

# **ACTION PLAN FOR INDUSTRIAL CLUSTER IN SEVERLY POLLUTED AREA**

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

**पिंपरी-चिंचवाड Pimpri-Chinchwad**



**Maharashtra Pollution Control Board**

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## Index

Acknowledgement: .....	3
Abbreviations: .....	4
<b>1. Introduction: .....</b>	<b>5</b>
<b>2. Scope of Work.....</b>	<b>6</b>
2.1 Stack Emission Parameters.....	6
2.2 Ambient Air Quality Parameters .....	7
2.3 Water/Waste Water Parameters .....	7
2.3 Methodology followed in Sampling and Analysis .....	10
<b>3. Result of Analysis: .....</b>	<b>10</b>
3.1 Stack Emission: .....	10
3.2 Ambient Air Quality: .....	15
3.3 Water/ Waste Water Quality: .....	19
3.4 Ground Water Quality: .....	31
<b>4. Summary and Conclusion.....</b>	<b>43</b>
4.1 Stack Emission Monitoring:.....	43
4.2 Ambient Air Quality Monitoring: .....	43
4.3 Waste Water Quality Monitoring:.....	44
4.3 Ground Water Quality Monitoring: .....	45
<b>5. CEPI Score .....</b>	<b>47</b>
5.1 Comparison of CEPI scores: .....	49
<b>6. References .....</b>	<b>52</b>
<b>7. Annexure .....</b>	<b>53</b>
Annexure I Health related data in impact on humans .....	53
Annexure II: Stack Emission Sampling and Analysis Methodology .....	54
Annexure III: Ambient Air Sampling and Analysis Methodology .....	56
Annexure IV: Water/Wastewater Sampling and Analysis Methodology .....	58
Annexure V: National Ambient Air Quality Standards, 2009.....	62
Annexure VI: General Standards for Discharge of Environmental Pollutants, Part A: Effluents (The Environment (Protection) Rules, 1986, Schedule VI).....	63
Annexure VII: Drinking Water Specification-IS 10500:2012 .....	67
Annexure VIII: CPCB Water Quality Criteria: .....	71
Annexure IX: Water Quality Parameters Requirements and Classification.....	72

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## Abbreviations:

<b>APHA</b>	American Public Health Association
<b>BDL</b>	Below Detection Limit
<b>BOD</b>	Biochemical Oxygen Demand
<b>CEPI</b>	Comprehensive Environmental Pollution Index
<b>CETP</b>	Common Effluent Treatment Plant
<b>COD</b>	Chemical Oxygen Demand
<b>CPA</b>	Critically Polluted Areas
<b>SPA</b>	Severely Polluted Areas
<b>DO</b>	Dissolved Oxygen
<b>ETP</b>	Effluent Treatment Plant
<b>MIBK</b>	Methyl Isobutyl Ketone
<b>MPCB</b>	Maharashtra Pollution Control Board
<b>NAAQS</b>	National Ambient Air Quality Standards
<b>NO<sub>x</sub></b>	Oxides of Nitrogen
<b>ND</b>	Not Detected
<b>PAH</b>	Poly Aromatic Hydrocarbons
<b>PCB</b>	Poly Chlorinated Biphenyls
<b>PCT</b>	Poly Chlorinated Terphenyls
<b>PM<sub>10</sub></b>	Particulate Matter (size less than 10 µm)
<b>PM<sub>2.5</sub></b>	Particulate Matter (size less than 2.5 µm)
<b>SO<sub>2</sub></b>	Sulphur Dioxide
<b>STAP</b>	Short Term Action Plan
<b>WHO</b>	World Health Organization

## 1. Introduction:

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

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

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

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 Optronics 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, ThyssenKrupp and GEA Ecoflex, Alfa Laval & 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-Chinchwad:**

- The sampling was carried out in 6 days i.e. on 21<sup>st</sup>, 23<sup>rd</sup>, 26<sup>th</sup>, 28<sup>th</sup>, 29<sup>th</sup> May and 4<sup>th</sup> June 2018 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<sub>2</sub>)
2. Nitrogen Dioxide (NO<sub>2</sub>)
3. Particulate Matter (PM10)
4. Particulate Matter (PM2.5)
5. Ozone (O<sub>3</sub>)
6. Lead (Pb)
7. Carbon Monoxide (CO)
8. Ammonia (NH<sub>3</sub>)
9. Benzene (C<sub>6</sub>H<sub>6</sub>)
10. Benzo (a) Pyrene (BaP) (Particulate Phase Only)
11. Arsenic (As)
12. Nickel (Ni)

## **2.3 Water/Waste Water Parameters**

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

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

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

**i. Simple Parameters:**

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

**ii. Regular Monitoring Parameters:**

7. pH
8. Oil & Grease
9. Suspended Solids
10. Dissolved Oxygen (% saturation) (Not applicable for ground waters)
11. Chemical Oxygen Demand
12. Biochemical Oxygen Demand
13. Electrical Conductivity
14. Nitrite-Nitrogen
15. Nitrate-Nitrogen
16. (NO<sub>2</sub> + NO<sub>3</sub>)-Nitrogen
17. Free Ammonia
18. Total Residual Chlorine
19. Cyanide
20. Fluoride



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

**iii. Special Parameters:**

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

40. Lead
41. Cadmium
42. Mercury
43. Manganese
44. Iron
45. Vanadium
46. Selenium
47. Boron

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

**2.3 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 deductible limit.

**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.
-----	------------------	----------------	-----------

Sr.	Name of Industry	Stack Identity	Table No.
1.	Atlas Castalloy Ltd.	Melting Furnace	I
2.	Tata Motors	CH <sub>3</sub> Core drying Oven East Side	I
3.	Century Enka Ltd.	Super Heater S3	I
4.	Century Enkai Ltd.	Boiler S1	II
5.	Tata Motors	Wet Scruber no.3	II
6.	Alfa Laval (I) Pvt. Ltd.	Plant Booth	II

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

**Table No. I**

Name of Industry			Atlas Castalloy Ltd.	Tata Motors	Century Enka Ltd.
Date of Sampling			04.06.18	28.05.18	28.05.18
Sr.	Parameter	Unit	Results		
1.	Particulate Matter (as PM)	mg/Nm <sup>3</sup>	12	BDL	BDL
	<b>Std. Limit</b>	<b>mg/Nm<sup>3</sup></b>	<b>150</b>	<b>150</b>	<b>150</b>
2.	Sulphur Dioxide (as SO <sub>2</sub> )	mg/Nm <sup>3</sup>	17.3	21.7	7.36
		kg/day	2.59	2.36	3.94
	<b>Std. Limit</b>	<b>mg/Nm<sup>3</sup></b>	<b>100</b>	<b>100</b>	<b>100</b>
3.	Nitrogen Dioxide (NO <sub>2</sub> )	mg/Nm <sup>3</sup>	66	78	34
		<b>Std. Limit</b>	<b>mg/Nm<sup>3</sup></b>	<b>50</b>	<b>50</b>
4.	Acid Mist (as H <sub>2</sub> SO <sub>4</sub> )	mg/Nm <sup>3</sup>	7.51	57.6	18.7
		<b>Std. Limit</b>	<b>mg/Nm<sup>3</sup></b>	<b>35</b>	<b>35</b>
5.	Ammonia (NH <sub>3</sub> )	mg/Nm <sup>3</sup>	BDL	BDL	BDL
		<b>Std. Limit</b>	<b>mg/Nm<sup>3</sup></b>	-	-
6.	Carbon Monoxide (CO)	mg/Nm <sup>3</sup>	2.18	31.7	1.55

Name of Industry			Atlas Castalloy Ltd.	Tata Motors	Century Enka Ltd.
Date of Sampling			04.06.18	28.05.18	28.05.18
Sr.	Parameter	Unit	Results		
	<b>Std. Limit</b>	<b>mg/Nm<sup>3</sup></b>	-	-	-
7.	Chlorine (Cl <sub>2</sub> )	mg/Nm <sup>3</sup>	BDL	1	BDL
	<b>Std. Limit</b>	<b>mg/Nm<sup>3</sup></b>	-	-	-
8.	Fluoride (Gaseous)	mg/Nm <sup>3</sup>	BDL	BDL	BDL
	<b>Std. Limit</b>	<b>mg/Nm<sup>3</sup></b>	-	-	-
9.	Hydrogen Chloride (HCL)	mg/Nm <sup>3</sup>	2.51	2.5	1.43
	<b>Std. Limit</b>	<b>mg/Nm<sup>3</sup></b>	<b>35</b>	<b>35</b>	<b>35</b>
10.	Hydrogen Sulphide (H <sub>2</sub> S)	mg/Nm <sup>3</sup>	BDL	BDL	BDL
	<b>Std. Limit</b>	<b>mg/Nm<sup>3</sup></b>	<b>50</b>	<b>50</b>	<b>50</b>
11.	Oxygen	%	12	8	11
	<b>Std. Limit</b>	<b>%</b>	-	-	-

Table No. II

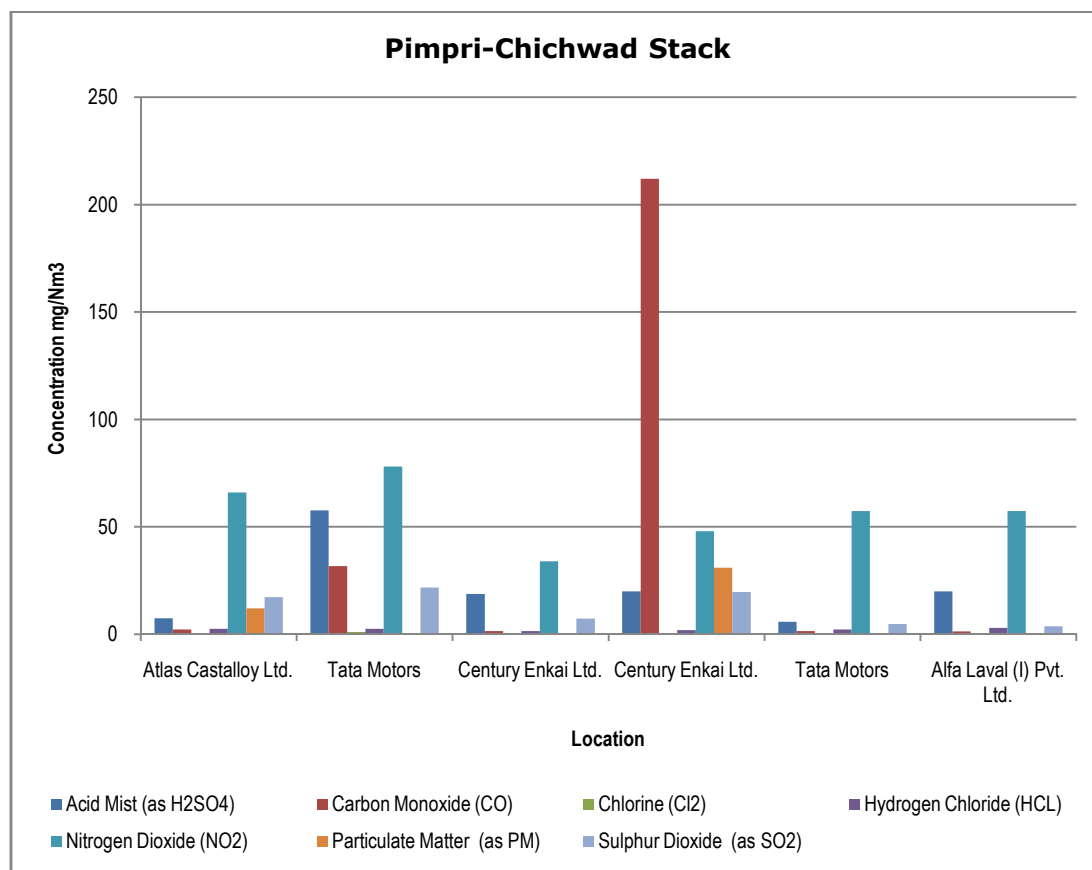
Name of Industry			Century Enkai Ltd.	Tata Motors	Alfa Laval (I) Pvt. Ltd.
Date of Sampling			26.05.18	26.05.18	29.05.18
Sr.	Parameter	Unit	Results		
1.	Particulate Matter (as PM)	mg/Nm <sup>3</sup>	13	BDL	BDL
	<b>Std. Limit</b>	<b>mg/Nm<sup>3</sup></b>	<b>150</b>	<b>150</b>	<b>150</b>
2.	Sulphur Dioxide (as SO <sub>2</sub> )	mg/Nm <sup>3</sup>	19.7	4.7	3.7
		kg/day	14.7	7.51	0.03
	<b>Std. Limit</b>	<b>mg/Nm<sup>3</sup></b>	<b>100</b>	<b>100</b>	<b>100</b>

