**	BDL	BDL	BDL
XVI.	Beta Endosulfan	µg/L	**0.4**	BDL	BDL	BDL
XVII.	Endosulfan Sulphate	µg/L	**0.4**	BDL	BDL	BDL
VIII.	YHCH (Lindane)	µg/L	**0.4**	BDL	BDL	BDL
28.	Polynuclear aromatic hydrocarbons (as PAH)	mg/L	**2.0**	BDL	BDL	BDL
29.	Polychlorinated Biphenyls (PCB)	mg/L	**0.0001**	BDL	BDL	BDL
30.	Zinc(as Zn)	mg/L	**0.0005**	BDL	BDL	BDL
31.	Nickel(as Ni)	mg/L	**5.0**	BDL	BDL	BDL
32.	Copper(as Cu)	mg/L	**0.02**	BDL	BDL	BDL

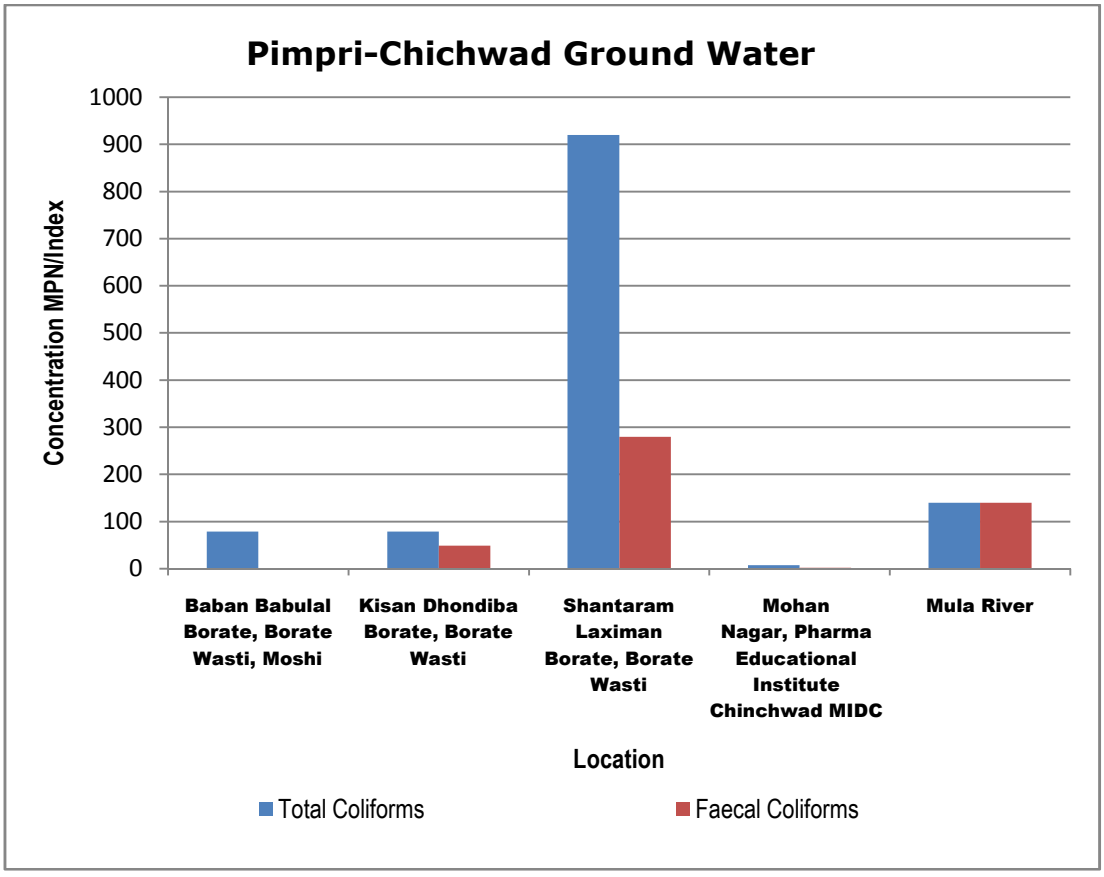
Location				Shantaram Laximan Borate, Borate Wasti	Mohan Nagar, Pharma Education al Institute	Mula River
Date of Sampling				09.06.17	09.06.17	09.06.17
Sr.	**Parameters**	**Unit**	**Std. Limit**	**Results**		
33.	Hexavalent Chromium (as Cr^{6+})	mg/L	**0.05**	BDL	BDL	BDL
34.	Total Chromium (as Cr)	mg/L	**1**	BDL	BDL	BDL
35.	Total Arsenic(as As)	mg/L	**0.05**	BDL	BDL	BDL
36.	Lead(as Pb)	mg/L	**0.01**	BDL	BDL	BDL
37.	Cadmium (as Cd)	mg/L	**0.01**	BDL	BDL	BDL
38.	Mercury (as Hg)	mg/L	**0.003**	BDL	BDL	BDL
39.	Manganese (as Mn)	mg/L	**0.001**	0.027	BDL	0.073
40.	Iron(as Fe)	mg/L	**0.1**	BDL	BDL	0.184
41.	Vanadium (as V)	mg/L	**0.3**	BDL	BDL	BDL
42.	Selenium (as Se)	mg/L		BDL	BDL	BDL
43.	Boron(as B)	mg/L	**0.01**	BDL	0.162	0.124
44.	Bioassay Test on fish	%survival		100	100	90

