# Monitoring, Sampling and Analysis for Ambient Air Quality, Surface Water Quality and Ground Water Quality in Critically/Severely/Other Polluted Industrial Areas of Maharashtra

## NAVI MUMBAI

**Pre-Monsoon (April 2023 to June 2023)**

MAHARASHTRA

LiFE Lifestyle for Environment

**Maharashtra Pollution Control Board**

Kalptaru Point, Sion East, Mumbai – 400 022

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# ABBREVIATIONS

| | |
|---|---|
| **APHA** | American Public Health Association |
| **ASTM** | American Society for Testing and Materials |
| **BIS** | Bureau of Indian Standards |
| **BLQ** | Below the Limit of Quantification |
| **CAAQMS** | Continuous Ambient Air Quality Monitoring Station |
| **CEMS** | Continuous Emission Monitoring System |
| **CEPI** | Comprehensive Environmental Pollution Index |
| **CETP** | Common Effluent Treatment Plant |
| **CPA** | Critically Polluted Area |
| **CPCB** | Central Pollution Control Board |
| **EPA** | Environmental Protection Act, 1986 |
| **GDP** | Gross Domestic Product |
| **MIDC** | Maharashtra Industrial Development Corporation |
| **MPCB** | Maharashtra Pollution Control Board |
| **NAAQS** | National Ambient Air Quality Standard |
| **NWMP** | National Water Quality Monitoring Program |
| **SPA** | Severely Polluted Area |
| **VOCs** | Volatile Organic Compounds |
| **WHO** | World Health Organisation |
| **ZLD** | Zero Liquid Discharge |

# 1. Executive Summary

Navi Mumbai was monitored for Ambient Air Quality, Ground and Surface Water quality. Based on the data collected by monitoring, a Comprehensive Environmental Pollution Index (CEPI) Score [as per latest directions 120 of Letter No. B-29012/ESS (CPA)/2015-16 dated 26th April 2016 of Central Pollution Control Board (CPCB)] was calculated. Maharashtra Pollution Control Board (MPCB) has carried out monitoring at CPCB location with the additional locations of sampling for ambient air, surface and ground water in consideration with the previous CEPI monitoring and covering the entire CEPI Impact Zone. The pre-monsoon monitoring was carried out during the period of April 2023 to June 2023 to assess the ambient air quality, surface water quality and ground water quality.

The Ambient Air Quality stations were identified considering the upwind and cross wind direction in the CEPI impact area. Ambient Air Quality was monitored at eight locations. The concentration of all the ambient air parameters was found well within the limits prescribed by NAAQS. Six locations each for surface water and groundwater were monitored for the study. Land index is represented by groundwater in the CEPI. Ground water parameters were also found to be within the permissible limits when compared with IS 10500:2012 drinking water standards.

Based on the study conducted by CPCB during the period March 2018, the CEPI score of Navi Mumbai region as per the revised guidelines of CEPI (2016) was 66.32 (Air Index–56, Water Index-63 and Land Index–16). However, the present study reports aggregated CEPI score of Navi Mumbai region of pre-monsoon season (June, 2023). Based on the study, the present CEPI score is 52.2 (Air Index–36.00, Water Index-49.3 and Land Index–16.00). The CEPI score is the combination of A, B, C and D factors. Here, C factor represents the health data and D factor represents the initiatives taken by MPCB in the past few years to mitigate pollution. The regional offices of MPCB have taken various initiatives like the installation of CAAQMS, CETPs, online VOC analysers etc. in the past few years to control and mitigate air and water pollutants. This has contributed to the factor D, hence reducing the CEPI score of the region over the years.

The analysis of the aggregated CEPI score shows that the pollution in Navi Mumbai industrial clusters has reduced in the last three years. Approximately 21% decrease in CEPI score is observed from 66.32 in 2018 to 52.2 in June 2023.

## 2. Introduction

Industries play a pivotal role in a country's economic development, contributing to GDP growth, job creation, and technological advancement. However, in recent years, the environmental pollution caused by industries has emerged as a formidable challenge for authorities worldwide. The impact of these industrial activities on the environment is severe, affecting the quality of the water we drink, the air we breathe, and the soil that nurtures our plants. Industries releasing untreated wastewater have contaminated drinking water with hazardous substances, posing risks to human, animal, and aquatic life. Exposure to air pollutants has been linked to various respiratory and cardiovascular diseases, particularly in early human life, leading to infant mortality or chronic health issues in adulthood. According to the World Health Organization (WHO), environmental pollution is responsible for an estimated 9 million premature deaths worldwide each year. It also estimates that over 90% of the global population is exposed to air pollution levels that exceed WHO guidelines, causing serious health risks. Around 2 billion people worldwide use drinking water contaminated with faeces leading to infectious diseases such as cholera and dysentery.

Hence, addressing these pollution sources is crucial to achieving significant environmental and health benefits. Additionally, the widespread nature of industrial pollution requires extensive monitoring systems and resources to collect reliable data and assess the full extent of the environmental impacts. The complexities associated with monitoring and identifying pollution sources make it a daunting task for authorities to develop targeted strategies and enforce regulations effectively. Striking a balance between economic growth and environmental protection requires delicate negotiations and innovative policy approaches. Overcoming these challenges demands robust regulatory frameworks, international collaboration, advanced monitoring technologies, and a commitment to sustainable practices from industries and governments alike.

In view of this, Central Pollution Control Board (CPCB) has evolved the concept of the 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 in 2016, the revised concept of CEPI was formulated by eliminating the subjective factors but retaining the factors which are monitorable CEPI bridges the perceptive gap between experts, public, and government departments by simplifying the complexity of environmental issues. It aims at categorizing critically polluted industrial areas based on scientific criteria, so as to ascertain various dimensions of pollution. This is a combined framework used to evaluate the impacts caused by industrial clusters on the nearby environment, as a numerical value.