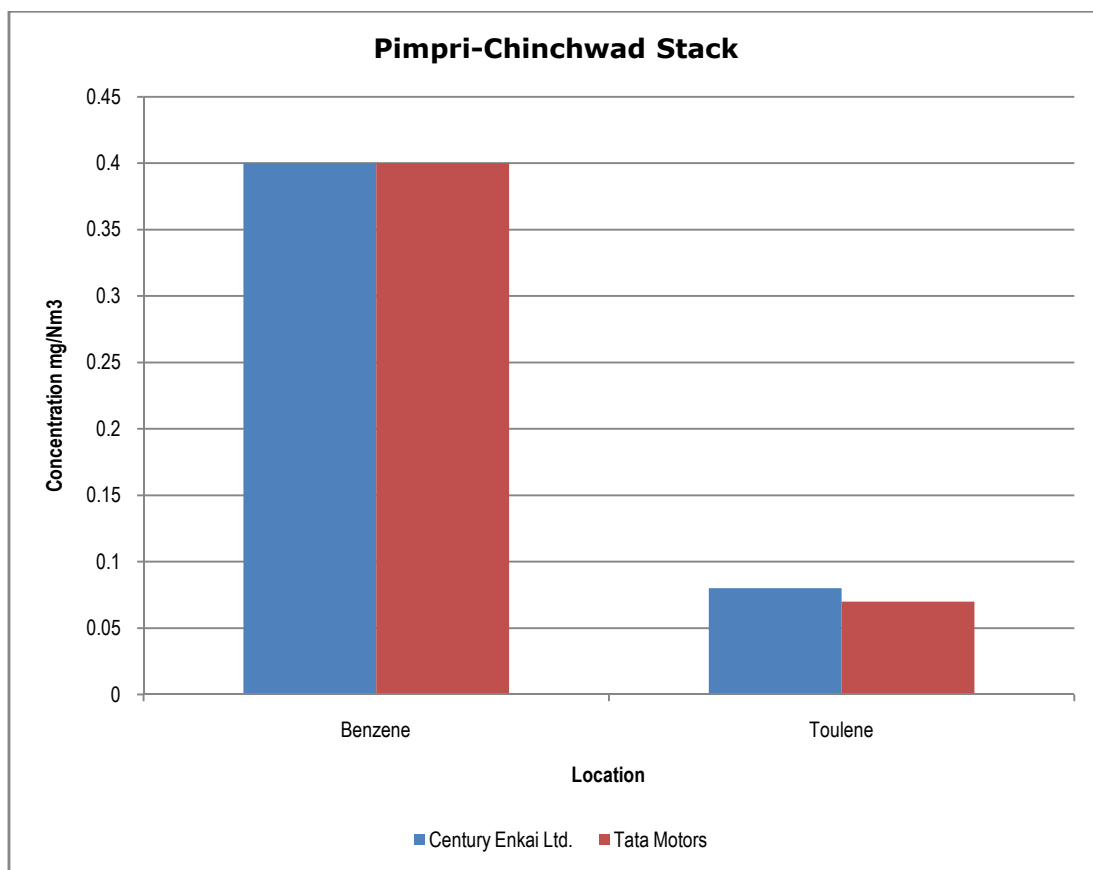
Name of Industry			Century Enkai Ltd.	Tata Motors	Alfa Laval (I) Pvt. Ltd.
Date of Sampling			26.05.18	26.05.18	29.05.18
Sr.	Parameter	Unit	Results		
3.	Nitrogen Dioxide (NO <sub>2</sub> )	mg/Nm <sup>3</sup>	47.9	57.4	57.4
	<b>Std. Limit</b>	<b>mg/Nm<sup>3</sup></b>	<b>50</b>	<b>50</b>	<b>50</b>
4.	Acid Mist (as H <sub>2</sub> SO <sub>4</sub> )	mg/Nm <sup>3</sup>	20	5.84	20
	<b>Std. Limit</b>	<b>mg/Nm<sup>3</sup></b>	<b>35</b>	<b>35</b>	<b>35</b>
5.	Ammonia (NH <sub>3</sub> )	mg/Nm <sup>3</sup>	BDL	BDL	BDL
	<b>Std. Limit</b>	<b>mg/Nm<sup>3</sup></b>	-	-	-
6.	Carbon Monoxide (CO)	mg/Nm <sup>3</sup>	212	1.47	1.29
	<b>Std. Limit</b>	<b>mg/Nm<sup>3</sup></b>	-	-	-
7.	Chlorine (Cl <sub>2</sub> )	mg/Nm <sup>3</sup>	BDL	BDL	BDL
	<b>Std. Limit</b>	<b>mg/Nm<sup>3</sup></b>	-	-	-
8.	Fluoride (Gaseous)	mg/Nm <sup>3</sup>	BDL	BDL	BDL
	<b>Std. Limit</b>	<b>mg/Nm<sup>3</sup></b>	-	-	-
9.	Hydrogen Chloride (HCL)	mg/Nm <sup>3</sup>	2	2.25	3
	<b>Std. Limit</b>	<b>mg/Nm<sup>3</sup></b>	<b>35</b>	<b>35</b>	<b>35</b>
10.	Hydrogen Sulphide (H <sub>2</sub> S)	mg/Nm <sup>3</sup>	BDL	BDL	BDL
	<b>Std. Limit</b>	<b>mg/Nm<sup>3</sup></b>	<b>50</b>	<b>50</b>	<b>50</b>
11.	Oxygen	%	8	8	8
	<b>Std. Limit</b>	<b>%</b>	-	-	-

**Table No. III**

Name of Industry			Atlas Castalloy Ltd.	Alfa Laval (I) Pvt. Ltd.
Date of Sampling			04.06.18	29.05.18
Sr.	Parameter	Unit	Results	
1.	VOC			
I.	Methyl Isobutyl Ketone	mg/Nm <sup>3</sup>	ND	ND
II.	Benzene	mg/Nm <sup>3</sup>	0.4	0.4
III.	Toulene	mg/Nm <sup>3</sup>	0.08	0.07
IV.	Xylene	mg/Nm <sup>3</sup>	ND	ND
V.	Ethyl Benzene	mg/Nm <sup>3</sup>	ND	ND
VI.	Ethyl Acetate	mg/Nm <sup>3</sup>	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.	Bajaj Auto Ltd.	Near Main Gate	<b>I</b>
2.	Bajaj Auto Ltd.	Near ETP	<b>I</b>
3.	Alfa Lava India Pvt. Ltd.	Near Main Gate	<b>I</b>
4.	Sandvik Asia Ltd.	Near Main Gate	<b>II</b>
5.	Century Enkey Bhosari Pune	Near Main Gate	<b>II</b>
6.	Atlas Mohanagar	Near Main Gate	<b>II</b>

**Table No. I**

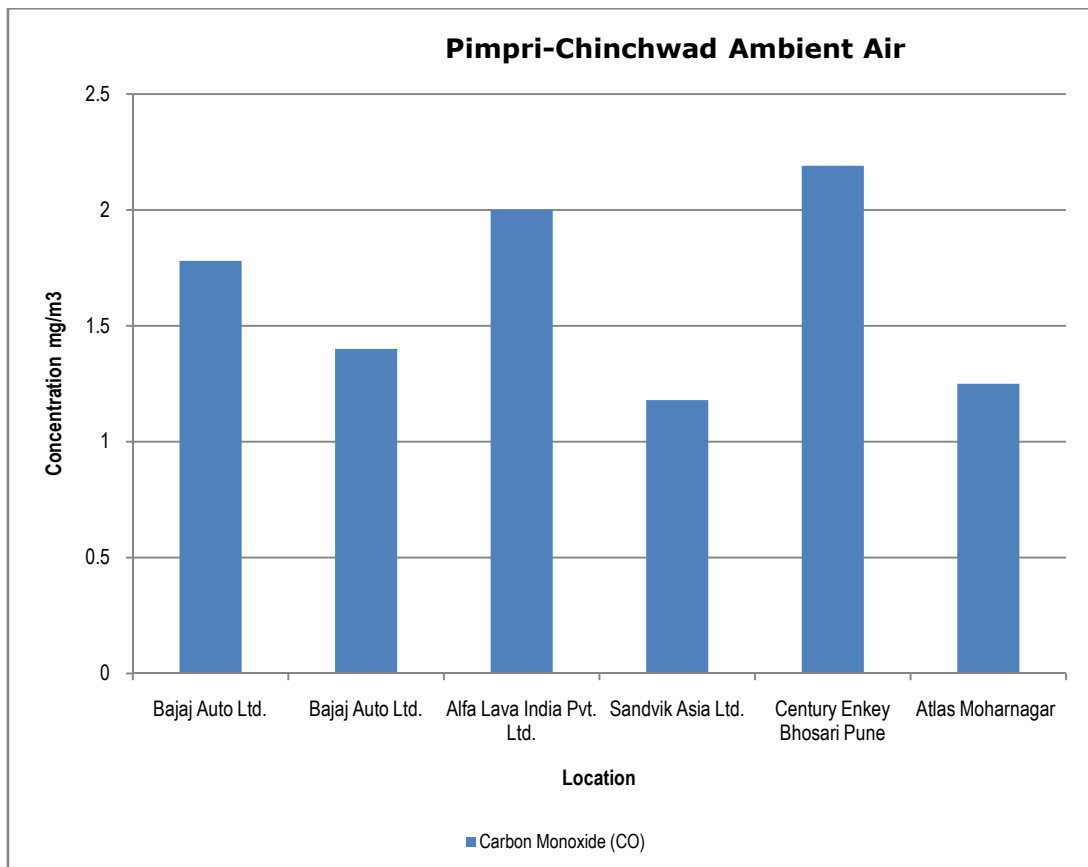
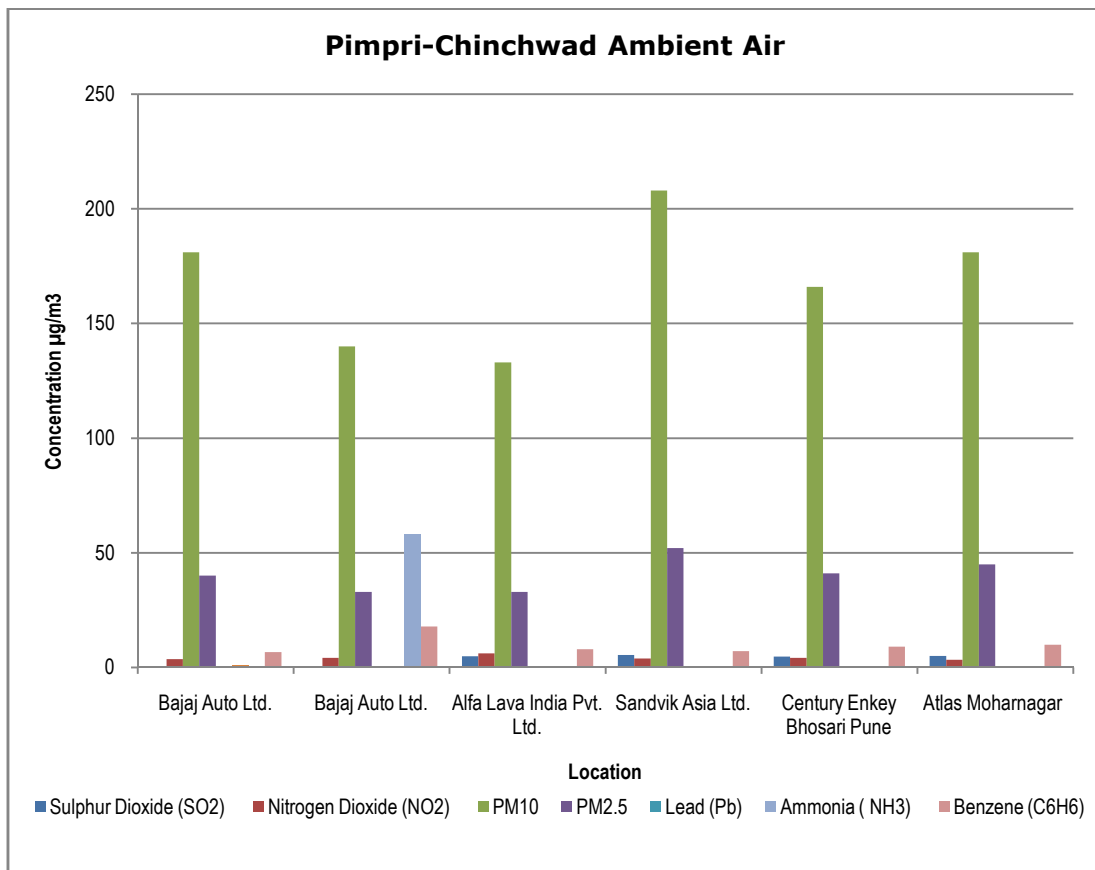
Location				Bajaj Auto Ltd.	Bajaj Auto Ltd.	Alfa Lava India Pvt. Ltd.
Date of Sampling				21.05.18	21.05.18	21.05.18
Sr.	Parameters	Unit	Std. Limit (NAAQS 2009)	Results		
1.	Sulphur Dioxide (SO <sub>2</sub> )	µg/m <sup>3</sup>	80	BDL	BDL	4.89
2.	Nitrogen Dioxide (NO <sub>2</sub> )	µg/m <sup>3</sup>	80	3.58	4.25	6.14
3.	Particulate Matter (size less than 10 µm) or PM <sub>10</sub>	µg/m <sup>3</sup>	100	181	140	133
4.	Particulate Matter (size less than 2.5 µm) or PM <sub>2.5</sub>	µg/m <sup>3</sup>	60	40	33	33
5.	Ozone (O <sub>3</sub> )	µg/m <sup>3</sup>	180	BDL	BDL	BDL
6.	Lead (Pb)	µg/m <sup>3</sup>	1	0.04	0.02	BDL
7.	Carbon Monoxide (CO)	mg/m <sup>3</sup>	4	1.78	1.4	2
8.	Ammonia (NH <sub>3</sub> )	µg/m <sup>3</sup>	400	BDL	58.3	BDL
9.	Benzene (C <sub>6</sub> H <sub>6</sub> )	µg/m <sup>3</sup>	5	6.67	17.9	7.89
10.	Benzo (a) Pyrene (BaP) – particulate phase only	ng/m <sup>3</sup>	1	BDL	BDL	BDL
11.	Arsenic (As)	ng/m <sup>3</sup>	6	BDL	BDL	0.404
12.	Nickel (Ni)	ng/m <sup>3</sup>	20	BDL	BDL	BDL