Graphs: Ground Water Quality Monitoring for Pimpri-Chinchwad:






Pimpri-Chichwad Ground Water
Concentration MPN/Index
1000
900
800
700
600
500
400
300
200
100
0
Baban Babulal Borate, Borate Wasti, Moshi
Kisan Dhondiba Borate, Borate Wasti
Shantaram Laximan Borate, Borate Wasti
Mohan Nagar, Pharma Educational Institute Chinchwad MIDC
Mula River
Location
Total Coliforms
Faecal Coliforms


Pimpri-Chichwad Ground Water
Concentration MPN/Index
1000
900
800
700
600
500
400
300
200
100
0
Baban Babulal Borate, Borate Wasti, Moshi
Kisan Dhondiba Borate, Borate Wasti
Shantaram Laximan Borate, Borate Wasti
Mohan Nagar, Pharma Educational Institute Chinchwad MIDC
Mula River
Location
Total Coliforms
Faecal Coliforms

4. Summary of the result

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

4.1 Stack Emission Monitoring:

Six industries from Pimpri-Chinchwad were selected for Stack emission monitoring.

1. **Particulate matter (PM):** Out the 6 stacks, only 5 stacks were analysed for Particulate matter and all locations was observed well within the limits.

2. **Sulphur dioxide (SO_2):** For SO_2 also Outthe6 stacks, only 5 stacks were analysed for Particulate matter and all locations was observed well within the limits.

3. **Nitrogen dioxide (NO_2):** NO_2 at 3 stacks out of the 6 stacks monitored was exceeding the permissible limit of emission. The highest level of NO_2 was observed at Alicon Castalloy Ltd. stack with 167 mg/Nm^3 emission.

4. **Acid Mist (as H_2SO_4):** The concentration of Acid Mist at Alfa Laval (India) Ltd. stack with 108 mg/Nm^3 had the highest and out of the limit concentration.

5. **Carbon Monoxide (CO):** Out the 6 stacks, only 3 stacks were analysed for Carbon Monoxide and all locations was observed well within the limits.

6. **Hydrogen Chloride (HCL):** Out the 6 stacks, only 3 stacks were analysed for Carbon Monoxide and all locations was observed well within the limits.

4.2 Ambient Air Quality Monitoring:

Six ambient air samples were collected from Pimpri-Chinchwad region. The parameters monitored were studied as per the NAAQS standards. The variations of each parameter within the area under study are discussed below:

1. **Sulphur dioxide (SO_2):**All 6 locations were observed with below detectable limit for concentration of SO_2.

2. **Nitrogen dioxide (NO_2):** Values of nitrogen dioxide are also observed below the standard limit of 80 µg/m^3 at all the 6 locations.

3. **Particulate Matter (PM_{10}):** PM_{10} concentration of only one location was higher than the standard limit of 100 µg/m^3 with 102 µg/m^3at Alicon Cast Alloy Ltd.

4. **Particulate Matter ($PM_{2.5}$):** Values of $PM_{2.5}$ are also observed below the standard limit of 60 µg/m^3 at all the 6 locations. The highest level of $PM_{2.5}$ was observed at Alicon Cast Alloy Ltd. with a result of 23 µg/$m^{3.}$

5. **Ozone (O_3):** Ozone was found to be below detectable limit in all location.