The present CEPI study includes Navi Mumbai region, which is the largest planned city in the world. Its development was started in 1972 to de-congest Mumbai. Navi Mumbai is environmentally very important, ecologically sensitive and are natural habitats for migratory birds. It also includes mangroves, lakes and wetlands. Its industrial area is commonly known as TTC MIDC Estate. This TTC MIDC accounts for about 3254 industrial units of various category engaged in the manufacturing of chemicals, dyes, dye-intermediates, Bulk drugs, pharmaceuticals, Textile auxiliaries, Pesticides, Petrochemicals, Textile processors, Engineering units etc. Besides the industries, there are other

sources which are major contributors of pollution like emissions by transport and construction activities etc.

The present report is based on the revised CEPI version 2016. The results of the application of the Comprehensive Environmental Pollution Index (CEPI) to selected industrial cluster 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. 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.

**Fig. Navi Mumbai Region - CEPI Monitoring Zone**

## 3. Scope of Work

The major scope of work includes:

I. The scope of the present study is to perform three (3) rounds of "Monitoring, Sampling and Analysis for Ambient Air Quality, VOCs in Ambient Air, Surface Water Quality & Ground Water Quality in selected Pollution Industrial Areas (PIAs) of Navi Mumbai, Maharashtra" with a gap of one or two days. The analysis of the collected samples was carried out by the standard methods (CPCB, BIS, APHA, USEPA).

II. To Collect health-related data in the CEPI region.

III. To calculate the Comprehensive Environmental Pollution Index (CEPI) Score as per Revised CEPI-2016 issued by Central Pollution Control Board (CPCB).

The sampling details and frequency of sampling in Ambient Air, VOCs, Surface Water and Ground Water are given in Table 3.1 and Table 3.2 respectively.

**Table 3.1 Sampling Details of Navi Mumbai**

| Sampling Criteria | Total Sites | Monitoring Parameters |
|---|---|---|
| **Ambient Air Quality** | **08** | $PM_{10}$, $PM_{2.5}$, $SO_2$, $NO_2$, $NH_3$, $O_3$, $C_6H_6$, CO, BAP, Pb, Ni, As |
| **Volatile Organic Compounds (VOCs)** | **02** | Dichloromethane, Chloroform, Carbon Tetrachloride, Trichloroethylene, Bromodichloromethane, 1,3-Dichloropropane, 1,4-Dichlorobenzene, 1,3-Dichlorobenzene, 1,2-Dichlorobenzene, 1,2-Dibromo-3-Chloropropane, Napthalene, Bromobenzene,1,2,4-Trimethylbenzene, 2-Chlorotoluene, Tert-Butylbenzene, SEC-Butylbenzene, P-Isopropyl toluene, M-Xylene, P-Xylene, Styrene, Cumene 1,2,3-Trichloropropane, N-Propyl benzene, Dibromochloromethane, 1,2-Dibromoethane, Chlorobenzene, 1,1,1,2-Tetrachloroethane, Ethylbenzene, 1,1-Dichloropropylene, 1,2-Dichloroethane, 1,2-Dichloropropane, Trans-1,3-Dichloropropene, CIS 1,3-Dichloropropene, 1,1,2-Trichloroethane, Tetrachloroethylene, 1,3,5-Trimethylbenzene, N-Butylbenzene, 1,2,3-Trichlorobenzene, Hexachlorobutadiene, 1,2,4-Trichlorobenzene, 2,2-Dichloropropane, Dibromo methane, Toluene, O-Xylene, Bromoform, 1,1,2,2-Tetrachloroethane, 4-Chlorotoluene, 1,1-Dichloroethylene, Trans-1,2-Dichloroethylene, 1,1-Dichloroethane, CIS-1,2-Dichloroethylene, Bromochloromethane, 1,1,1-Trichloroethane |

| Sampling Criteria | Total Sites | Monitoring Parameters |
|---|---|---|
| **Water Quality Monitoring** | **Surface water - 06** | **(i) Simple Parameters**<br><br>Sanitary Survey, General Appearance, Colour, Smell, Transparency and Ecological<br><br>**(ii) Regular Monitoring Parameters**<br><br>pH, O & G, Suspended Solids, DO, COD, BOD, TDS, Electrical Conductivity, Total Dissolved Solids, Nitrite–Nitrogen, Nitrate-Nitrogen, ($NO_2$+$NO_3$) total nitrogen, Free Ammonia, Total Residual Chlorine, Cyanide, Fluoride, Chloride, Sulphate, Sulphides, Total Hardness, Dissolved Phosphates, SAR, Total Coliforms, Faecal Coliform<br><br>**(iii) Special Parameters**<br><br>Total Phosphorous, TKN, Total Ammonia ($NH_4$+$NH_3$)-Nitrogen, Phenols, Surface Active Agents, Anionic detergents, Organo-Chlorine Pesticides, PAH, PCB and PCT, Zinc, Nickel, Copper, Hexa-valent Chromium, Chromium (Total), Arsenic (Total), Lead, Cadmium, Mercury, Manganese, Iron, Vanadium, Selenium, Boron<br><br>**(iv) Bio-assay (zebra Fish)** Test – For specified samples only. |
| | **Ground water - 06** | |

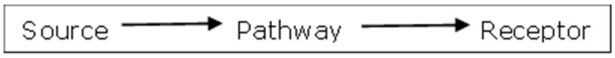
**Table 3.2 Frequency of Sampling**

| | Parameter | Round of Sampling | Frequency in Each Round |
|---|---|---|---|
| **A** | **Ambient Air Quality Monitoring** | | |
| 1. | Particulate Matter (size less than 10 µm) or $PM_{10}$ | 03 | 3 Shifts of 8 hrs each |
| 2. | Particulate Matter (size less than 2.5 µm) or $PM_{2.5}$ | 03 | 1 Shift of 24 hrs |
| 3. | Sulphur Dioxide ($SO_2$) | 03 | 6 Shifts of 4 hrs each |
| 4. | Nitrogen Dioxide ($NO_2$) | 03 | 6 Shifts of 4 hrs each |
| 5. | Ammonia ($NH_3$) | 03 | 6 Shifts of 4 hrs each |