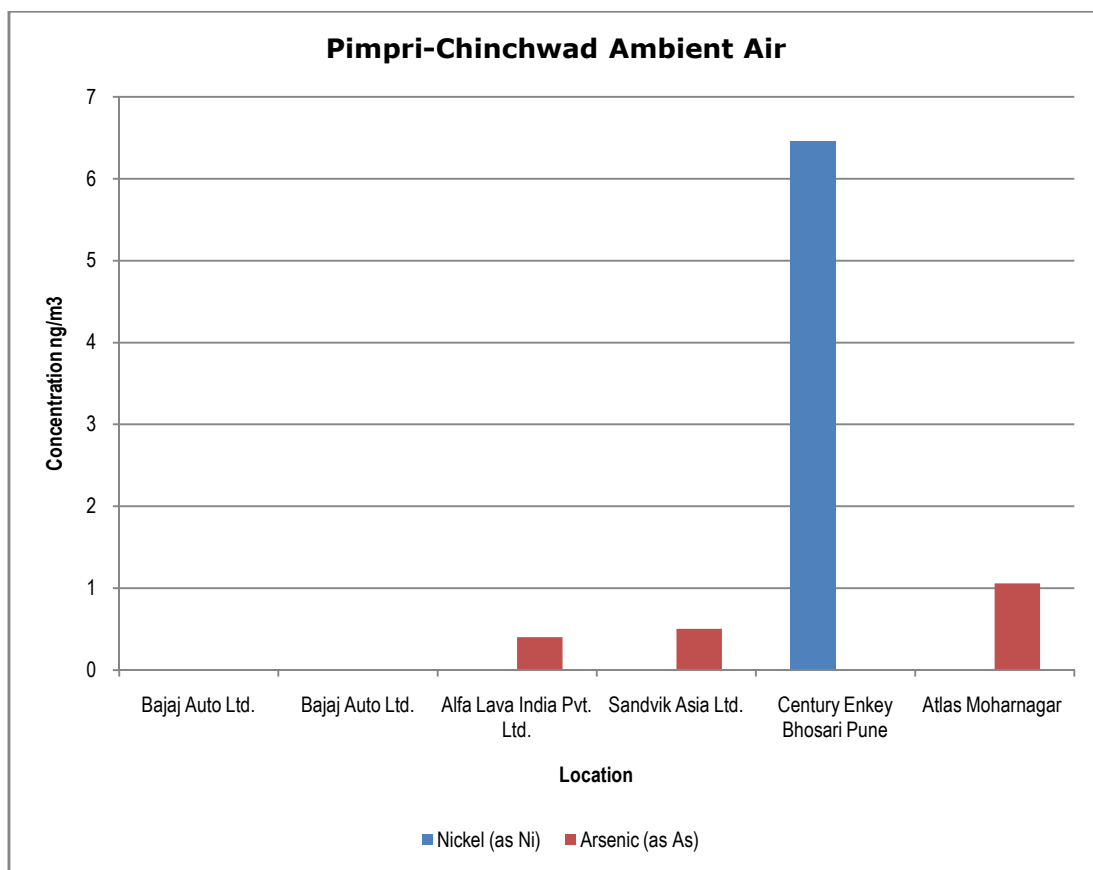


**Table No. II**

Location				Sandvik Asia Ltd.	Century Enkey Bhosari Pune	Atlas Moharnagar
Date of Sampling				23.05.18	23.05.18	23.05.18
Sr.	Parameters	Unit	Std. Limit (NAAQS 2009)	Results		
1.	Sulphur Dioxide (SO <sub>2</sub> )	µg/m <sup>3</sup>	80	5.47	4.79	4.99
2.	Nitrogen Dioxide (NO <sub>2</sub> )	µg/m <sup>3</sup>	80	3.93	4.13	3.41
3.	Particulate Matter (size less than 10 µm) or PM <sub>10</sub>	µg/m <sup>3</sup>	100	208	166	181
4.	Particulate Matter (size less than 2.5 µm) or PM <sub>2.5</sub>	µg/m <sup>3</sup>	60	52	41	45
5.	Ozone (O <sub>3</sub> )	µg/m <sup>3</sup>	180	BDL	BDL	BDL
6.	Lead (Pb)	µg/m <sup>3</sup>	1	BDL	BDL	BDL
7.	Carbon Monoxide (CO)	mg/m <sup>3</sup>	4	1.18	2.19	1.25
8.	Ammonia (NH <sub>3</sub> )	µg/m <sup>3</sup>	400	BDL	BDL	BDL
9.	Benzene (C <sub>6</sub> H <sub>6</sub> )	µg/m <sup>3</sup>	5	7.15	9.13	9.86
10.	Benzo (a) Pyrene (BaP) – particulate phase only	ng/m <sup>3</sup>	1	BDL	BDL	BDL
11.	Arsenic (As)	ng/m <sup>3</sup>	6	0.505	BDL	1.06
12.	Nickel (Ni)	ng/m <sup>3</sup>	20	BDL	6.46	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.	Sandvik Asia Pvt. Ltd. Dapodi Pune	STP Outlet	<b>I</b>
2.	Alfa Laval (India) Ltd. Dapodi	STP Outlet	<b>I</b>
3.	Century Enkai Ltd. Bhosari	ETP Outlet	<b>I</b>
4.	Finolex Cables Ltd.Pimpri	ETP Outlet	<b>II</b>
5.	Atlas Castalloy Ltd. MIDC Chinchwad	ETP Outlet	<b>II</b>
6.	Tata Motors MIDC Pimpri	ETP Outlet	<b>II</b>

**Table No. I**

Location				Sandvik Asia Pvt. Ltd. Dapodi Pune	Alfa Laval (India) Ltd. Dapodi	Century Enkai Ltd. Bhosari
Date of Sampling				04.06.18	04.06.18	04.06.18
Sr.	Parameters	Unit	Std. Limit	Results		
1.	Colour	Hazen		1	1	1
2.	Smell	-		Agreeable	Agreeable	Agreeable
3.	pH	-	<b>5.5 -9.0</b>	6.51	6.74	6.3
4.	Oil & Grease	mg/L	<b>10.0</b>	BDL	1.2	1.4
5.	Suspended Solids	mg/L	<b>100.0</b>	18	16	10
6.	Dissolved Oxygen (% Saturation)	%		80	75	70
7.	Chemical Oxygen Demand	mg/L	<b>250.0</b>	80	129	169
8.	Biochemical Oxygen Demand (3 days,27° C)	mg/L	<b>30.0</b>	27	44	52
9.	Electrical Conductivity (at 25° C )	µmho/cm		2470	1238	1180
10.	Nitrite Nitrogen (as NO <sub>2</sub> )	mg/L		0.1	BDL	0.02
11.	Nitrate Nitrogen (as NO <sub>3</sub> )	mg/L	<b>10.0</b>	35.9	39.2	35.6
12.	(NO <sub>2</sub> + NO <sub>3</sub> )-Nitrogen	mg/L	<b>5.0</b>	36	39.2	35.6
13.	Free Ammonia (as NH <sub>3</sub> -N)	mg/L	<b>5.0</b>	BDL	BDL	BDL

Location				Sandvik Asia Pvt. Ltd. Dapodi Pune	Alfa Laval (India) Ltd. Dapodi	Century Enkai Ltd. Bhosari
Date of Sampling				04.06.18	04.06.18	04.06.18
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	BDL	BDL	BDL
17.	Sulphide (as S <sup>2-</sup> )	mg/L	2.0	BDL	BDL	BDL
18.	Dissolved Phosphate (as P)	mg/L	5.0	BDL	1.71	BDL
19.	Sodium Absorption Ratio	mg/L		2.45	1.27	1.63
20.	Total Coliforms	MPN index/ 100 ml	100.0	540	170	540
21.	Faecal Coliforms	MPN index/ 100 ml	1000.0	14	6.1	21
22.	Total Phosphorous (as P)	mg/L	1.0	0.19	3.4	0.13
23.	Total Kjeldahl Nitrogen (as TKN)	mg/L	100.0	1.04	0.81	1.15
24.	Total Ammonia (NH <sub>4</sub> +NH <sub>3</sub> )-Nitrogen	mg/L	5.0	0.22	BDL	0.28
25.	Phenols (as C <sub>6</sub> H <sub>5</sub> OH)	mg/L	3.0	BDL	BDL	BDL

Location				Sandvik Asia Pvt. Ltd. Dapodi Pune	Alfa Laval (India) Ltd. Dapodi	Century Enkai Ltd. Bhosari
Date of Sampling				04.06.18	04.06.18	04.06.18
Sr.	Parameters	Unit	Std. Limit	Results		
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	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	0.2	BDL	BDL	BDL
IX.	p,p DDT	µg/L	0.05	BDL	BDL	BDL
X.	o,p DDT	µg/L	100.0	BDL	BDL	BDL
XI.	p,p DDE	µg/L	250.0	BDL	BDL	BDL
XII.	o,p DDE	µg/L	30.0	BDL	BDL	BDL
XIII.	p,p DDD	µg/L		BDL	BDL	BDL
XIV.	o,p DDD	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

Location				Sandvik Asia Pvt. Ltd. Dapodi Pune	Alfa Laval (India) Ltd. Dapodi	Century Enkai Ltd. Bhosari
Date of Sampling				04.06.18	04.06.18	04.06.18
Sr.	Parameters	Unit	Std. Limit	Results		
VIII.	Y HCH (Lindane)	µg/L	1.0	BDL	BDL	BDL
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	0.321	BDL	BDL
31.	Nickel (as Ni)	mg/L	3.0	BDL	BDL	BDL
32.	Copper (as Cu)	mg/L		BDL	BDL	BDL
33.	Hexavalent Chromium (as Cr <sup>6+</sup> )	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	0.0022	0.0015	BDL
39.	Manganese (as Mn)	mg/L	2.0	BDL	0.0399	0.0514
40.	Iron (as Fe)	mg/L	3.0	BDL	BDL	BDL

Location				Sandvik Asia Pvt. Ltd. Dapodi Pune	Alfa Laval (India) Ltd. Dapodi	Century Enkai Ltd. Bhosari
Date of Sampling				04.06.18	04.06.18	04.06.18
Sr.	Parameters	Unit	Std. Limit	Results		
41.	Vanadium (as V)	mg/L	0.2	BDL	0.0107	BDL
42.	Selenium (as Se)	mg/L	0.05	0.0082	0.006	BDL
43.	Boron (as B)	mg/L		0.774	0.275	BDL
44.	Bioassay Test on fish	% survival	90% survival after 96h in 100%effluent	80	100	100

Table No. II

Location				Finolex Cables Ltd. Pimpri	Atlas Castalloy Ltd. MIDC Chinchwad	Tata Motors MIDC Pimpri
Date of Sampling				04.06.18	04.06.18	04.06.18
Sr.	Parameters	Unit	Std. Limit	Results		
1.	Colour	Hazen		1	200	1
2.	Smell	-		Agreeable	Disagreeable	Agreeable
3.	pH	-	5.5 -9.0	8.01	7.07	7.07
4.	Oil & Grease	mg/L	10.0	1.2	BDL	1.4
5.	Suspended Solids	mg/L	100.0	12	25	8
6.	Dissolved Oxygen (% Saturation)	%		60	65	55



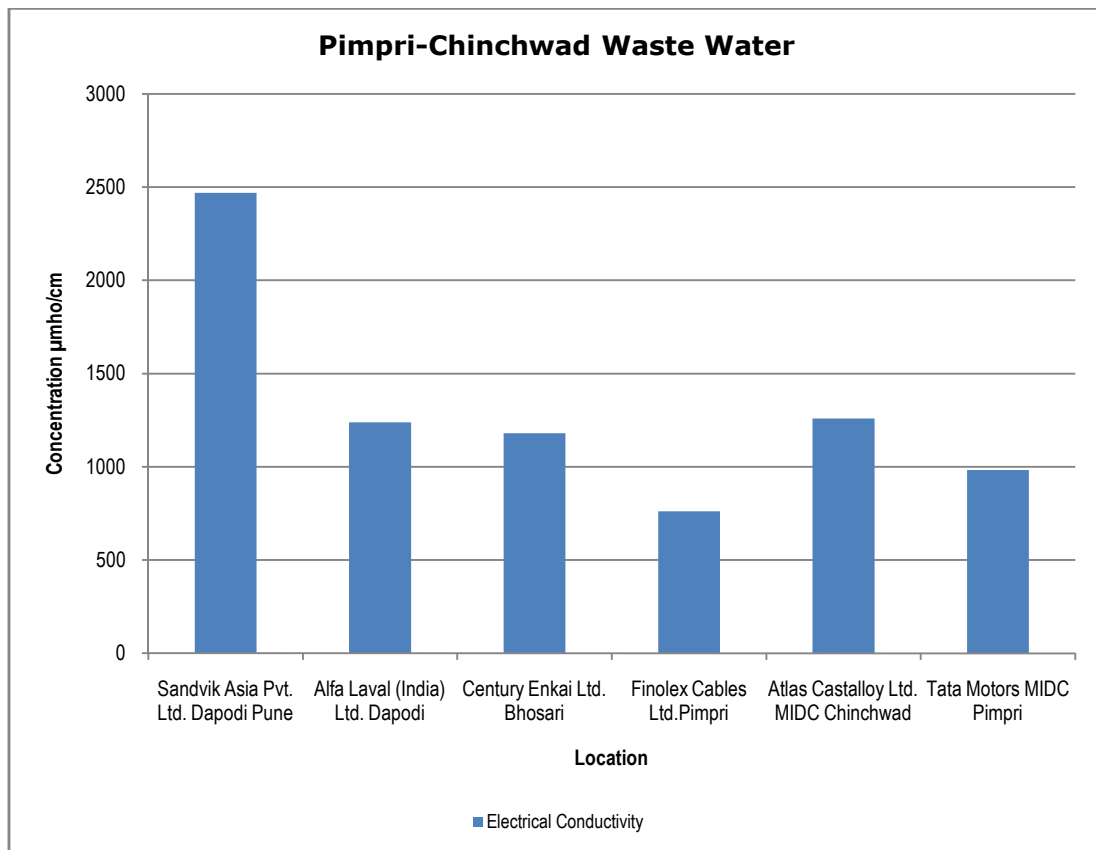
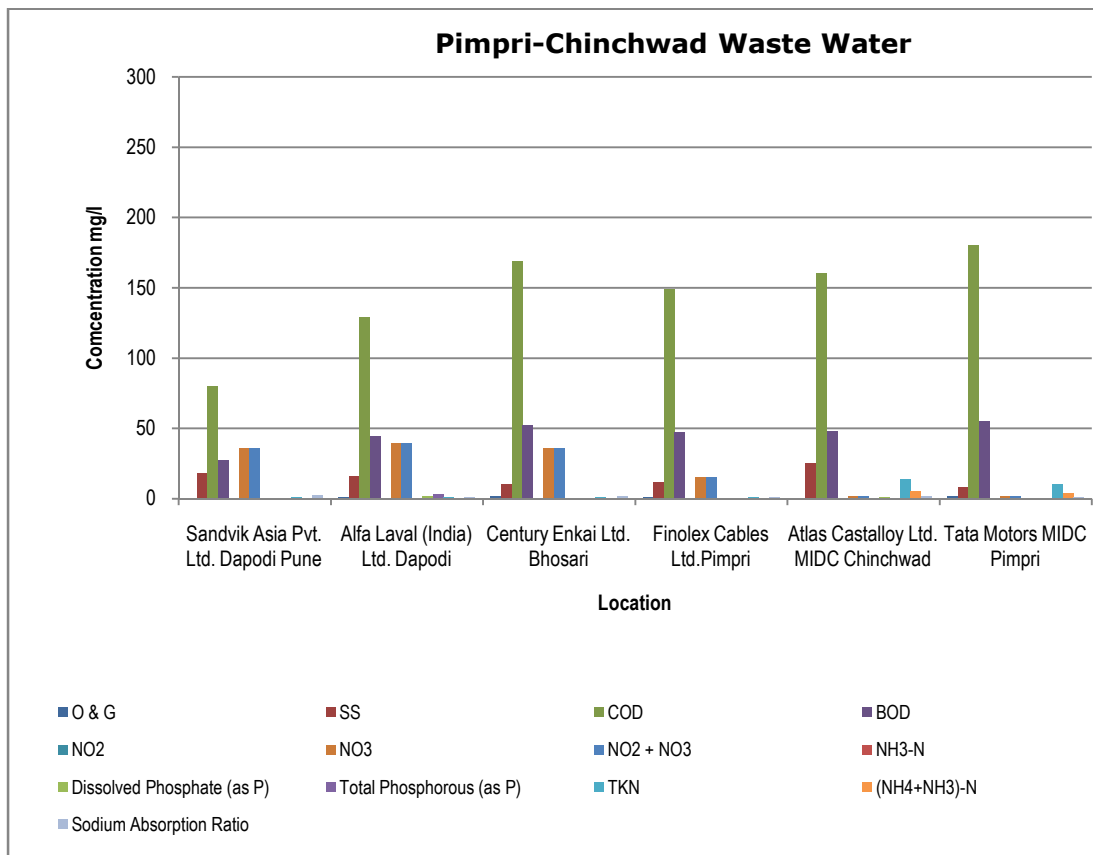
Location				Finolex Cables Ltd. Pimpri	Atlas Castalloy Ltd. MIDC Chinchwad	Tata Motors MIDC Pimpri
Date of Sampling				04.06.18	04.06.18	04.06.18
Sr.	Parameters	Unit	Std. Limit	Results		
7.	Chemical Oxygen Demand	mg/L	250.0	149	160	180
8.	Biochemical Oxygen Demand (3 days, 27° C)	mg/L	30.0	47	48	55
9.	Electrical Conductivity (at 25° C)	µmho/cm		761	1258	983
10.	Nitrite Nitrogen (as NO <sub>2</sub> )	mg/L		BDL	0.106	0.15
11.	Nitrate Nitrogen (as NO <sub>3</sub> )	mg/L	10.0	15.1	1.95	1.8
12.	(NO <sub>2</sub> + NO <sub>3</sub> )-Nitrogen	mg/L	5.0	15.1	2.05	1.95
13.	Free Ammonia (as NH <sub>3</sub> -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	BDL	BDL	BDL
17.	Sulphide (as S <sup>2-</sup> )	mg/L	2.0	BDL	17.6	BDL
18.	Dissolved Phosphate (as P)	mg/L	5.0	0.33	0.8	0.26