6. **Lead (Pb):**Four out of 6 locations monitored was detected with concentration of lead and was well within the NAAQS standard.

7. **Carbon Monoxide (CO):** Five out of 6 locations monitored was detected with concentration of lead and was well within the NAAQS standard.

8. **Ammonia (NH_3):** Ammonia was below the detectable limit in all 6 locations monitored.

9. **Benzene (C_6H_6):**Benzene also was below the detectable limit in all 6 locations monitored.

10. **Benzo(a)pyrene (BaP):** BaP was also below detectable limit in all 6 locations monitored.

11. **Arsenic (As):** Arsenic was also below detectable limit in all 6 locations monitored.

12. **Nickel (Ni):** Concentration of Nickel was observed at only two out of six locations monitored and was well within the permissible limit of 20 ng/m^3.

4.3 Waste Water Quality Monitoring:

To understand the quality of treated effluent, samples were collected from 7 industries of Pimpri-Chinchwad. Considering the general parameters of all the industries mentioned, following are the conclusions:

1. **Colour:** Colour units are found well within the limit in all samples collected.

2. **Odour**: odour of all six samples collected is found agreeable.

3. **pH**: it is observed in between 7.13 and 7.87 which is well within the range.

4. **Suspended Solids**: Suspended solids of all six water samples is well within the limits and ranged in between 8 mg/L to 38 mg/l.

5. **Chemical Oxygen Demand**: All samples collected, were well within the limit required as per standard. The highest COD was observed at Alfa Laval (India) Ltd. with 60 mg/L concentration.

6. **Biochemical Oxygen Demand**: All samples collected, were well within the limit required as per standard. The highest BOD was observed at Alfa Laval (India) Ltd. with 21 mg/L concentration.

7. **Sulphide**: All six samples collected were found to have below detectable limit.

8. **Total Ammoia**: All six water samples collected was well within the standards of Ammonia and the highest concentration of 0.59mg/L was observed at Tata Motors.

9. **Total Kjeldahl Nitrogen**: All six water samples collected was well within the standards of Total Kjeldahl Nitrogen and the highest concentration of 29.1 mg/L was observed at Exide Industries.

10. **Fish Bioassay**: 100% Survival was attained in two water samples collected for Bioassay test.

11. **Heavy metals**: All the heavy metals are found below the standard limits in all the samples.

4.3 Ground Water Quality Monitoring:

Four ground water samples were collected from Pimpri-Chinchwad region.

1) **Colour** (Hazen Units): Colour units are below the acceptable standard of all water samples collected.

2) **Odour**: odour of all the samples is found agreeable.

3) **Chemical Oxygen Demand:** The COD of all 6 samples was found well within the standard limit with highest concentration at Shantaram Laximan Borate with 79 mg/L.

4) **Biological Oxygen Demand:** BOD of all 6 samples was found in the range between 2.6 mg/L to 28 mg/L.

Following are the parameters which are compared with ISO10500:2012 Drinking water specifications.

1) **Nitrite**: Values of Nitrite at all location was below detectable limit.

2) **Nitrate:** Results of Nitrate are also observed below standard limit (42 mg/L). The highest concentration of Nitrate was observed in the sample collected at Kisan Dhondiba Borate with 18.1 mg/L

3) **Residual Free Chlorine**: Values are below the detectable limit in five out of six samples collected.

4) **Total Ammonia**: Values are below the detectable limit in all samples collected.

5) **Fluoride:** Values are below the acceptable standards, below<0.05mg/L.

6) **Sulphide:** All the readings of sulphide are below detectable limit in all 6 samples collected.

7) **Sodium Absorption Ratio:** These values fit within range of water quality criteria of CPCB.

8) **Total Kjeldahl nitrogen:** All six water samples collected exceeded the standard limit of TKN and ranged in between 0.11 mg/L to 0.56 mg/L concentration.

9) **Fish Bioassay**: Five out of six locations monitored was observed with 100% survival of Fishes.

10) **Boron:** Three out of the six water samples collected had Boron concentration higher than the prescribed value of 0.01 mg/L.

11) **Surface Active Agents:** All 4 samples showed below detectable limit.

12) **Metals:** All the metals except Copper, Lead and Total Chromium at few locations are observed within the acceptable limits of drinking water standards.

5. CEPI Score

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

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

approach is based on the basic hazard assessment logic that can be summarized as below.