| | Parameter | Round of Sampling | Frequency in Each Round |
|---|---|---|---|
| 6. | Ozone ($O_3$) | 03 | 24 Shifts of 1 hr each |
| 7. | Benzene ($C_6H_6$) | 03 | 1 Shifts of 24 hrs |
| 8. | Carbon Monoxide (CO) | 03 | 24 Shifts of 1 hr each |
| 9. | Benzo (a) Pyrene (BaP) – particulate phase only | 03 | 3 Shifts of 8 hrs each |
| 10. | Lead (Pb) | 03 | 3 Shifts of 8 hrs each |
| 11. | Arsenic (As) | 03 | 3 Shifts of 8 hrs each |
| 12. | Nickel (Ni) | 03 | 3 Shifts of 8 hrs each |
| **B** | **Volatile Organic Compounds (VOCs)** | | |
| | As mentioned in Table 3.1 | 03 | 3 Shifts of 24 hrs each |
| **C** | **Ground Water** | | |
| | As mentioned in Table 3.1 | 03 | 01 sample at each round |
| **D** | **Surface Water** | | |
| | As mentioned in Table 3.1 | 03 | 01 sample at each round |

# 4. Methodology

The present report is based on the revised Comprehensive Environmental Pollution Index (CEPI) version 2016. The index captures the various dimensions of the environment including air, water and land. Comprehensive Environmental Pollution Index (CEPI) is a rational number, which is used to characterize the environmental quality at a given location. It is three-step process based on the algorithm of Source, Pathway and Receptor.




Ambient air stations, Surface water locations and Ground water locations were decided by the respective regional officers. The sampling was done in 3 rounds with an interval of one or two days at each location. Sampling has been done at the potentially 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.

# AIR ENVIRONMENT

# 5. Air Environment

For studying the Air Environment of Navi Mumbai area, monitoring stations were identified considering the upwind and cross wind direction and all 12 parameters as per the notification of National Ambient Air Quality Standards (NAAQS) were carried out.

**Kindly note: Volatile Organic Compounds (VOCs) concentration is not detected in most of the Air samples collected; hence it is not shown in the graphs.*

In Navi Mumbai eight locations have been monitored for checking the Ambient Air Quality (AAQ) in triplicate from 29th May 2023 to 2nd June 2023. Volatile Organic Compounds (VOCs) were monitored at 2 locations namely Zoetis Pharmaceuticals Research Pvt. Ltd. and Deepak Fertilizer and Petrochemicals Ltd.

**Table 5.1 Details of Sampling Location of Ambient Air Quality Monitoring**

| Sr. No. | Name of Monitoring Location | Latitude | Longitude | Date of Sampling | | |
|---|---|---|---|---|---|---|
| | | | | Round-1 | Round-2 | Round-3 |
| 1. | DY Patil Hospital | N19$^0$02'27.88" | E73$^0$01'27.22" | 29.05.2023 | 31.05.2023 | 02.06.2023 |
| 2. | TTCWMA, Mahape | N19$^0$06'28.72" | E73°01'51.68" | 29.05.2023 | 31.05.2023 | 02.06.2023 |
| 3. | Nearby Reliable IT Park | N19$^0$06'30.77" | E73$^0$01'49.57" | 29.05.2023 | 31.05.2023 | 02.06.2023 |
| 4. | Nearby Zoetis Pharmaceuticals Research Pvt. Ltd. | N19°03'59.58" | E73°01'32.13" | 29.05.2023 | 31.05.2023 | 02.06.2023 |
| 5. | CETP Koparkharine, near ETP Table No. I | N19$^0$04'30.99" | E73$^0$04'03.74" | 29.05.2023 | 31.05.2023 | 02.06.2023 |
| 6. | Nearby Ashi India Glass | N19$^0$05'10.73" | E73$^0$06'19.14" | 29.05.2023 | 31.05.2023 | 02.06.2023 |
| 7. | Nearby Technova Imaging System | N19$^0$03'27.50" | E73$^0$06'48.19" | 29.05.2023 | 31.05.2023 | 02.06.2023 |
| 8. | Nearby Deepak Fertilizer and Petrochemicals | N19$^0$04'08.26" | E73$^0$07'59.22" | 29.05.2023 | 31.05.2023 | 02.06.2023 |

**Table 5.2 Details of Sampling Location of Volatile Organic Compounds (VOCs) Monitoring**

| Sr. No. | Name of Monitoring Location | Latitude | Longitude | Date of Sampling | | |
|---|---|---|---|---|---|---|
| | | | | Round-1 | Round-2 | Round-3 |
| 1. | Nearby Zoetis Pharmaceuticals Research Pvt. Ltd. | N19°03'59.58" | E73°01'32.13" | 29.05.2023 | 31.05.2023 | 02.06.2023 |
| 2. | Nearby Deepak Fertilizer and Petrochemicals | N19$^0$04'08.26" | E73$^0$07'59.22" | 29.05.2023 | 31.05.2023 | 02.06.2023 |

**Fig: Geographical Locations of Ambient Air Quality Monitoring**

**Fig. Geographical Locations of VOCs Monitoring**

**Table 5.3 Ambient Air Quality Monitoring Results**

| Parameters | Unit | Results | | | |
|---|---|---|---|---|---|
| | | DY Patil Hospital | TTC WMA, Mahape | Nearby Reliable IT Park | Nearby Zoetis Pharmaceuticals Research Pvt. Ltd. |
| Sulphur Dioxide ($SO_2$) | $\mu g/m^3$ | BLQ | 99.70 | BLQ | BLQ |
| Nitrogen Dioxide ($NO_2$) | $\mu g/m^3$ | 57 | 61 | 61 | 78 |
| Particulate Matter (size less than 10 µm) or $PM_{10}$ | $\mu g/m^3$ | 16 | 16 | 17 | 22 |
| Particulate Matter (size less than 2.5 µm) or $PM_{2.5}$ | $\mu g/m^3$ | 16 | 16 | 17 | 22 |
| Ozone ($O_3$) | $\mu g/m^3$ | 27.70 | BLQ | 43.20 | 28.80 |
| Lead (Pb) | $\mu g/m^3$ | BLQ | BLQ | BLQ | 0.02 |
| Carbon Monoxide (CO) (1h) | $mg/m^3$ | 1.39 | 1.60 | 1.54 | 1.51 |
| Carbon Monoxide (CO) (8h) | $mg/m^3$ | 1.74 | 1.78 | 1.71 | 1.81 |
| Ammonia ($NH_3$) | $\mu g/m^3$ | 87.53 | 170.50 | 110.23 | 203.00 |