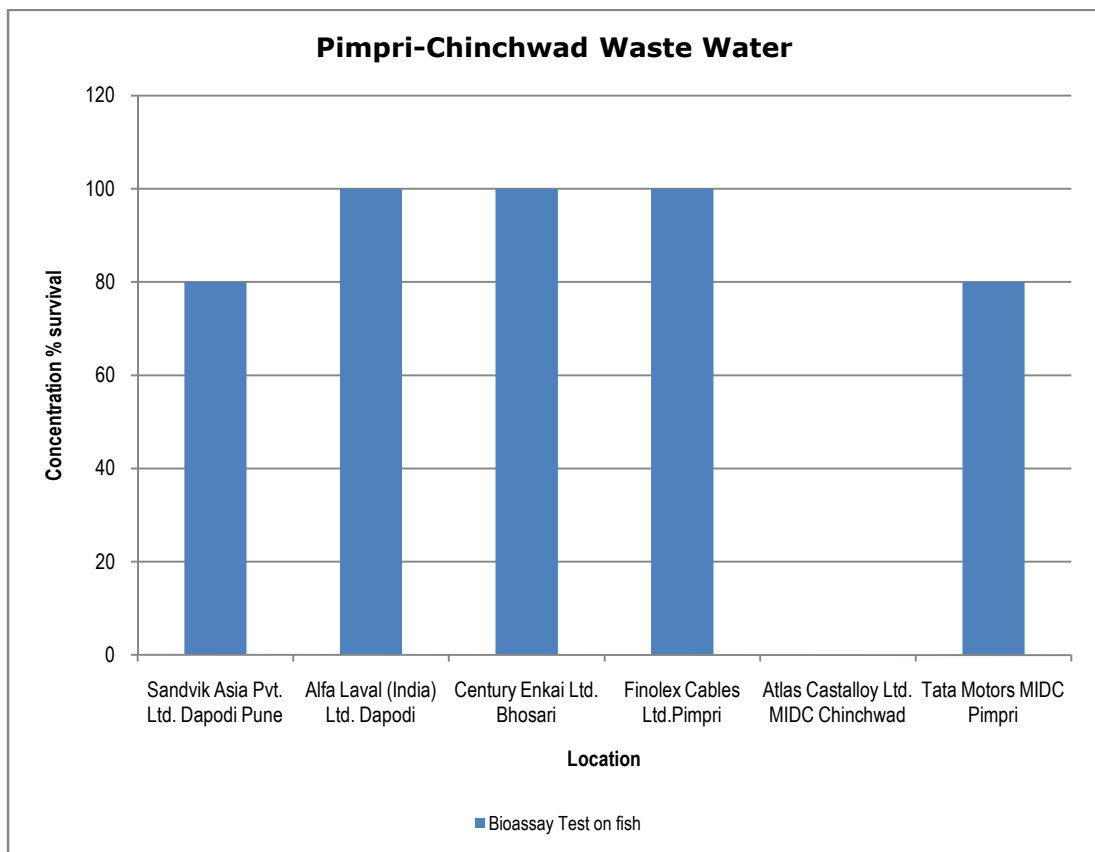
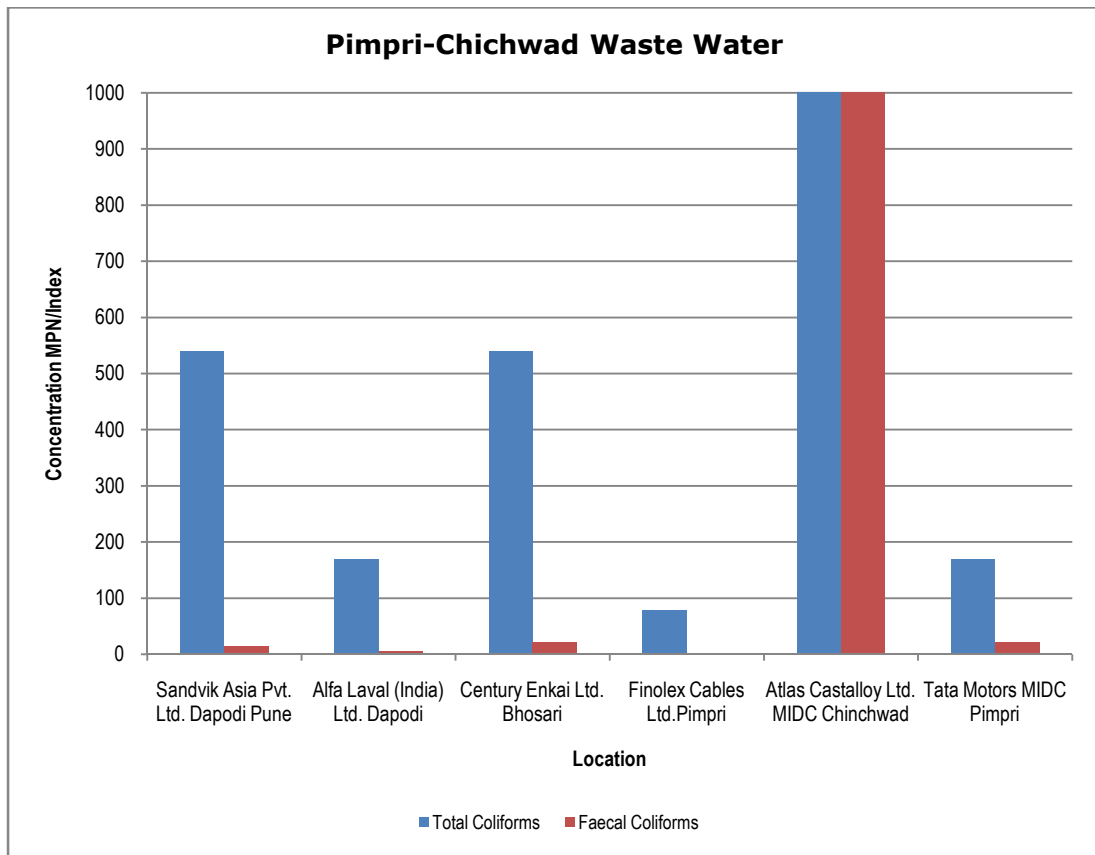
Location				Finolex Cables Ltd. Pimpri	Atlas Castalloy Ltd. MIDC Chinchwad	Tata Motors MIDC Pimpri
Date of Sampling				04.06.18	04.06.18	04.06.18
Sr.	Parameters	Unit	Std. Limit	Results		
19.	Sodium Absorption Ratio	mg/L		0.75	1.93	1.32
20.	Total Coliforms	MPN index/ 100 ml	<b>100.0</b>	79	7.9 x 10 <sup>5</sup>	170
21.	Faecal Coliforms	MPN index/ 100 ml	<b>1000.0</b>	BDL	1.7 x 10 <sup>5</sup>	21
22.	Total Phosphorous (as P)	mg/L	<b>1.0</b>	0.61	0.1	0.4
23.	Total Kjeldahl Nitrogen (as TKN)	mg/L	<b>100.0</b>	0.92	13.7	9.92
24.	Total Ammonia (NH <sub>4</sub> +NH <sub>3</sub> )-Nitrogen	mg/L	<b>5.0</b>	BDL	5	3.5
25.	Phenols (as C <sub>6</sub> H <sub>5</sub> OH)	mg/L	<b>3.0</b>	BDL	BDL	BDL
26.	Surface Active Agents (as MBAS)	mg/L	<b>3.0</b>	BDL	BDL	BDL
27.	Organo Chlorine Pesticides					
I.	Alachlor	µg/L	<b>2.0</b>	0.025	BDL	BDL
II.	Atrazine	µg/L	<b>0.2</b>	BDL	BDL	BDL
III.	Aldrin	µg/L	<b>0.1</b>	BDL	BDL	BDL
IV.	Dieldrin	µg/L	<b>2.0</b>	BDL	BDL	BDL
V.	Alpha HCH	µg/L	<b>0.01</b>	BDL	BDL	BDL

Location				Finolex Cables Ltd. Pimpri	Atlas Castalloy Ltd. MIDC Chinchwad	Tata Motors MIDC Pimpri
Date of Sampling				04.06.18	04.06.18	04.06.18
Sr.	Parameters	Unit	Std. Limit	Results		
VI.	Beta HCH	µg/L	2.0	BDL	BDL	BDL
VII.	Delta HCH	µg/L	3.0	BDL	BDL	BDL
VIII.	Butachlor	µg/L	0.2	BDL	BDL	BDL
IX.	p,p DDT	µg/L	0.05	BDL	BDL	BDL
X.	o,p DDT	µg/L	100.0	BDL	BDL	BDL
XI.	p,p DDE	µg/L	250.0	BDL	BDL	BDL
XII.	o,p DDE	µg/L	30.0	BDL	BDL	BDL
XIII.	p,p DDD	µg/L		BDL	BDL	BDL
XIV.	o,p DDD	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.	Y HCH (Lindane)	µg/L	1.0	BDL	BDL	BDL
28.	Polynuclear aromatic hydrocarbons (as PAH)	mg/L	0.2	0.0001	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	BDL
32.	Copper (as Cu)	mg/L		BDL	BDL	BDL

Location				Finolex Cables Ltd. Pimpri	Atlas Castalloy Ltd. MIDC Chinchwad	Tata Motors MIDC Pimpri
Date of Sampling				04.06.18	04.06.18	04.06.18
Sr.	Parameters	Unit	Std. Limit	Results		
33.	Hexavalent Chromium (as Cr6+)	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	0.0171	BDL	BDL
39.	Manganese (as Mn)	mg/L	2.0	BDL	0.043	0.0327
40.	Iron (as Fe)	mg/L	3.0	BDL	0.154	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		0.0394	BDL	0.0117
44.	Bioassay Test on fish	% survival	90% survival after 96h in 100%effluent	100	0	80

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





**3.4 Ground Water Quality:**

Sr.	Location	Source	Table No.
1.	Borate Shubham Wagjai Mala Borate Wasti Mosi	Well Water	<b>I</b>
2.	Sontara Building Khandesh Nagar Moshi	Borewell Water	<b>I</b>
3.	Ram biradar, Mohan Nagar Chinchwad	Bore well	<b>I</b>
4.	Alcon Square, MIDC Sector 2, Industrial Area, Bhosri	Bore well	<b>II</b>
5.	Silver Associates sBhosri	Bore well	<b>II</b>
6.	Nishant Bahirwadi Datt Mandir Chowk, Mohan nagar	Bore well	<b>II</b>

**Table No. I**

Location				Borate Shubham Wagjai Mala Borate Wasti Mosi	Sontara Building Khandesh Nagar Moshi	Ram biradar, Mohan Nagar Chinchwad
Date of Sampling				<b>04.06.18</b>	<b>04.06.18</b>	<b>04.06.18</b>
Sr.	Parameters	Unit	Std. Limit	Results		
1.	Colour	Hazen		1	1	1
2.	Smell	-	<b>Agreeable</b>	Agreeable	Agreeable	Agreeable
3.	pH	-	<b>6.5-8.5</b>	6.72	7.5	7.13
4.	Oil & Grease	mg/L		BDL	BDL	BDL
5.	Suspended Solids	mg/L	<b>100</b>	6	7	8
6.	Dissolved Oxygen (%Saturation)	%		80	90	75
7.	Chemical Oxygen Demand	mg/L	<b>500</b>	9	9.96	11