Hazard = pollutant source, pathways, and receptor

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

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

i. Revised concept is prepared by eliminating the debatable factors but retaining the factors which can be measured precisely.

ii. It is decided to develop the Comprehensive Environmental Pollution Index (CEPI) retaining the existing algorithm of Source, Pathway and Receptor.

iii. Health component was also retained in the revised concept in line with the suggestions of Secretary, MoEFCC during the meeting held in MoEF.

Outlines of revised CEPI 2016 criteria

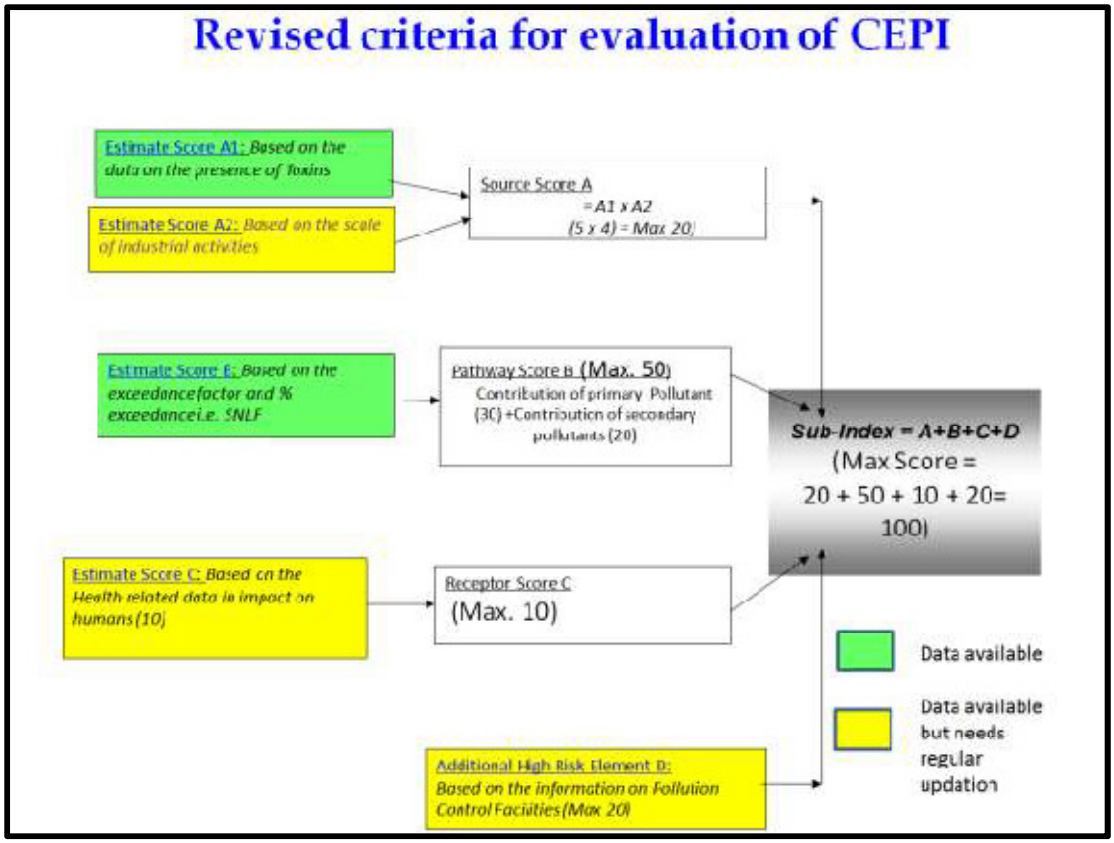
The outlines of the revised CEPI criteria are as follows:

1. It is proposed to develop the Comprehensive Environmental Pollution Index (CEPI) based on Sources of pollution, real time observed values of the pollutants in the ambient air, surface water and ground water in & around the industrial cluster and health related statistics.

2. For assessment of the environmental quality of the area i.e. CEPI score, the concept of SNLF i.e. a surrogate number which represents the level of exposure (a function of percentage sample Exceedance & Exceedance Factor) shall be used.

3. Health component to be evaluated based on the health data available from major hospitals in the area was also retained in the revised concept.