| Parameters | Unit | Results | | | |
|---|---|---|---|---|---|
| | | DY Patil Hospital | TTC WMA, Mahape | Nearby Reliable IT Park | Nearby Zoetis Pharmaceuticals Research Pvt. Ltd. |
| Benzene ($C_6H_6$) | µg/m$^3$ | 2.37 | 2.67 | 2.72 | 2.68 |
| Benzo (a) Pyrene (BaP) – particulate phase only | ng/m$^3$ | BLQ | BLQ | BLQ | BLQ |
| Arsenic (As) | ng/m$^3$ | BLQ | BLQ | 0.87 | 0.45 |
| Nickel (Ni) | ng/m$^3$ | BLQ | BLQ | BLQ | BLQ |

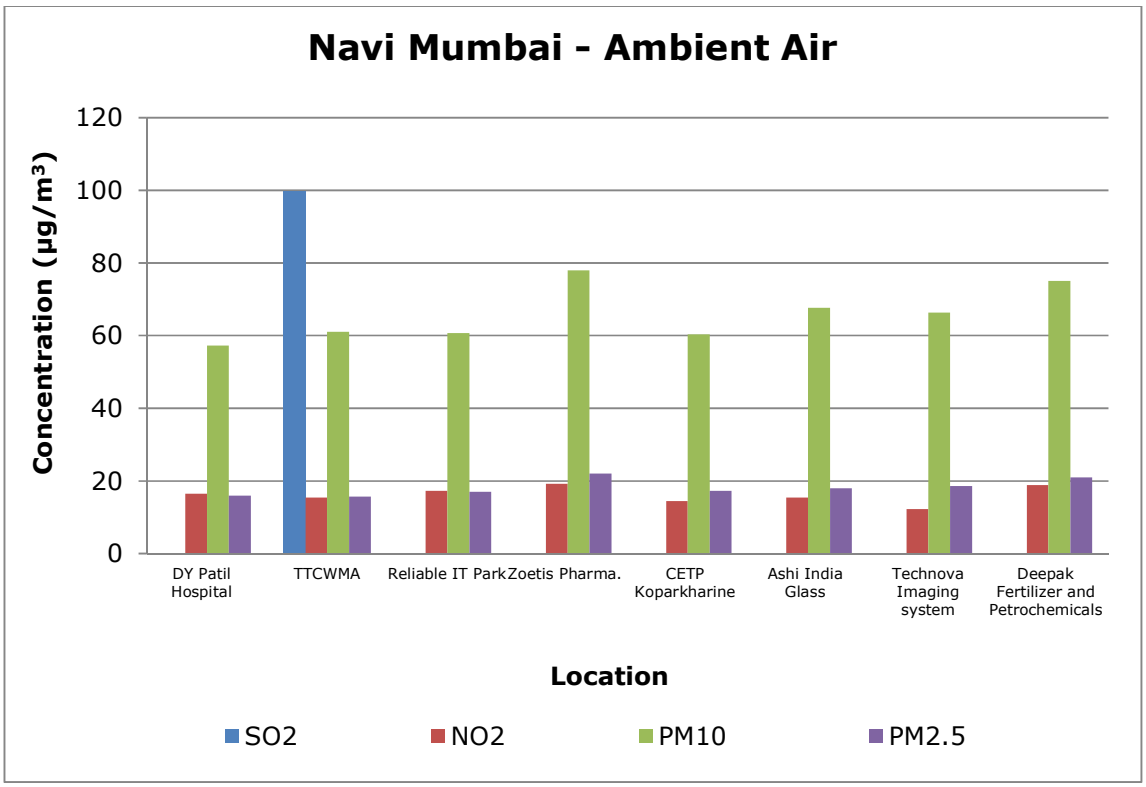
| Parameters | Unit | Results | | | |
|---|---|---|---|---|---|
| | | CETP Koparkharine Near ETP Table No. I | Nearby Ashi India Glass | Nearby Technova Imaging System | Nearby Deepak Fertilizer and Petrochemicals |
| Sulphur Dioxide ($SO_2$) | µg/m$^3$ | BLQ | BLQ | BLQ | BLQ |
| Nitrogen Dioxide ($NO_2$) | µg/m$^3$ | 14.50 | 15.40 | 12.30 | 18.90 |
| Particulate Matter (size less than 10 µm) or $PM_{10}$ | µg/m$^3$ | 60 | 68 | 66 | 75 |
| Particulate Matter (size less than 2.5 µm) or $PM_{2.5}$ | µg/m$^3$ | 17 | 18 | 19 | 21 |
| Ozone ($O_3$) | µg/m$^3$ | 26.40 | 27.85 | 30.40 | 98.50 |
| Lead (Pb) | µg/m$^3$ | BLQ | 0.02 | 0.02 | BLQ |
| Carbon Monoxide (CO) (1h) | mg/m$^3$ | 1.52 | 1.77 | 1.53 | 1.36 |
| Carbon Monoxide (CO) (8h) | mg/m$^3$ | 1.76 | 1.94 | 1.84 | 1.88 |
| Ammonia ($NH_3$) | µg/m$^3$ | 151.07 | 91.13 | 76.67 | 77.40 |
| Benzene ($C_6H_6$) | µg/m$^3$ | 2.44 | 2.34 | 3.10 | 2.75 |
| Benzo (a) Pyrene (BaP) – particulate phase only | ng/m$^3$ | BLQ | BLQ | BLQ | BLQ |
| Arsenic (As) | ng/m$^3$ | BLQ | BLQ | 0.73 | 0.35 |
| Nickel (Ni) | ng/m$^3$ | 4.11 | BLQ | BLQ | BLQ |