Location				Borate Shubham Wagjai Mala Borate Wasti Mosi	Sontara Building Khandesh Nagar Moshi	Ram biradar, Mohan Nagar Chinchwad
Date of Sampling				04.06.18	04.06.18	04.06.18
Sr.	Parameters	Unit	Std. Limit	Results		
8.	Biochemical Oxygen Demand (3 days,27°C)	mg/L	<b>10 (WHO, 1993)</b>	2.74	3.04	3.35
9.	Electrical Conductivity (at 25°C )	µmho/cm	<b>6 (WHO, 1993)</b>	1397	785	647
10.	Nitrite Nitrogen (as NO <sub>2</sub> )	mg/L	<b>0.3 (WHO, 1993)</b>	0.06	0.06	0.01
11.	Nitrate Nitrogen (as NO <sub>3</sub> )	mg/L		14.4	25.6	17.7
12.	(NO <sub>2</sub> + NO <sub>3</sub> )-Nitrogen	mg/L	<b>45</b>	15	25.7	17.8
13.	Free Ammonia (as NH <sub>3</sub> -N)	mg/L	<b>1.0</b>	BDL	BDL	BDL
14.	Total Residual Chlorine	mg/L	<b>0.5</b>	BDL	BDL	BDL
15.	Cyanide (as CN)	mg/L	<b>0.2</b>	BDL	BDL	BDL
16.	Fluoride (as F)	mg/L		BDL	BDL	BDL
17.	Sulphide (as S <sub>2</sub> -)	mg/L	<b>1</b>	BDL	BDL	BDL
18.	Dissolved Phosphate (as P)	mg/L	<b>0.05</b>	BDL	BDL	BDL



Location				Borate Shubham Wagjai Mala Borate Wasti Mosi	Sontara Building Khandesh Nagar Moshi	Ram biradar, Mohan Nagar Chinchwad
Date of Sampling				04.06.18	04.06.18	04.06.18
Sr.	Parameters	Unit	Std. Limit	Results		
19.	Sodium Absorption Ratio	mg/L		0.5	1.53	1.49
20.	Total Coliforms	MPN index/ 100 ml		240	350	33
21.	Faecal Coliforms	MPN index/ 100 ml	<b>ND</b>	BDL	BDL	BDL
22.	Total Phosphorous (as P)	mg/L	<b>ND</b>	0.148	BDL	0.17
23.	Total Kjeldahl Nitrogen	mg/L	<b>0.5</b>	1.04	0.92	0.81
24.	Total Ammonia (NH <sub>4</sub> +NH <sub>3</sub> )-Nitrogen	mg/L	<b>0.001</b>	BDL	BDL	BDL
25.	Phenols (as C <sub>6</sub> H <sub>5</sub> OH)	mg/L	<b>0.5</b>	BDL	BDL	BDL
26.	Surface Active Agents (as MBAS)	mg/L	<b>0.001</b>	BDL	BDL	BDL
27.	Organo Chlorine Pesticides					
I.	Alachlor	µg/L	<b>0.05</b>	BDL	BDL	BDL
II.	Atrazine	µg/L	<b>20</b>	BDL	BDL	BDL
III.	Aldrin	µg/L	<b>2</b>	BDL	BDL	BDL
IV.	Dieldrin	µg/L	<b>0.03</b>	BDL	BDL	BDL

Location				Borate Shubham Wagjai Mala Borate Wasti Mosi	Sontara Building Khandesh Nagar Moshi	Ram biradar, Mohan Nagar Chinchwad
Date of Sampling				04.06.18	04.06.18	04.06.18
Sr.	Parameters	Unit	Std. Limit	Results		
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,p DDT	µg/L	0.04	BDL	BDL	BDL
X.	o,p DDT	µg/L	1	BDL	BDL	BDL
XI.	p,p DDE	µg/L	1	BDL	BDL	BDL
XII.	o,p DDE	µg/L	1	BDL	BDL	BDL
XIII.	p,p DDD	µg/L	1	BDL	BDL	BDL
XIV.	o,p DDD	µg/L	1	BDL	BDL	BDL
XV.	Alpha Endosulfan	µg/L	1	BDL	BDL	BDL
XVI.	Beta Endosulfan	µg/L	0.4	BDL	BDL	BDL
XVII.	Endosulfan Sulphate	µg/L	0.4	BDL	BDL	BDL
XVIII.	Y HCH (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

Location				Borate Shubham Wagjai Mala Borate Wasti Mosi	Sontara Building Khandesh Nagar Moshi	Ram biradar, Mohan Nagar Chinchwad
Date of Sampling				04.06.18	04.06.18	04.06.18
Sr.	Parameters	Unit	Std. Limit	Results		
31.	Nickel (as Ni)	mg/L	<b>5.0</b>	BDL	BDL	BDL
32.	Copper (as Cu)	mg/L	<b>0.02</b>	BDL	BDL	BDL
33.	Hexavalent Chromium (as Cr <sup>6+</sup> )	mg/L	<b>0.05</b>	BDL	BDL	BDL
34.	Total Chromium (as Cr)	mg/L	<b>1</b>	0.03	BDL	BDL
35.	Total Arsenic (as As)	mg/L	<b>0.05</b>	BDL	BDL	BDL
36.	Lead (as Pb)	mg/L	<b>0.01</b>	BDL	BDL	0.014
37.	Cadmium (as Cd)	mg/L	<b>0.01</b>	BDL	BDL	BDL
38.	Mercury (as Hg)	mg/L	<b>0.003</b>	BDL	BDL	BDL
39.	Manganese (as Mn)	mg/L	<b>0.001</b>	0.096	BDL	BDL
40.	Iron (as Fe)	mg/L	<b>0.1</b>	0.096	0.262	BDL
41.	Vanadium (as V)	mg/L	<b>0.3</b>	0.032	0.026	0.032
42.	Selenium (as Se)	mg/L		BDL	BDL	BDL
43.	Boron (as B)	mg/L	<b>0.01</b>	0.051	0.065	0.061
44.	Bioassay Test on fish	% survival		100	100	100

**Table No. II**

Location				Alcon Square, MIDC Sector 2, Industrial Area, Bhosri	Silver Associates Bhosri	Nishant Bahirwadi Datt Mandir Chowk, Mohan nagar
Date of Sampling				04.06.18	04.06.18	04.06.18
Sr.	Parameters	Unit	Std. Limit	Results		
1.	Colour	Hazen		1	1	1
2.	Smell	-	<b>Agreeable</b>	Agreeable	Agreeable	Agreeable
3.	pH	-	<b>6.5-8.5</b>	6.67	7	7.04
4.	Oil & Grease	mg/L		BDL	BDL	BDL
5.	Suspended Solids	mg/L	<b>100</b>	8	8	7
6.	Dissolved Oxygen (%Saturation)	%		70	85	80
7.	Chemical Oxygen Demand	mg/L	<b>500</b>	7	6	7
8.	Biochemical Oxygen Demand (3 days,27°C)	mg/L	<b>10 (WHO, 1993)</b>	2.13	1.83	2.13
9.	Electrical Conductivity (at 25°C )	µmho/cm	<b>6 (WHO, 1993)</b>	354	534	743
10.	Nitrite Nitrogen (as NO <sub>2</sub> )	mg/L	<b>0.3 (WHO, 1993)</b>	BDL	0.03	0.01
11.	Nitrate Nitrogen (as NO <sub>3</sub> )	mg/L		6.28	10.6	8.74
12.	(NO <sub>2</sub> + NO <sub>3</sub> )-Nitrogen	mg/L	<b>45</b>	6.28	10.6	8.75

Location				Alcon Square, MIDC Sector 2, Industrial Area, Bhosri	Silver Associates Bhosri	Nishant Bahirwadi Datt Mandir Chowk, Mohan nagar
Date of Sampling				04.06.18	04.06.18	04.06.18
Sr.	Parameters	Unit	Std. Limit	Results		
13.	Free Ammonia (as NH <sub>3</sub> -N)	mg/L	<b>1.0</b>	BDL	BDL	BDL
14.	Total Residual Chlorine	mg/L	<b>0.5</b>	BDL	BDL	BDL
15.	Cyanide (as CN)	mg/L	<b>0.2</b>	BDL	BDL	BDL
16.	Fluoride (as F)	mg/L		BDL	BDL	BDL
17.	Sulphide (as S <sub>2</sub> -)	mg/L	<b>1</b>	BDL	BDL	BDL
18.	Dissolved Phosphate (as P)	mg/L	<b>0.05</b>	BDL	BDL	BDL
19.	Sodium Absorption Ratio	mg/L		0.31	0.45	0.64
20.	Total Coliforms	MPN index/ 100 ml		920	BDL	79
21.	Faecal Coliforms	MPN index/ 100 ml	<b>ND</b>	BDL	BDL	BDL
22.	Total Phosphorous (as P)	mg/L	<b>ND</b>	BDL	BDL	0.1
23.	Total Kjeldahl Nitrogen	mg/L	<b>0.5</b>	0.69	1.04	1.15
24.	Total Ammonia (NH <sub>4</sub> +NH <sub>3</sub> )- Nitrogen	mg/L	<b>0.001</b>	BDL	BDL	BDL

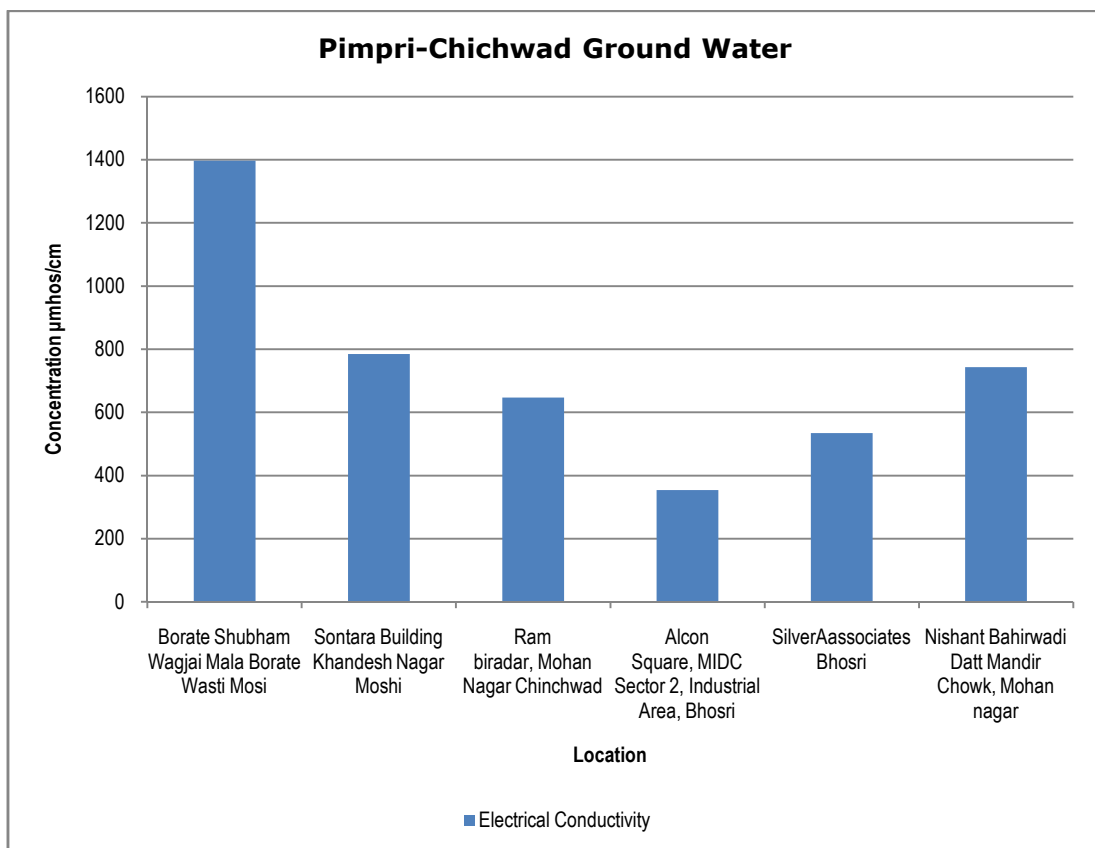
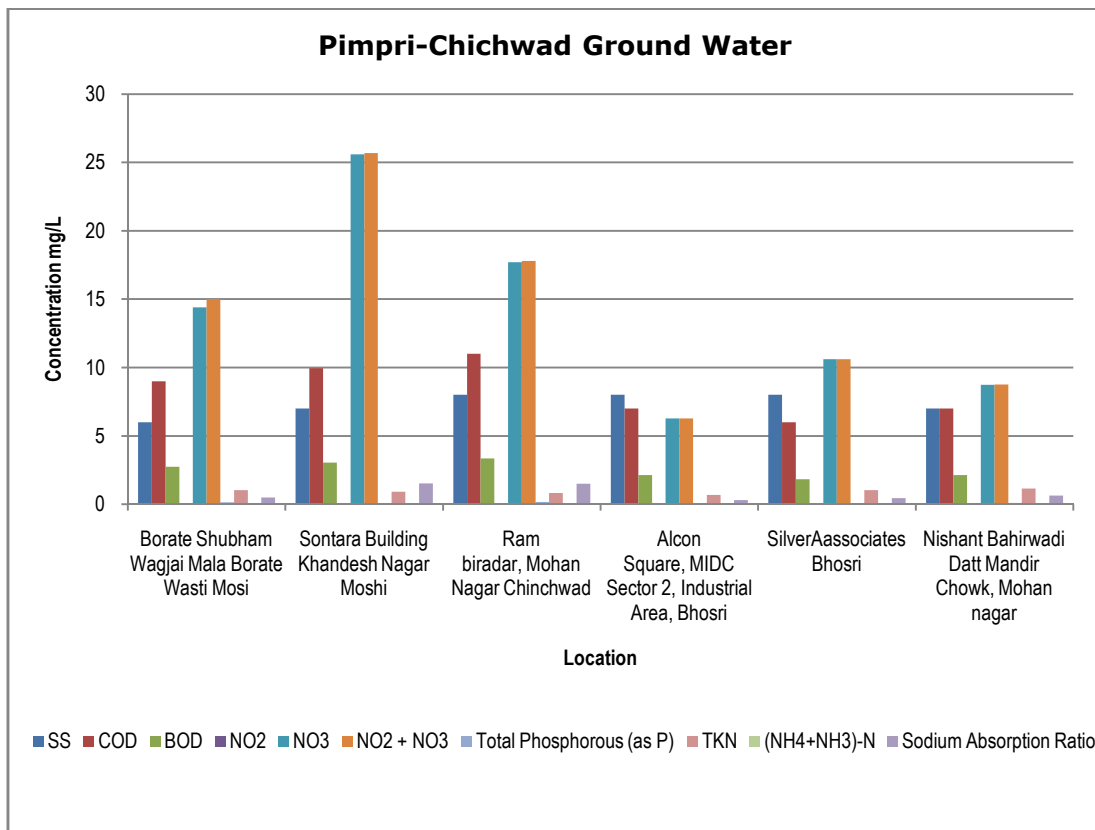
Location				Alcon Square, MIDC Sector 2, Industrial Area, Bhosri	Silver Associates Bhosri	Nishant Bahirwadi Datt Mandir Chowk, Mohan nagar
Date of Sampling				04.06.18	04.06.18	04.06.18
Sr.	Parameters	Unit	Std. Limit	Results		
25.	Phenols (as C <sub>6</sub> H <sub>5</sub> OH)	mg/L	<b>0.5</b>	BDL	BDL	BDL
26.	Surface Active Agents (as MBAS)	mg/L	<b>0.001</b>	BDL	BDL	BDL
27.	Organo Chlorine Pesticides					
XIX.	Alachlor	µg/L	<b>0.05</b>	BDL	BDL	BDL
XX.	Atrazine	µg/L	<b>20</b>	BDL	BDL	BDL
XXI.	Aldrin	µg/L	<b>2</b>	BDL	BDL	BDL
XXII.	Dieldrin	µg/L	<b>0.03</b>	BDL	BDL	BDL
XIII.	Alpha HCH	µg/L	<b>0.03</b>	BDL	BDL	BDL
XIV.	Beta HCH	µg/L	<b>0.01</b>	BDL	BDL	BDL
XXV.	Delta HCH	µg/L	<b>0.04</b>	BDL	BDL	BDL
XVI.	Butachlor	µg/L	<b>125</b>	BDL	BDL	BDL
XXVII.	p,p DDT	µg/L	<b>0.04</b>	BDL	BDL	BDL
VIII.	o,p DDT	µg/L	<b>1</b>	BDL	BDL	BDL
XIX.	p,p DDE	µg/L	<b>1</b>	BDL	BDL	BDL
XXX.	o,p DDE	µg/L	<b>1</b>	BDL	BDL	BDL
XXI.	p,p DDD	µg/L	<b>1</b>	BDL	BDL	BDL
XXII.	o,p DDD	µg/L	<b>1</b>	BDL	BDL	BDL
XIII.	Alpha Endosulfan	µg/L	<b>1</b>	BDL	BDL	BDL