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



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

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

- **Score more than 63:** A Critical Level of Pollution in the respective level of environmental component
- **Score between 51-63:** Severe to critical level of pollution with reference to respective environmental component

Cut-off Score

- **Score 50:** Severely Polluted Industrial Clusters/areas
- **Score 60:** Critically Polluted Industrial Clusters/areas

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

- **Aggregated CEPI score >70:** Critically polluted areas
- **Aggregated CEPI score between 60-70:** Severely polluted areas

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

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

The result shows that CEPI score of present report is 40.79. It should be noticed here that MPCB's efforts through the formulation of action plans decreased the overall concentration of pollutants in all aspects i.e. air, land and water in Pimpri-Chinchwad area in past three years. This has also resulted in decreased score of CEPI.

5.1 Comparison of CEPI scores:

Results show that present CEPI score (40.79) of Pimpri-Chinchwad considering all revised standards is less the CEPI Score of February 2017 (50.1) report.

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

Air

	A1	A2	A	B1	B2	B3	B	C1	C2	C3	C	D	CEPI
Present Report June 2017 (Revised CEPI 2016)	2.9	3	8.7	-	-	-	12.8	-	-	-	0	10	**31.5**
February, 2017	2	5	10	5	0	0	5	4	2.9	0	11.6	10	**36.6**
CPCB Report 2009	5.75	5	28.75	6	0	0	6	3	3.50	0	10.50	10	**55.25**

Water:

	A1	A2	A	B1	B2	B3	B	C1	C2	C3	C	D	CEPI
Present Report June 2017 (Revised CEPI 2016)	3.9	4.55	17.55	-	-	-	10.1	-	-	-	0	10	**37.65**
February, 2017	2.9	6	17.4	5	0	4	9	4	2	3	11	10	**47.4**
CPCB Report 2009	3	5	15	7	0	3	10	5	3.5	0	17.5	10	**52.5**

Land:

	A1	A2	A	B1	B2	B3	B	C1	C2	C3	C	D	CEPI
Present Report June 2017 (Revised CEPI 2016)	3.3	4.8	15.84	-	-	-	10.2	-	-	-	0	10	**36.04**
February, 2017	4	5	20	3	4	0	7	4	2	0	8	10	**45.0**
CPCB Report 2009	3	5	15	6	0	3	9	3	4	0	12	10	**46.0**

Aggregated CEPI:

	Air Index	Water Index	Land Index	CEPI
Present Report June 2017 (Revised CEPI 2016)	31.5	37.65	36.04	**40.79**
February, 2017	36.6	47.4	45.0	**50.1**
CPCB Report 2009	55.25	52.50	46.00	**66.06**

6. Conclusion

Many of the industries this year have been changed from those of which were considered for calculation of CEPI during February 2017. This may be the reason for the change in the score calculated but as CEPI is calculated for the region and not for any specific industry, the decrease in the score can be taken as a positive impact.

Out of six stack samples collected higher concentration of NO_2 and Acid mist at three locations and one location respectively. This have been informed to the respective industry and asked by them to control the emission. The compliance of the same will be noted later.

PM_{10} values were exceeding the limit of NAAQS in some of the ambient air samples collected. This is mainly due to the vehicular emission in the region.

In the 7 waste water samples collected from the region,the results were observed well within the limits for almost all parameter tested. We can improve this by taking better measures in the treatment plant so that the outlet water is in the prescribed limit for disposal.

In the ground water samples collected, all the samples were well within the limits of the drinking water.

The pollution load in the region is reduced and continuous efforts have been inputted by the Regional pollution control board and state pollution control board inbringing the pollution lesser. Each civic department provides data about the status of environment related to their department which is compiled as the environment status report. There are several suggestions given to improve the environment concerning various subjects like air, water and noise pollution. Each department concerned will make budgetary provision to implement the suggestions

	A1	A2	A	B	C	D	CEPI
Air Index	2.9	3	8.7	12.8	0	10	**31.5**
Water Index	3.9	4.5	17.55	10.1	0	10	**37.65**
Land Index	3.3	4.8	15.84	10.2	0	10	**36.04**
						Aggregated CEPI	**40.79**

7. References

1) CriteriaforComprehensiveEnvironmentalAssessmentofIndustrialClusters,December 2009,CPCB,EIAS/4/2009-10

2) ComprehensiveEnvironmentalAssessmentofIndustrialClusters,December2009,CPCB,EIAS/5/2009-10

3) ActionPlanforIndustrialCluster:Chandrapur,November2010,MPCB

4) ActionPlanforIndustrialCluster:Chembur,November2010,MPCB

5) ActionPlanforIndustrialCluster:Aurangabad,November2010,MPCB

6) ActionPlanforIndustrialCluster:NaviMumbai,November2010,MPCB

7) ActionPlanforIndustrialCluster:NaviMumbai,November2010,MPCB

8) StandardMethodsfortheExaminationofWaterandWasteWater,AmericanPublicHealth Association,22ndEdition,2012.