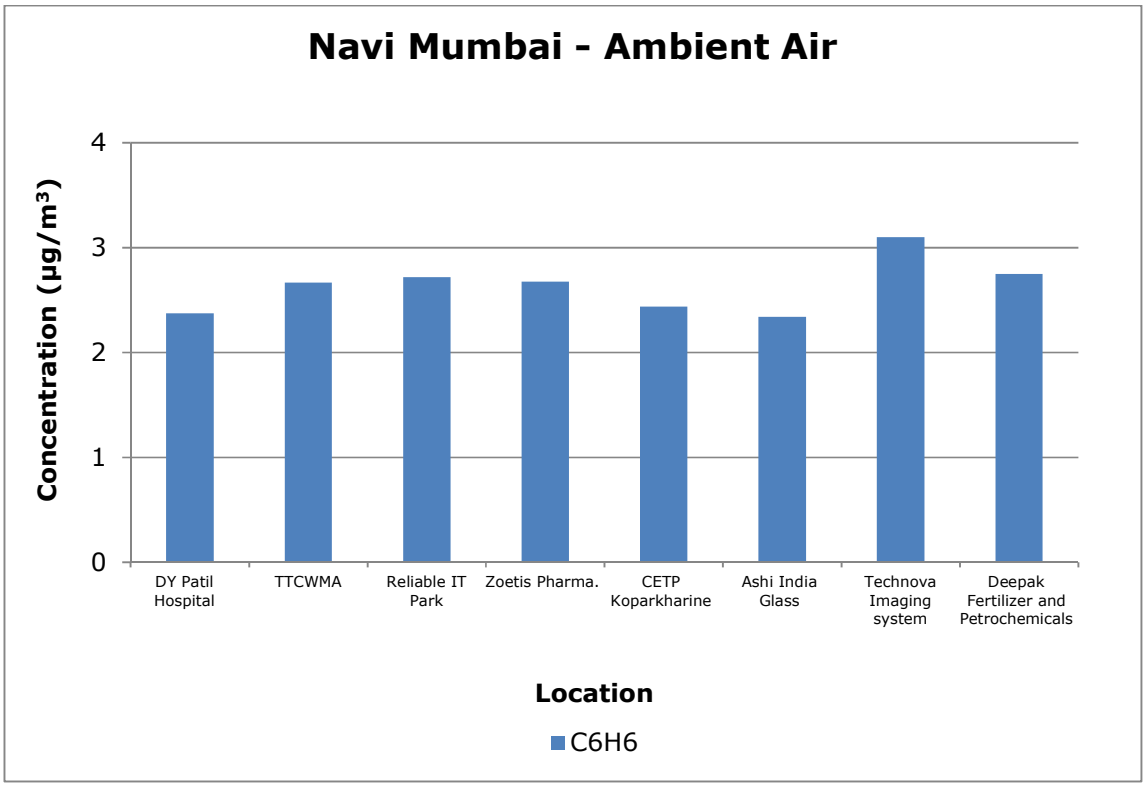
**Table 5.4 Volatile Organic Compounds (VOCs) in Ambient Air Results**

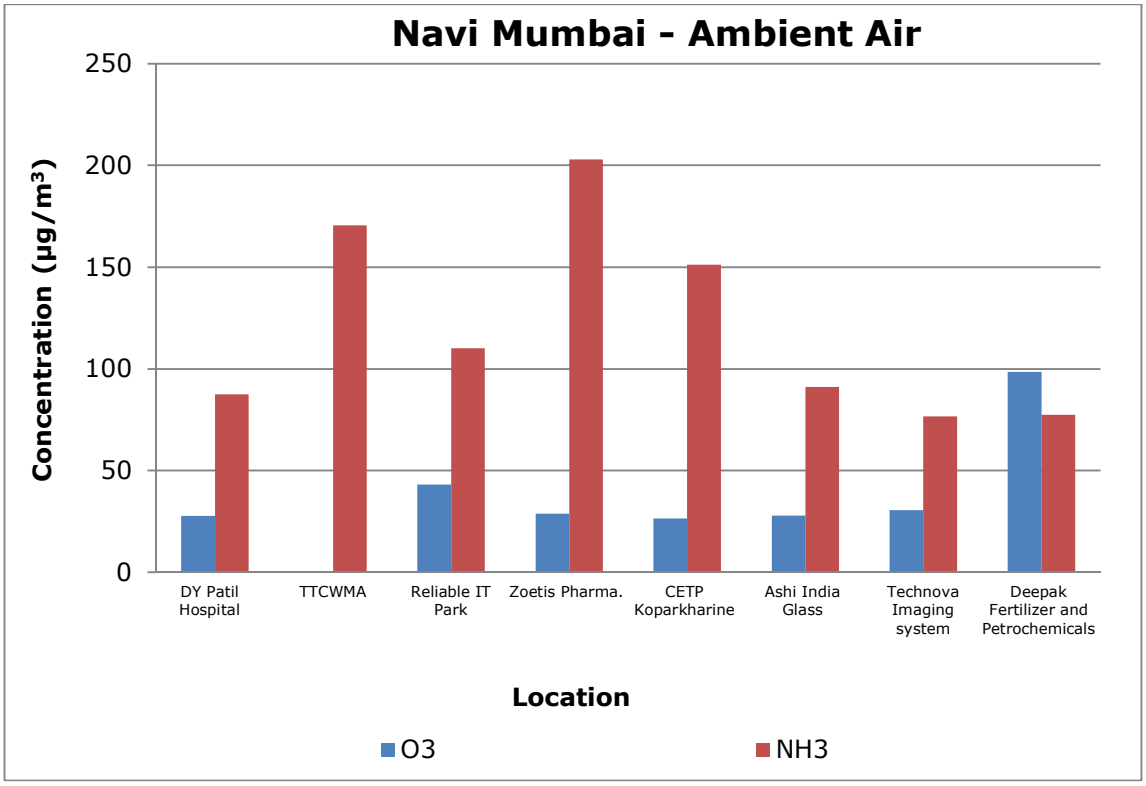
| Parameters | Unit | Results | |
|---|---|---|---|
| | | Zoetis Pharmaceuticals Research Pvt. Ltd. | Deepak Fertilizer and Petrochemicals |
| Dichloromethane | µg/m³ | 1.02 | 1.44 |
| Chloroform | µg/m³ | 0.94 | 0.55 |
| Carbon Tetrachloride | µg/m³ | BLQ | BLQ |
| Trichloroethylene | µg/m³ | BLQ | 0.58 |
| Bromodichloromethane | µg/m³ | BLQ | BLQ |
| 1,3-Dichloropropane | µg/m³ | BLQ | BLQ |
| 1,4-Dichlorobenzene | µg/m³ | 6.76 | BLQ |
| 1,3-Dichlorobenzene | µg/m³ | BLQ | 1.50 |
| 1,2-Dichlorobenzene | µg/m³ | BLQ | BLQ |
| 1,2-Dibromo-3-Chloropropane | µg/m³ | BLQ | BLQ |
| Napthalene | µg/m³ | BLQ | BLQ |
| Bromobenzene | µg/m³ | BLQ | BLQ |
| 1,2,4-Trimethylbenzene | µg/m³ | BLQ | BLQ |
| 2-Chlorotoluene | µg/m³ | BLQ | BLQ |
| Tert-Butylbenzene | µg/m³ | BLQ | BLQ |
| SEC-Butylbenzene | µg/m³ | BLQ | BLQ |
| P-Isopropyltoluene | µg/m³ | 1.21 | 1.79 |
| M-Xylene | µg/m³ | BLQ | BLQ |
| P-Xylene | µg/m³ | 1.74 | 3.30 |
| Styrene | µg/m³ | BLQ | BLQ |
| Cumene | µg/m³ | BLQ | BLQ |
| 1,2,3-Trichloropropane | µg/m³ | BLQ | BLQ |
| N-Propylbenzene | µg/m³ | BLQ | 7.95 |
| Dibromochloromethane | µg/m³ | BLQ | BLQ |
| 1,2-Dibromoethane | µg/m³ | BLQ | BLQ |
| Chlorobenzene | µg/m³ | BLQ | BLQ |
| 1,1,1,2-Tetrachloroethane | µg/m³ | BLQ | BLQ |
| Ethylbenzene | µg/m³ | BLQ | 1.72 |
| 1,1-Dichloropropylene | µg/m³ | BLQ | BLQ |
| 1,2-Dichloroethane | µg/m³ | 6.15 | 3.47 |