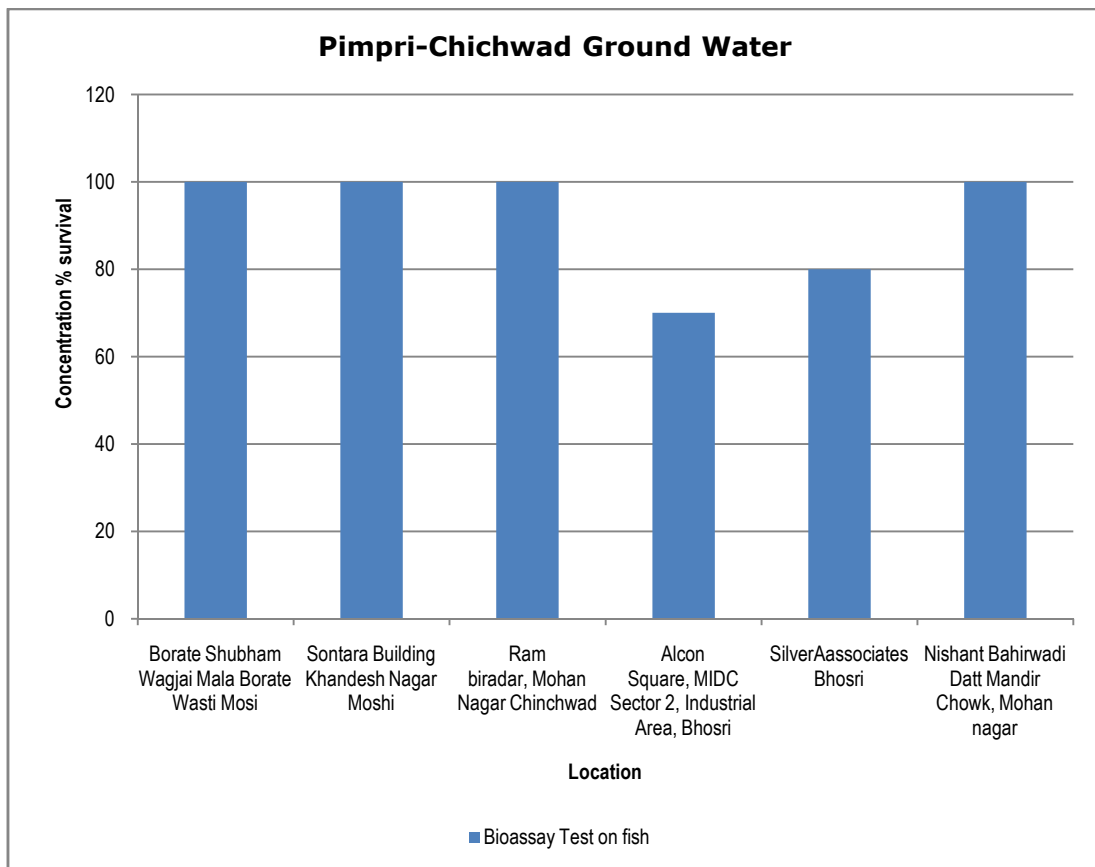
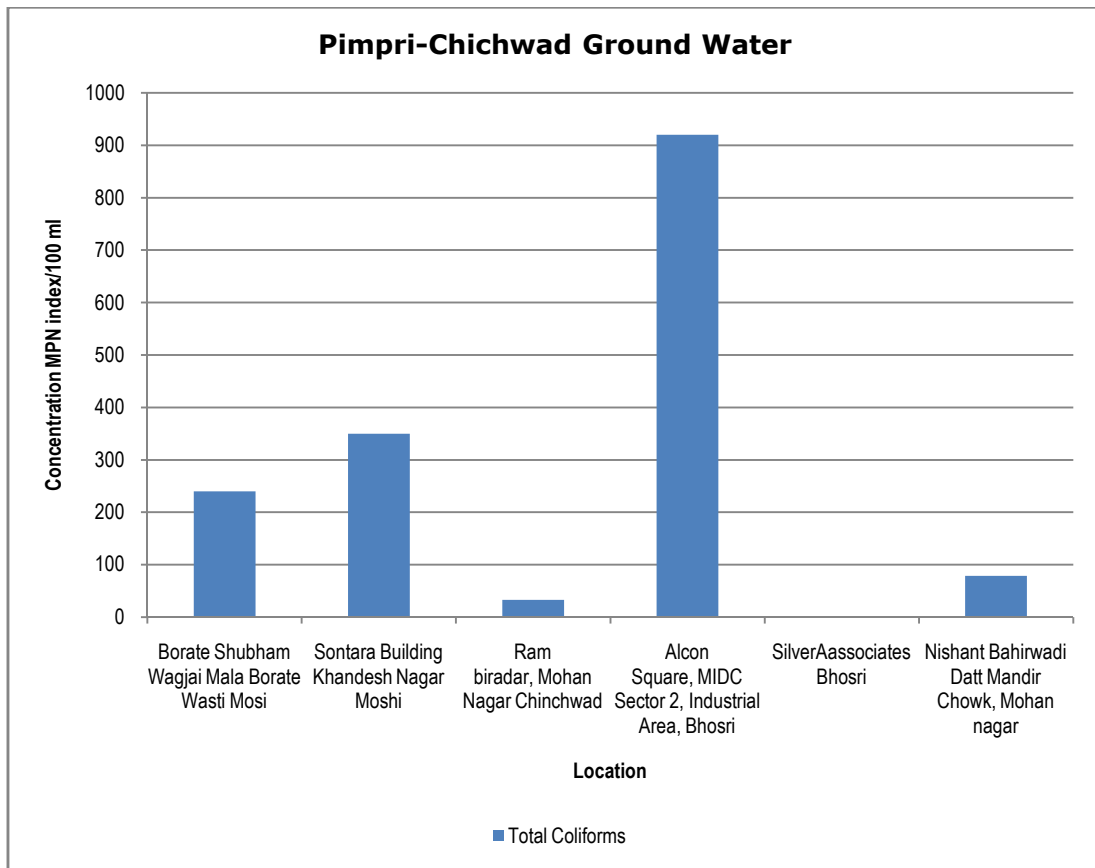
Location				Alcon Square, MIDC Sector 2, Industrial Area, Bhosri	Silver Associates Bhosri	Nishant Bahirwadi Datt Mandir Chowk, Mohan nagar
Date of Sampling				04.06.18	04.06.18	04.06.18
Sr.	Parameters	Unit	Std. Limit	Results		
XIV.	Beta Endosulfan	µg/L	0.4	BDL	BDL	BDL
XXV.	Endosulfan Sulphate	µg/L	0.4	BDL	BDL	BDL
XVI.	Y HCH (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	0.026	BDL	BDL
33.	Hexavalent Chromium (as Cr <sup>6+</sup> )	mg/L	0.05	BDL	BDL	BDL
34.	Total Chromium (as Cr)	mg/L	1	0.024	BDL	BDL
35.	Total Arsenic (as As)	mg/L	0.05	BDL	BDL	BDL
36.	Lead (as Pb)	mg/L	0.01	0.009	BDL	BDL
37.	Cadmium (as Cd)	mg/L	0.01	BDL	BDL	BDL

Location				Alcon Square, MIDC Sector 2, Industrial Area, Bhosri	Silver Associates Bhosri	Nishant Bahirwadi Datt Mandir Chowk, Mohan nagar
Date of Sampling				04.06.18	04.06.18	04.06.18
Sr.	Parameters	Unit	Std. Limit	Results		
38.	Mercury (as Hg)	mg/L	<b>0.003</b>	BDL	BDL	BDL
39.	Manganese (as Mn)	mg/L	<b>0.001</b>	0.071	BDL	BDL
40.	Iron (as Fe)	mg/L	<b>0.1</b>	0.072	BDL	BDL
41.	Vanadium (as V)	mg/L	<b>0.3</b>	BDL	BDL	0.016
42.	Selenium (as Se)	mg/L		BDL	BDL	BDL
43.	Boron (as B)	mg/L	<b>0.01</b>	0.01	0.015	0.029
44.	Bioassay Test on fish	% survival		70	80	100



**Graphs: Ground Water Quality Monitoring for Pimpri-Chinchwad:**





## 4. Summary and Conclusion

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 of the 6 stacks, the result of 4 stacks was found to be below the detectable limit. Remaining all the results obtained is within the standard emission for the specified industry.
- 2. Sulphur dioxide (SO<sub>2</sub>):** Emission of SO<sub>2</sub> was well within the limit in all 6 stacks sampled. The highest level of SO<sub>2</sub> was observed at Tata Power CH<sub>3</sub> Core drying Oven East Side stack with 21.7 mg/Nm<sup>3</sup> emission.
- 3. Nitrogen dioxide (NO<sub>2</sub>):** NO<sub>2</sub> at 4 stacks out of the 6 stacks monitored was exceeding the permissible limit of emission. The highest level of NO<sub>2</sub> was observed at Tata Power CH<sub>3</sub> Core drying Oven East Side stack with 78 mg/Nm<sup>3</sup> emission.
- 4. Acid Mist (as H<sub>2</sub>SO<sub>4</sub>):** The concentration of Acid Mist at Tata Power CH<sub>3</sub> Core drying Oven East Side stack with 57.6 mg/Nm<sup>3</sup> had the highest and out of the limit concentration.
- 5. Ammonia (NH<sub>3</sub>):** All 6 stacks had concentration of Ammonia below the detectable limit.
- 6. Carbon Monoxide (CO):** The highest concentration of carbon monoxide was observed at Century Enkai Ltd. with 212 mg/Nm<sup>3</sup>.
- 7. Chlorine (Cl<sub>2</sub>):** Out of the 6 stacks monitored, 5 of them showed below detectable limit of Chlorine and at Tata Power CH<sub>3</sub> Core drying Oven East Side stack showed 1 mg/Nm<sup>3</sup> concentration of Cl<sub>2</sub>.
- 8. Fluoride (Gaseous):** All 6 stacks had concentration of Fluoride below the detectable limit.
- 9. Hydrogen Chloride (HCL):** All 6 stacks monitored were within the standard limit of Hydrogen Chloride concentration.
- 10. Hydrogen Sulphide (H<sub>2</sub>S):** All 6 stacks had concentration of H<sub>2</sub>S below the detectable limit.
- 11. Oxygen:** The highest concentration of 12% oxygen was observed at Atlas Castalloy Ltd.

### 4.2 Ambient Air Quality Monitoring:

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

- 1. Sulphur dioxide (SO<sub>2</sub>):** All the locations are observed with very low concentrations of SO<sub>2</sub>, with 2 stacks out of the 6 showed results below the detection limit. The highest level of SO<sub>2</sub> was observed at Sandvik Asia Ltd. with 5.47 µg/m<sup>3</sup> which is very much lower than the standard limit of NAAQS i.e. 80 µg/m<sup>3</sup>.

2. **Nitrogen dioxide (NO<sub>2</sub>):** Values of nitrogen dioxide are also observed below the standard limit of 80 µg/m<sup>3</sup> at all the 6 locations. The highest level of NO<sub>2</sub> was observed at Alfa Lava India Pvt. Ltd. with a result of 6.14 µg/m<sup>3</sup>.
3. **Particulate Matter (PM<sub>10</sub>):** PM<sub>10</sub> concentration of all 6 locations was higher than the standard limit of 100 µg/m<sup>3</sup>. The highest concentration of PM<sub>10</sub> was observed at Sandvik Asia Ltd. with 208 µg/m<sup>3</sup>.
4. **Particulate Matter (PM<sub>2.5</sub>):** Values of PM<sub>2.5</sub> are also observed below the standard limit of 60 µg/m<sup>3</sup> at all the 6 locations. The highest level of PM<sub>2.5</sub> was observed at Sandvik Asia Ltd. with a result of 52 µg/m<sup>3</sup>.
5. **Ozone (O<sub>3</sub>):** Ozone was found to be below detectable limit in all location.
6. **Lead (Pb):** Two location out of 6 location monitored was detected with concentration of lead and was well within the NAAQS standard.
7. **Carbon Monoxide (CO):** Concentration of carbon monoxide has been found to well within the limits in all 6 locations monitored with the highest concentration at Alfa Lava India Pvt. Ltd. with 2 mg/m<sup>3</sup>.
8. **Ammonia (NH<sub>3</sub>):** Ammonia was below the detectable limit in 5 locations out of the 6 locations monitored. The level of NH<sub>3</sub> was well within the limits.
9. **Benzene (C<sub>6</sub>H<sub>6</sub>):** All 6 locations monitored had Benzene concentration higher than 5 µg/m<sup>3</sup> which is the standard limit as per NAAQS. The highest level of was observed at Bajaj Auto Ltd. with 17.96 ng/m<sup>3</sup>.
10. **Benzo(a)pyrene (BaP):** BaP was below detectable limit in all 6 locations monitored.
11. **Arsenic (As):** As was detected on in 3 locations out of the 6 locations monitored and was well within the standard limit of 6 ng/m<sup>3</sup>.
12. **Nickel (Ni):** Concentration of Nickel was observed at Century Enkey Bhosari Pune and was well within the permissible limit of 20 ng/m<sup>3</sup>.