9) IS3025(variousparts)

10) www.mpcb.gov.in

11) www.cpcb.gov.in

8. Annexure

Annexure I: Health related data in impact on humans

C: Receptor

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

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

Attached below health data collected for the Pimpri-Chinchwad region

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	5.0mg/Nm^3

Sr.	Parameters	Method References	Techniques	Detection Limit
				0.02kg/day
14.	BTX (Benzene, Toluene, Xylene)	NIOSH (NMAM) 1501	Adsorption and Desorption followed by GC-FID analysis	0.001 mg/Nm^3
15.	VOC (Volatile Organic Compounds)	NIOSH (NMAM) 1501 for sampling	Adsorption and Desorption followed by GC-FID or GC/MS analysis	-
i	Methyl Isobutyl Ketone	-	-	0.001 mg/Nm^3
ii	Benzene	-	-	0.001 mg/Nm^3
iii	Toluene	-	-	0.001 mg/Nm^3
iv	Xylene	-	-	0.001 mg/Nm^3
v	Ethyl Benzene	-	-	0.001 mg/Nm^3
vi	Ethyl Acetate	-	-	0.001 mg/Nm^3

Annexure III: Ambient Air Sampling and Analysis Methodology

Sr.	Parameters	Method References	Techniques	Detection Limit
1.	Sulphur Dioxide (SO_2)	CPCB Guidelines for the Measurement of Ambient Air Pollutants, Volume I, May 2011, Page No.1	Improved West &Gaeke Method	4 µg/m^3
2.	Nitrogen Dioxide (NO_2)	CPCB Guidelines for the Measurement of Ambient Air Pollutants, Volume I, May 2011, Page No.7	Modified Jacob &Hochheiser Method	3 µg/m^3
3.	Particulate Matter (size less than 10 µm) or PM_{10}	CPCB Guidelines for the Measurement of Ambient Air Pollutants, Volume I, May 2011, Page No.11	Gravimetric Method	2 µg/m^3
4.	Particulate Matter (size less than 2.5 µm) or $PM_{2.5}$	CPCB Guidelines for the Measurement of Ambient Air Pollutants, Volume I, May 2011, Page No. 15	Gravimetric Method	0.4 µg/m^3
5.	Ozone (O_3)	APHA, Method No. 820, Page no. 836	Chemical Method	19.6 µg/m^3
6.	Lead (Pb)	CPCB Guidelines for the Measurement of Ambient Air Pollutants, Volume I, May 2011, Page No. 47	AAS Method	0.02 µg/m^3
7.	Carbon Monoxide (CO)	CPCB Guidelines for the Measurement of Ambient Air Pollutants, Volume II, May 2011, Page No. 16	Non Dispersive Infra Red (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	4.0µg/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	0.3ng/m^3
12.	Nickel (Ni)	CPCB Guidelines for the Measurement of Ambient Air Pollutants, Volume I, May 2011, Page No. 47	AAS Method	3.0ng/m^3

Annexure IV: Water/Wastewater Sampling and Analysis Methodology

Sr.	Parameters	Methods References	Techniques	Detection Limit
1.	Sampling Procedure for Chemical Parameters	IS 3025 (Part 1): 1987, Reaffirmed 1998, Amds.1& APHA, 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, 22ndEd., 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,22ndEd., 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	IodometricMethod	0.08 mg/L
21.	Dissolved Phosphate (P)	APHA,22ndEd., 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,22ndEd., 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,22dEd., 2012, 4500 NH_3, F, 4 -115	Colorimetric Method	0.001 mg/L
26.	Phenols (C_6H_5OH)	APHA,22ndEd., 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,22ndEd., 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, 22ndEd., 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 Test (Zebra Fish)	IS 6582, 1971, Reaffirmed 1987	Static Technique	-

Annexure V: National Ambient Air Quality Standards, 2009

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National Ambient Air Quality Standards: Central Pollution Control Board