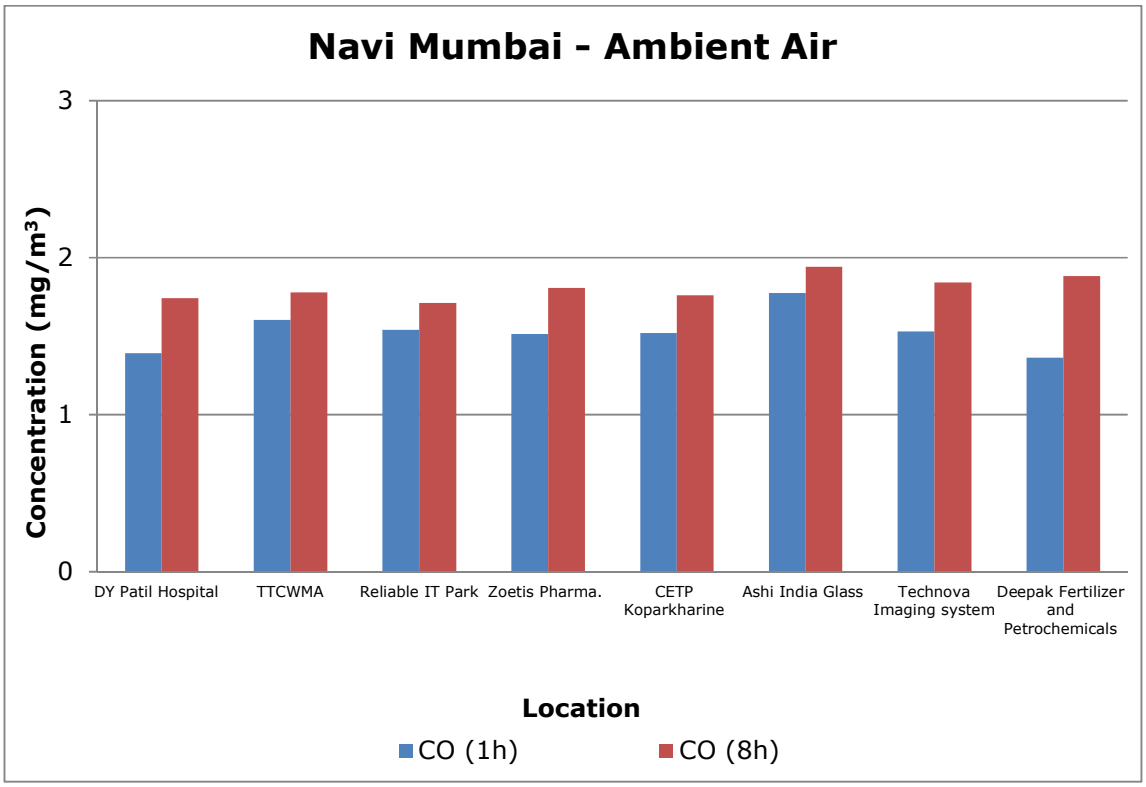
| Parameters | Unit | Results | |
|---|---|---|---|
| | | Zoetis Pharmaceuticals Research Pvt. Ltd. | Deepak Fertilizer and Petrochemicals |
| 1,2-Dichloropropane | µg/m³ | BLQ | BLQ |
| Trans-1,3-Dichloropropene | µg/m³ | BLQ | BLQ |
| CIS 1,3-Dichloropropene | µg/m³ | BLQ | BLQ |
| 1,1,2-Trichloroethane | µg/m³ | BLQ | BLQ |
| Tetrachloroethylene | µg/m³ | 0.50 | BLQ |
| 1,3,5-Trimethylbenzene | µg/m³ | BLQ | BLQ |
| N-Butylbenzene | µg/m³ | BLQ | BLQ |
| 1,2,3-Trichlorobenzene | µg/m³ | BLQ | BLQ |
| Hexachlorobutadiene | µg/m³ | BLQ | BLQ |
| 1,2,4-Trichlorobenzene | µg/m³ | BLQ | BLQ |
| 2,2-Dichloropropane | µg/m³ | BLQ | 2.64 |
| Dibromomethane | µg/m³ | BLQ | BLQ |
| Toluene | µg/m³ | 1.16 | 0.69 |
| O-Xylene | µg/m³ | 1.24 | BLQ |
| Bromoform | µg/m³ | BLQ | BLQ |
| 1,1,2,2-Tetrachloroethane | µg/m³ | BLQ | BLQ |
| 4-Chlorotoluene | µg/m³ | BLQ | BLQ |
| 1,1-Dichloroethylene | µg/m³ | BLQ | BLQ |
| Trans-1,2-Dichloroethylene | µg/m³ | BLQ | BLQ |
| 1,1-Dichloroethane | µg/m³ | BLQ | BLQ |
| CIS-1,2-Dichloroethylene | µg/m³ | BLQ | BLQ |
| Bromochloromethane | µg/m³ | BLQ | BLQ |
| 1,1,1-Trichloroethane | µg/m³ | BLQ | BLQ |