#### 4.3 Waste Water Quality Monitoring:

To understand the quality of treated effluent, samples were collected from 6 industries of Pimpri-Chinchwad. Considering the general parameters of all the industries mentioned, following are the conclusions:

1. **Colour:** Colour units are found high with 200 Hazen unit in the water sample collected from Atlas Castalloy Ltd. MIDC Chinchwad.
2. **Odour:** odour of only 1 sample is found disagreeable at 6 water samples collected.
3. **pH:** it is observed in between 6.3 and 8.01 which is well within the range.
4. **Suspended Solids:** Suspended solids of all 6 water sample is well within the limits and ranged in between 8 mg/L to 25 mg/l.
5. **Chemical Oxygen Demand:** All samples collected, were well within the limit required as per standard. The highest COD was observed at Tata Motors with 180 mg/L concentration.

- 6. Biochemical Oxygen Demand:** 5 out of the 6 samples collected was exceeding the limit required as per standard of BOD. The highest BOD was observed at Tata Motors with 55 mg/L concentration.
- 7. Sulphide:** 5 samples out of 6 samples collected were found to have below detectable limit. Atlas Castalloy Ltd. showed 17.6 mg/L concentration of Sulphide which was higher than than the permissible limit of 2 mg/L.
- 8. Total Ammonia:** 6 water samples collected was well within the standards of Ammonia ranging in between 0.22 mg/L to 5 mg/L.
- 9. Total Kjeldahl Nitrogen:** All samples collected, were well within the limit required as per standard.
- 10. Fish Bioassay:** 100% Survival was attained in 3 water samples collected for Bioassay test. In 1 water samples, no fishes survived at all and the other 2 samples 80% of the fishes survived.
- 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-Chichwad 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 in the range between 7 mg/L to 11 mg/L.
- 4) Biological Oxygen Demand:** BOD of all 6 samples was found in the range between 1.83 mg/L to 3.35 mg/L.

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

- 1) Nitrite:** Values of Nitrite at all location was well within the standard.
- 2) Nitrate:** Results of Nitrate are also observed below standard limit (42 mg/L).
- 3) Residual Free Chlorine:** Values are below the detectable limit in all 6 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 6 water sample collected exceeded the standard limit of TKN and ranged in between 0.69 mg/L to 1.14 mg/L concentration.
- 9) Fish Bioassay:** Alcon Square, MIDC Sector 2, Industrial Area, Bhosri borewell water and Silver associates Bhosri borewell water sample had 70% and 80% survival of fishes respectively. Remaining all location 100% survival was observed.
- 10) Boron:** 5 out of the 6 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.

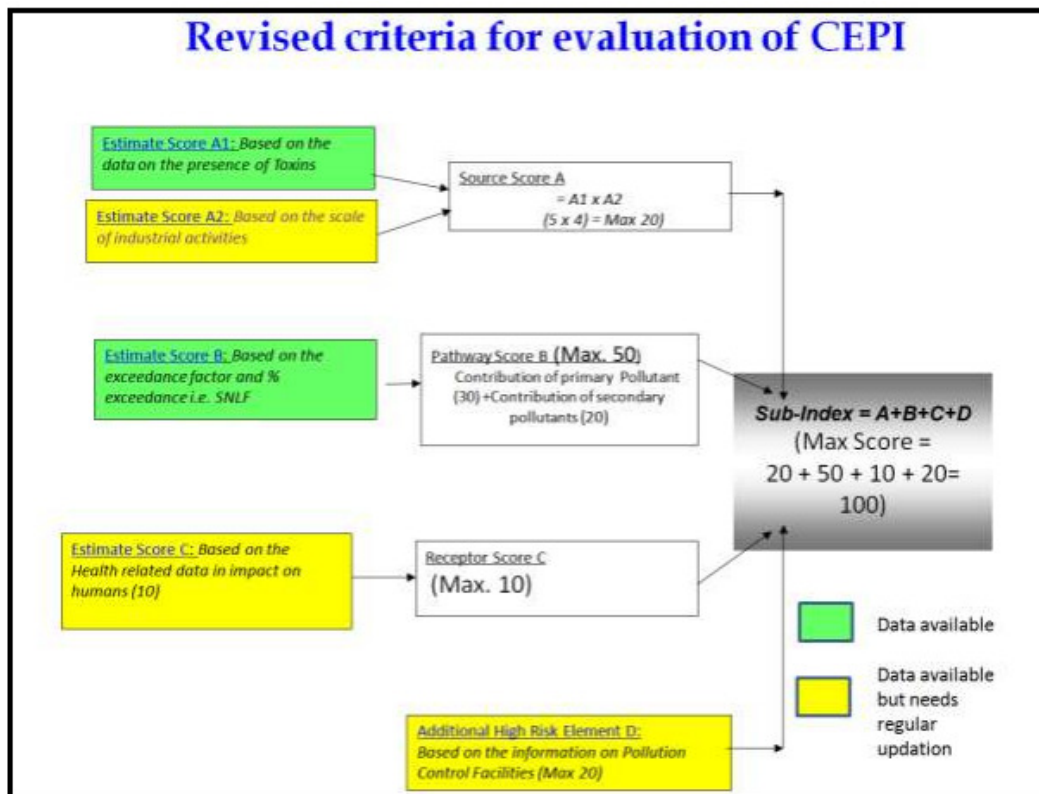
- I. Revised concept is prepared by eliminating the debatable factors but retaining the factors which can be measured precisely.
- II. It is decided to develop the Comprehensive Environmental Pollution Index (CEPI) retaining the existing algorithm of Source, Pathway and Receptor.
- III. Health component 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.

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 June 2018 prepared by MPCB, CEPI is calculated considering all these revised standards' limiting values, list of parameters and complete scope of monitoring.

### 5.1 Comparison of CEPI scores:

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

1. CEPI score by CPCB in 2009
2. CEPI score MPCB 2016
3. CEPI score MPCB February 2017
4. CEPI score MPCB June 2017
5. CEPI score MPCB February 2018

Results show that present CEPI score (40.82) of Pimpri-Chinchwad considering all revised standards is more or less the same as CPCB CEPI Score of February 2018 (43.49) 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
<b>CEPI score June 2018</b>	2.4	3.8	9.12	-	-	-	12.4	-	-	-	5	10	<b>37</b>
<b>CEPI score February 2018</b>	2	4	8	-	-	-	11.45	-	-	-	5	10	<b>34.45</b>
<b>CEPI score June 2017</b>	2.9	3	8.7	-	-	-	12.8	-	-	-	0	10	<b>31.5</b>
<b>CEPI score February 2017</b>	2	5	10	5	0	0	5	4	2.9	0	11.6	10	<b>36.6</b>
<b>CPCB Report 2009</b>	5.75	5	28.75	6	0	0	6	3	3.50	0	10.50	10	<b>55.25</b>

**Water:**

	<b>A1</b>	<b>A2</b>	<b>A</b>	<b>B1</b>	<b>B2</b>	<b>B3</b>	<b>B</b>	<b>C1</b>	<b>C2</b>	<b>C3</b>	<b>C</b>	<b>D</b>	<b>CEPI</b>
<b>CEPI score June 2018</b>	3.1	1.5	4.65	-	-	-	10.5	-	-	-	0	10	<b>25.15</b>
<b>CEPI score February 2018</b>	4	3.8	15.2	-	-	-	12.2	-	-	-	0	10	<b>37.4</b>
<b>CEPI score June 2017</b>	3.9	4.55	17.55	-	-	-	10.1	-	-	-	0	10	<b>37.65</b>
<b>CEPI score February 2017</b>	2.9	6	17.4	5	0	4	9	4	2	3	11	10	<b>47.4</b>
<b>CPCB Report 2009</b>	3	5	15	7	0	3	10	5	3.5	0	17.5	10	<b>52.5</b>

**Land:**

	<b>A1</b>	<b>A2</b>	<b>A</b>	<b>B1</b>	<b>B2</b>	<b>B3</b>	<b>B</b>	<b>C1</b>	<b>C2</b>	<b>C3</b>	<b>C</b>	<b>D</b>	<b>CEPI</b>
<b>CEPI score June 2018</b>	3.1	2.74	8.49	-	-	-	8.5	-	-	-	0	10	<b>26.99</b>
<b>CEPI score February 2018</b>	2.9	4.6	13.34	-	-	-	10.57	-	-	-	3	10	<b>36.91</b>
<b>CEPI score June 2017</b>	3.3	4.8	15.84	-	-	-	10.2	-	-	-	0	10	<b>36.04</b>
<b>CEPI score February 2017</b>	4	5	20	3	4	0	7	4	2	0	8	10	<b>45.0</b>
<b>CPCB Report 2009</b>	3	5	15	6	0	3	9	3	4	0	12	10	<b>46.0</b>

**Aggregated CEPI:**

	<b>Air Index</b>	<b>Water Index</b>	<b>Land Index</b>	<b>CEPI</b>
<b>CEPI score June 2018</b>	37	25.15	26.99	<b>40.82</b>
<b>CEPI score February 2018</b>	34.45	37.4	36.91	<b>43.49</b>
<b>CEPI score June 2017</b>	31.5	37.65	36.04	<b>40.79</b>
<b>CEPI score February 2017</b>	36.6	47.4	45.0	<b>50.1</b>
<b>CPCB Report 2009</b>	55.25	52.50	46.00	<b>66.06</b>

## **6. References**

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

## 7. Annexure

### Annexure I Health related data in impact on humans

#### C: Receptor

<b>Component C</b> <b>(Impact on Human Health)</b> <b>10</b>	
<b>Main - 10</b>	
<b>% increase in cases</b>	<b>Marks</b>
<b>&lt;5%</b>	<b>0</b>
<b>5-10%</b>	<b>5</b>
<b>&gt;10%</b>	<b>10</b>

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

**Attached below health data collected for the region**

## INFORMATION ON HEALTH STATISTICS IN PIA

1. Name of the polluted industrial area (PIA) :
2. Name of the major health center/organization:
3. Name and designation of the contact person :
4. Address:
5. Year of establishment:

Peme Medical Department

Sl. No.	Air Borne Diseases	No. of patients reported for the years				
		2017-2016	2016-2015	2015-2014	2014-2013	2013-2012
1.	Asthma	830	570	421	335	
2.	Acute Respiratory Infection	94116	79140	87283	61753	
3.	Bronchitis	—	—	—	—	
4.	Cancer	—	—	—	—	
		—	—	—	—	
	Water Borne Diseases		—	—	—	
5.	Gastroenteritis	1007	1124	1460	775	
6.	Diarrhea	22077	23959	26341	28068	
7.	Renal diseases	—	—	—	—	
8.	Cancer	—	—	—	—	

Health status data received from the Hospital

Signature of 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 <sup>3</sup>
2.	Ammonia	IS 11255 (Part 6):1999, Reaffirmed 2003	Titration/Nessler Reagent / Spectrophotometric Method	1 mg/Nm <sup>3</sup>
3.	Carbon Monoxide	USEPA Method 10B	GC-FID Method	0.2 mg/Nm <sup>3</sup>
4.	Chlorine	US EPA Method 26 for sampling	Titrimetric	0.001 mg/Nm <sup>3</sup>
5.	Fluoride (Gaseous)	US EPA Method 13 A	SPADNS Zirconium Lake Spectrophotometric Method	0.025 mg/Nm <sup>3</sup>
6.	Fluoride (Particulate)	US EPA Method 13 A	SPADNS Zirconium Lake Spectrophotometric Method	0.005 mg/Nm <sup>3</sup>
7.	Hydrogen Chloride	US EPA Method 26 for sampling	Titrimetric	0.25 mg/Nm <sup>3</sup>
8.	Hydrogen Sulphide	IS 11255 (Part 4):1985	Titrimetric	1 mg/Nm <sup>3</sup>
9.	Oxides of Nitrogen	IS 11255 (Part 7): 2005	PDSA Colorimetric Method	10 mg/Nm <sup>3</sup>
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 <sup>3</sup>
12.	Suspended Particulate Matter	IS 11255 (Part 1):1985, Reaffirmed 2003	Gravimetric Method	10 mg/Nm <sup>3</sup>
13.	Sulphur Dioxide	IS 11255 (Part 2): 1985, Reaffirmed 2003	Titrimetric IPA thorine Method	5.0mg/Nm <sup>3</sup>

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 <sup>3</sup>
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 <sup>3</sup>
ii	Benzene	-	-	0.001 mg/Nm <sup>3</sup>
iii	Toluene	-	-	0.001 mg/Nm <sup>3</sup>
iv	Xylene	-	-	0.001 mg/Nm <sup>3</sup>
v	Ethyl Benzene	-	-	0.001 mg/Nm <sup>3</sup>
vi	Ethyl Acetate	-	-	0.001 mg/Nm <sup>3</sup>