In exercise of the powers conferred by Sub-section (2) (h) of section 16 of the Air (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

Sr.	Parameter	Standards			
		Inland surface Water	**Public Sewers**	**Land for Irrigation**	**Marine Coastal Areas**
6.	Temperature °C, Max	Shall not exceed 40 in any section of the stream within 15 mts. Downstream from the effluent outlet	45 at the point of discharge	--	45 at the point of discharge
7.	Oil and Grease, mg/L, Max	10	20	10	20
8.,	Total Residual chlorine, mg/L, Max	1.0	--	--	1.0
9.	Ammonical Nitrogen (as N), mg/L, Max	50	50	--	50
10.	Total Kjeldahl Nitrogen (as N), mg/L, Max.	100	--	--	100
11.	Free Ammonia (as NH_3), mg/L, Max	5.0	--	--	5.0
12.	Biochemical oxygen demand (5 days, at 20° c) mg/L, Max	30	350	100	100
13.	Chemical oxygen demand, mg/L, Max	250	--	--	250
14.	Arsenic (as As), mg/l, Max	0.2	0.2	0.2	0.2
15.	Mercury (as Hg). Mg/L, Max	0.01	0.01	--	0.01
16.	Lead (as Pb), mg/L, Max	0.1	1.0	-	1.0
17.	Cadmium (as Cd), mg/L,	2.0	1.0	--	2.0

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

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

Sr.	Characteristic	Unit	Requirement (Acceptable Limit)	Permissible Limit in the Absence of Alternate Source
18.	Iron (as Fe)	mg/L	Max 0.3	No relaxation
19.	Magnesium (as Mg)	mg/L	Max 30	Max100
20.	Manganese (as Mn)	mg/L	Max 0.1	Max 0.3
21.	Mineral Oil	mg/L	Max 0.5	No relaxation
22.	Nitrate (as NO_3)	mg/L	Max 45	No relaxation
23.	Phenolic compounds (as C_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 (asCd)	mg/L	Max 0.003	No relaxation
32.	Cyanide (asCN)	mg/L	Max 0.05	No relaxation
33.	Lead (as Pb)	mg/L	Max 0.01	No relaxation
34.	Mercury (asHg)	mg/L	Max 0.001	No relaxation
35.	Molybdenum (as Mo)	mg/L	Max 0.07	No relaxation
36.	Nickel (as Ni)	mg/L	Max 0.02	No relaxation
37.	Pesticides	mg/L	See Table 5	No relaxation
38.	Polychlorinatedbiphenyls	mg/L	Max 0.0005	No relaxation

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

Sr.	Characteristic	Unit	Requirement (Acceptable Limit)	Permissible Limit in the Absence of Alternate Source
x)	DDT (o,p&p,p — Isomers of DDT, DDE and DDD)	µg/L	1	No relaxation
xi)	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
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/Lor more, and ➢ Biochemical Oxygen Demand 2 mg/Lor 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/Lor more, and ➢ Biochemical Oxygen Demand 3 mg/Lor 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/Lor more, and ➢ Biochemical Oxygen Demand 3 mg/Lor less
Propagation of wildlife and fisheries	D	➢ pH between 6.5 and 8.5 ➢ Dissolved Oxygen 4 mg/Lor more, and ➢ Free ammonia (as N) 1.2 mg/Lor 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
(vi)	Suspended solid, mg/l	<25	<50	<100

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

Note:

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

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

Sr.	Parameters	Requirement for Waters of Class		
		A- Excellent	B-Desirable	C-Acceptable
(i)	Total Phosphorous	<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	< 2µg/l	< 5µg/l	<10 µg/l
(v)	Surface Active Agents	<20 µg/l	<100µg/l	< 200µg/l
(vi)	Organo Chlorine Pesticides	< 0.05µg/l	< 0.1µg/l	< 0.2µg/l
(vii)	PAH	< 0.05µg/l	<0.1 µg/l	<0.2 µg/l
(viii)	PCB and PCT	< 0.01µg/l	< 0.01µg/l	< 0.02µg/l
(ix)	Zinc	< 100µg/l	< 200µg/l	<300 µg/l
(x)	Nickel	< 50µg/l	< 100µg/l	< 200µg/l
(xi)	Copper	< 20µg/l	< 50µg/l	<100µg/l

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