**Annexure III: Ambient Air Sampling and Analysis Methodology**

<b>Sr.</b>	<b>Parameters</b>	<b>Method References</b>	<b>Techniques</b>	<b>Detection Limit</b>
1.	Sulphur Dioxide (SO <sub>2</sub> )	CPCB Guidelines for the Measurement of Ambient Air Pollutants, Volume I, May 2011, Page No.1	Improved West & Gaeke Method	4 µg/m <sup>3</sup>
2.	Nitrogen Dioxide (NO <sub>2</sub> )	CPCB Guidelines for the Measurement of Ambient Air Pollutants, Volume I, May 2011, Page No.7	Modified Jacob & Hochheiser Method	3 µg/m <sup>3</sup>
3.	Particulate Matter (size less than 10 µm) or PM <sub>10</sub>	CPCB Guidelines for the Measurement of Ambient Air Pollutants, Volume I, May 2011, Page No.11	Gravimetric Method	2 µg/m <sup>3</sup>
4.	Particulate Matter (size less than 2.5 µm) or PM <sub>2.5</sub>	CPCB Guidelines for the Measurement of Ambient Air Pollutants, Volume I, May 2011, Page No. 15	Gravimetric Method	0.4 µg/m <sup>3</sup>
5.	Ozone (O <sub>3</sub> )	APHA, Method No. 820, Page no. 836	Chemical Method	19.6 µg/m <sup>3</sup>
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 <sup>3</sup>
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 <sup>3</sup>
8.	Ammonia (NH <sub>3</sub> )	CPCB Guidelines for the Measurement of Ambient Air Pollutants, Volume I, May 2011, Page No. 35	Indophenol Blue Method	4.0µg/m <sup>3</sup>
9.	Benzene (C <sub>6</sub> H <sub>6</sub> )	IS 5182 (Part 11):2006	Adsorption and Desorption followed by GC-FID analysis	1.0 µg/m <sup>3</sup>
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 <sup>3</sup>

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

**Annexure IV: Water/Wastewater Sampling and Analysis Methodology**

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

Sr.	Parameters	Methods References	Techniques	Detection Limit
14.	Nitrate-Nitrogen	APHA, 22 <sup>nd</sup> Ed., 2012, 4500-NO <sub>3</sub> , B-4-122	UV Spectrophotometer Screening Method	0.2 mg/L
15.	(NO <sub>2</sub> + NO <sub>3</sub> )-Nitrogen	APHA, 22 <sup>nd</sup> Ed., 2012, 4500-NO <sub>2</sub> -B, 4-120 APHA, 22 <sup>nd</sup> Ed., 2012, 4500-NO <sub>3</sub> , B-4-122	Colorimetric Method V Spectrophotometer Screening Method	0.2 mg/L
16.	Free Ammonia	APHA, 22 <sup>nd</sup> Ed., 2012, 4500 NH <sub>3</sub> , F, 4-115	Colorimetric Method	0.006 mg/L
17.	Total Residual Chlorine	IS 3025 (Part 26) :1986, Reaffirmed 2009, Ed. 2.1(2004-02)	Iodometric Method	0.1 mg/L
18.	Cyanide (CN)	APHA, 22 <sup>nd</sup> Ed., 2012, 4500-CN, C & E, 4-41 & 4-43	Colorimetric Method	0.001 mg/L
19.	Fluoride (F)	APHA, 22 <sup>nd</sup> Ed., 2012, 4500-F <sup>-</sup> , D, 4-87	SPADNS Method	0.05 mg/L
20.	Sulphide (S <sup>2-</sup> )	APHA, 22 <sup>nd</sup> Ed., 2012, 4500 -S <sup>2-</sup> , C-4-175, F-4-178	Iodometric Method	0.08 mg/L
21.	Dissolved Phosphate (P)	APHA, 22 <sup>nd</sup> Ed., 2012, 4500 P, E, 4-155	Ascorbic Acid Method	0.03 mg/L
22.	Sodium Absorption Ratio	IS 11624 :1986, Reaffirmed 2006	By Calculation	0.3
23.	Total Phosphorous (P)	APHA, 22 <sup>nd</sup> Ed., 2012, 4500 P, E, 4-155	Ascorbic Acid Method	0.03 mg/L
24.	Total Kjeldahl Nitrogen	APHA, 22 <sup>nd</sup> Ed., 2012, 4500 NH <sub>3</sub> , B & C, 4-110, 4-112	Titrimetric Method	0.1 mg/L
25.	Total Ammonia (NH <sub>4</sub> + NH <sub>3</sub> )-Nitrogen	APHA, 22 <sup>d</sup> Ed., 2012, 4500 NH <sub>3</sub> , F, 4-115	Colorimetric Method	0.001 mg/L
26.	Phenols (C <sub>6</sub> H <sub>5</sub> OH)	APHA, 22 <sup>nd</sup> Ed., 2012, 5530- B & C, 5-44 & 5-47	Chloroform Extraction Method	0.001 mg/L
27.	Surface Active	APHA, 22 <sup>nd</sup> Ed., 2012	Methylene Blue	0.1 mg/L

Sr.	Parameters	Methods References	Techniques	Detection Limit
	Agents	, 5540-B & C,5-50	Extraction Method	
28.	Organo Chlorine Pesticides	APHA, 22 <sup>nd</sup> Ed., 2012,6410B,6-74	GC MS-MS Method	0.01 µg/L
29.	Polynuclear aromatic hydrocarbons (PAH)	APHA, 22 <sup>nd</sup> Ed., 2012,6410B,6-74	GC MS-MS Method	0.01 µg/L
30.	Polychlorinated Biphenyls (PCB)	APHA, 22 <sup>nd</sup> 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 <sup>6+</sup> )	APHA, 22 <sup>nd</sup> Ed., 2012,3500-Cr,B,3-69	Colorimetric Method	0.02 mg/L
35.	Total Chromium (Cr)	IS 3025(Part 2): 2004	ICP Method	0.02 mg/L
36.	Total Arsenic (As)	IS 3025(Part 2): 2004	ICP Method	0.005 mg/L
37.	Lead (Pb)	IS 3025(Part 2): 2004	ICP Method	0.008 mg/L
38.	Cadmium (Cd)	IS 3025(Part 2): 2004	ICP Method	0.002 mg/L
39.	Mercury (Hg)	IS 3025(Part 2): 2004	ICP Method	0.0008 mg/L
40.	Manganese (Mn)	IS 3025(Part 2): 2004	ICP Method	0.02 mg/L
41.	Iron (Fe)	IS 3025(Part 2): 2004	ICP Method	0.06 mg/L
42.	Vanadium (V)	IS 3025(Part 2): 2004	ICP Method	0.05 mg/L
43.	Selenium (Se)	IS 3025(Part 2): 2004	ICP Method	0.005 mg/L

<b>Sr.</b>	<b>Parameters</b>	<b>Methods References</b>	<b>Techniques</b>	<b>Detection Limit</b>
44.	Boron (B)	IS 3025(Part 2): 2004	ICP Method	0.1 mg/L
45.	Total Coliforms	APHA, 22 <sup>nd</sup> Ed., 2012,9221-B, 9-66	Multiple tube fermentation technique (MPN/100ml)	1.1 MPN/100ml
46.	Faecal Coliforms	APHA, 22 <sup>nd</sup> 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  
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**National Ambient Air Quality Standards: Central Pollution Control Board**

In exercise of the powers conferred by Sub-section (2) (h) of section 16 of the Air (Prevention and Control of Pollution) Act, 1981 (Act No.14 of 1981), and in suppression of the Notification No(s). S.O.384(E), dated 11<sup>th</sup> April, 1994 and S.O.935(E), dated 14<sup>th</sup> 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 <sub>2</sub> ) $\mu\text{g}/\text{m}^3$	Annual *	50	20	– Improved West and Gaeke – Ultraviolet fluorescence
		24 hours **	80	80	
2	Nitrogen Dioxide (NO <sub>2</sub> ) $\mu\text{g}/\text{m}^3$	Annual *	40	30	– Modified Jacob & Hochheiser (Na-Arsenite) – Chemiluminescence
		24 hours **	80	80	
3	Particulate Matter (size less than 10 $\mu\text{m}$ ) or PM <sub>10</sub> $\mu\text{g}/\text{m}^3$	Annual *	60	60	– Gravimetric – TOEM – Beta attenuation
		24 hours **	100	100	
4	Particulate Matter (size less than 2.5 $\mu\text{m}$ ) or PM <sub>2.5</sub> $\mu\text{g}/\text{m}^3$	Annual *	40	40	– Gravimetric – TOEM – Beta attenuation
		24 hours **	60	60	
5	Ozone (O <sub>3</sub> ) $\mu\text{g}/\text{m}^3$	8 hours **	100	100	– UV photometric – Chemiluminescence – Chemical Method
		1 hour **	180	180	
6	Lead (Pb) $\mu\text{g}/\text{m}^3$	Annual *	0.50	0.50	– AAS/ICP method after sampling on EPM 2000 or equivalent filter paper – EDXRF using Teflon filter
		24 hours **	1.0	1.0	
7	Carbon Monoxide (CO) $\text{mg}/\text{m}^3$	8 hours **	02	02	– Non Dispersive Infra Red (NDIR) spectroscopy
		1 hour **	04	04	
8	Ammonia (NH <sub>3</sub> ) $\mu\text{g}/\text{m}^3$	Annual *	100	100	– Chemiluminescence – Indophenol blue method
		24 hours **	400	400	
9	Benzene (C <sub>6</sub> H <sub>6</sub> ) $\mu\text{g}/\text{m}^3$	Annual *	05	05	– Gas Chromatography based continuous analyzer – Adsorption and Desorption followed by GC analysis
10	Benzo (a) Pyrene (BaP) – particulate phase only, $\text{ng}/\text{m}^3$	Annual *	01	01	– Solvent extraction followed by HPLC/GC analysis
11	Arsenic (As) $\text{ng}/\text{m}^3$	Annual *	06	06	– AAS/ICP method after sampling on EPM 2000 or equivalent filter paper.
12	Nickel (Ni) $\text{ng}/\text{m}^3$	Annual *	20	20	– AAS/ICP method after sampling on EPM 2000 or equivalent filter paper.

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

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

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

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

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

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

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

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

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



Sr.	Parameter	Standards			
		Inland surface Water	Public Sewers	Land for Irrigation	Marine Coastal Areas
6.	Temperature °C, Max	Shall not exceed 40 in any section of the stream within 15 mts. Downstream from the effluent outlet	45 at the point of discharge	--	45 at the point of discharge
7.	Oil and Grease, mg/L, Max	10	20	10	20
8.,	Total Residual chlorine, mg/L, Max	1.0	--	--	1.0
9.	Ammonical Nitrogen (as N), mg/L, Max	50	50	--	50
10.	Total Kjeldahl Nitrogen (as N), mg/L, Max.	100	--	--	100
11.	Free Ammonia (as NH <sub>3</sub> ), 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 <sup>+6</sup> ) mg/L, Max	.1	2.0	--	1.0
19.	Total Chromium (as Cr), mg/L, Max	2.0	2.0	--	2.0
20.	Copper (as Cu), mg/L, Max.	3.0	3.0	--	3.0
21.	Zinc (as Zn), mg/L, Max.	5.0	15	0--	15
22	Selenium (as Se), mg/l, Max.	0.05	0.05	--	0.05
23	Nickel (as Ni), mg/l, Max.	3.0	3.0	--	5.0
24	Boron (as B), mg/l, Max.	2.0	2.0	2.0	--
25.	Percent Sodium, Max.	--	60	60	--
26.	Residual Sodium carbonate, mg/l, Max.	--	--	5.0	--
27.	Cyanide (as Cn), mg/L, Max.	0.2	2.0	0.2	0.2
28.	Chloride (as Cl), mg/L, Max.	1000	1000	600	--
29.	Fluoride (as F), mg/IL, Max.	2.0	15	--	15
30.	Dissolved Phosphate (as P), mg/L, Max.	5.0	--	--	--
31.	Sulphate (as SO <sub>4</sub> ), mg/L, Max.	1000	1000	1000	--
32.	Sulphide (as S), mg/L, Max.	2.0	--	--	5.0

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

**Annexure VII: Drinking Water Specification-IS 10500:2012**

<b>Sr.</b>	<b>Characteristic</b>	<b>Unit</b>	<b>Requirement (Acceptable Limit)</b>	<b>Permissible Limit in the Absence of Alternate Source</b>
<b>Table 1</b>	<b>Organoleptic and Physical Parameters</b>			
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
<b>Table 2</b>	<b>General parameters concerning substances undesirable in excessive amounts</b>			
7.	Aluminium (as Al)	mg/L	Max 0.03	Max 0.2
8.	Ammonia (as total ammonia-N)	mg/L	Max 0.5	No relaxation
9.	Anionic detergents (as MBAS)	mg/L	Max 0.2	Max 1.0
10.	Barium (as Ba)	mg/L	Max 0.7	No relaxation
11.	Boron (as B)	mg/L	Max 0.5	Max 1.0
12.	Calcium (as Ca)	mg/L	Max 75	Max 200
13.	Chloramines (as Cl <sub>2</sub> )	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 <sub>3</sub> )	mg/L	Max 45	No relaxation
23.	Phenolic compounds (as C <sub>6</sub> H <sub>5</sub> OH)	mg/L	Max 0.001	Max 0.002
24.	Selenium (as Se)	mg/L	Max 0.01	No relaxation
25.	Silver (as Ag)	mg/L	Max 0.1	No relaxation
26.	Sulphate (as SO <sub>4</sub> )	mg/L	Max 200	Max 400
27.	Sulphide (as H <sub>2</sub> S)	mg/L	Max 0.05	No relaxation
28.	Total Alkalinity as calcium carbonate	mg/L	Max 200	Max600
29.	Total hardness (as CaCO <sub>3</sub> )	mg/L	Max 200	Max 600
30.	Zinc (as Zn)	mg/L	Max 5	Max15
<b>Table 3</b>	<b>Parameters Concerning Toxic Substances</b>			
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
<b>Table 4</b>	<b>Parameters Concerning Radioactive Substances</b>			
43.	Radioactive Materials			
a)	Alpha emitters	Bq/L	Max 0.1	No relaxation
b)	Beta emitters	Bq/L	Max 1.0	No relaxation
<b>Table 5</b>	<b>Pesticide Residues Limits and Test Method</b>			
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
<b>Table 6</b>	<b>Bacteriological Quality of Drinking Water</b>			
44.	E.coli or thermotolerant coliform bacteria	/100	Not detectable	-
45.	Total coliform bacteria	/100 mL	Not detectable	-
	<b>Virological Requirements</b>			
46.	MS2 phage	/1 L	Absent	-
	<b>Biological Requirements</b>			
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:**

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



**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, $\mu$ mhos/cm	<1000	<2250	<4000
(v)	(NO <sub>2</sub> +NO <sub>3</sub> )-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 (NH <sub>4</sub> + NH <sub>3</sub> )-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

v.