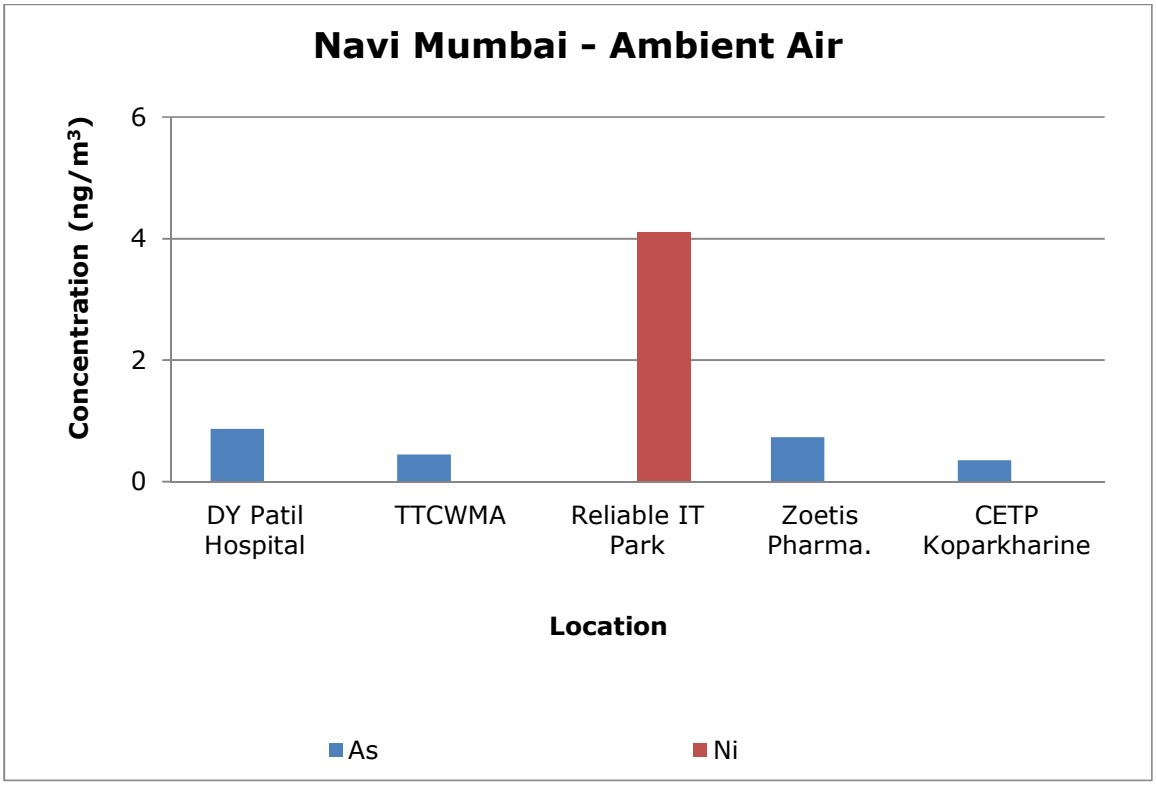
**Graphs - Ambient Air Quality Monitoring in Navi Mumbai**




Navi Mumbai - Ambient Air
Concentration (µg/m³)
250
200
150
100
50
0
DY Patil Hospital
TTCWMA
Reliable IT Park
Zoetis Pharma.
CETP Koparkharine
Ashi India Glass
Technova Imaging system
Deepak Fertilizer and Petrochemicals
Location
O3
NH3


Navi Mumbai - Ambient Air
Concentration (mg/m³)
3
2
1
0
DY Patil Hospital
TTCWMA
Reliable IT Park
Zoetis Pharma.
CETP Koparkharine
Ashi India Glass
Technova Imaging system
Deepak Fertilizer and Petrochemicals
Location
CO (1h)
CO (8h)


Navi Mumbai - Ambient Air
Concentration (ng/m³)
6
4
2
0
DY Patil Hospital
TTCWMA
Reliable IT Park
Zoetis Pharma.
CETP Koparkharine
Location
As
Ni

# 6. Water Environment

For studying the water environment of Navi Mumbai area, surface water was collected from Nallah, Lake and River. To understand the quality of treated effluent, samples were collected from following six industries - (i) Airoli Creek Taloja (ii) Vashi Creek (ii) CETP Outlet (iii) Siemens Nallah (iv) CBD Nallah (v) CETP Taloja Bridge (vi) Lek Village Ghot. The following points are observed through the analysis of water samples:

- All six water samples collected are found acceptable in general appearance, colour, smell and transparency.
- General parameters like suspended solids, oil and Grease are observed well within the limits in all the samples.
- pH is observed in the range of 6.71 to 7.16
- Total Dissolved Solids, Total Kjeldahl Nitrogen (TKN) and BOD concentration values were found to exceed the standard limit in all the samples.
- Concentration of Total Phosphorous (TP) is also found above the standard limit in all the water samples.
- In fish bioassay, 100% survival of fishes was achieved in the water sample of Vashi Creek.
- All metals like Arsenic, Nickel, Copper, Iron, Hexavalent Chromium ($Cr^{6+}$) etc. were also observed either below the limit of quantification (BLQ) or below their standard limits.
- Parameters like Total Residual Chlorine, Cyanide, Fluoride, Sulphide, Dissolved Phosphate, Total Ammonical Nitrogen and Phenolic compounds, also meet the criteria as prescribed by CPCB.
- Organo Chlorine Pesticides, Polynuclear aromatic hydrocarbons (PAH) and Polychlorinated Biphenyls (PCB) are also observed below the limit of quantification in all the studied samples.

**Table 6.1 Details of Sampling Location of Surface Water**

| Sr. No. | Name of Monitoring Location | Latitude | Longitude | Date of Sampling | | |
|---|---|---|---|---|---|---|
| | | | | Round-1 | Round-2 | Round-3 |
| 1. | Airoli Creek at Airoli Bridge | N19$^0$08'09.00" | E72$^0$59'59.03" | 30.05.2023 | 01.06.2023 | 03.06.2023 |
| 2. | Vashi Creek at Vashi Bridge | N19$^0$03'83.20" | E72$^0$58'68.20" | 30.05.2023 | 01.06.2023 | 03.06.2023 |
| 3. | Siemens Nallah | N19°09'3.11" | E73° 0'18.78" | 30.05.2023 | 01.06.2023 | 03.06.2023 |
| 4. | CBD Nallah | N19° 0'28.72" | E73° 1'29.24" | 30.05.2023 | 01.06.2023 | 03.06.2023 |

| Sr. No. | Name of Monitoring Location | Latitude | Longitude | Date of Sampling | | |
|---|---|---|---|---|---|---|
| | | | | Round-1 | Round-2 | Round-3 |
| 5. | Kasardi River Near CETP Taloja Bridge | N19°05321593° | E73°11432839° | 30.05.2023 | 01.06.2023 | 03.06.2023 |
| 6. | Lek Village Ghot | N19°0872947° | E73°1030953° | 30.05.2023 | 01.06.2023 | 03.06.2023 |

**Fig: Geographical Locations of Surface Water Sampling**

**Table 6.2 Results of Surface Water**

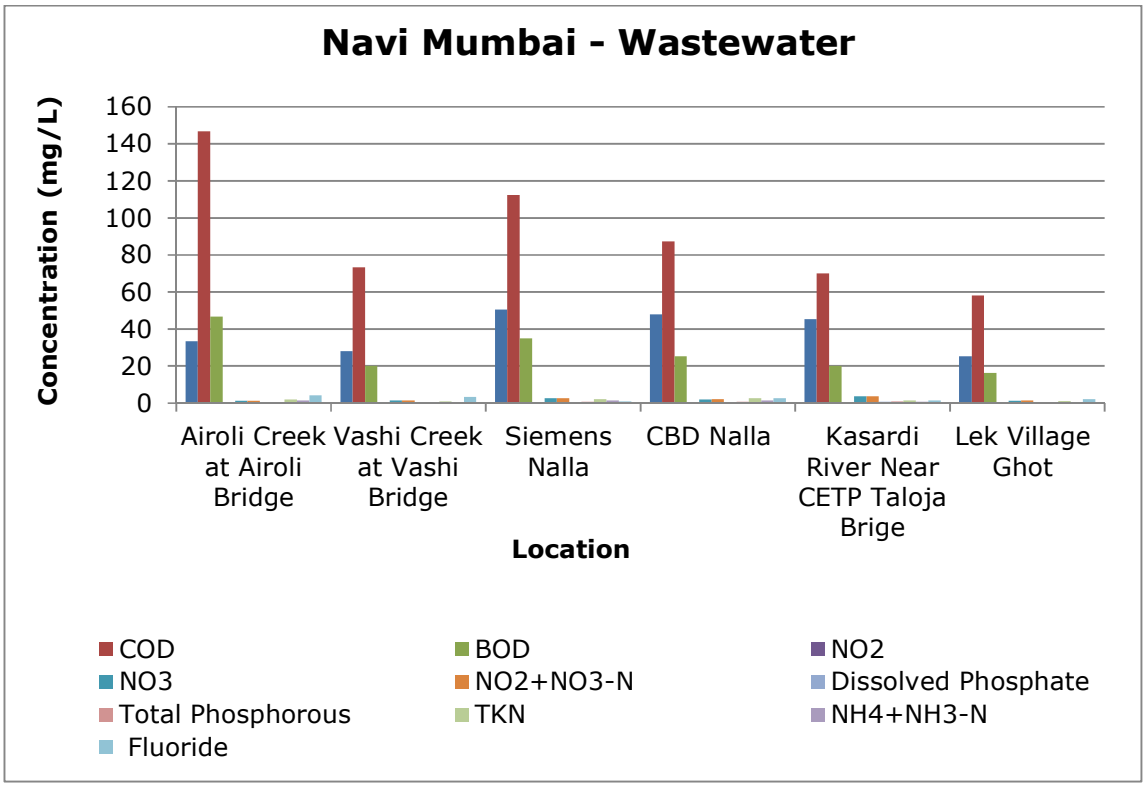
| Parameters | Unit | Results | | | | | |
|---|---|---|---|---|---|---|---|
| | | Airoli Creek at Airoli Bridge | Vashi Creek at Vashi Bridge | Siemens Nallah | CBD Nallah | Kasardi River Near CETP Taloja Bridge | Lek Village Ghot |
| Sanitary Survey | - | Reasonably clean neighbourhood | Reasonably clean neighbourhood | Reasonably clean neighbourhood | Reasonably clean neighbourhood | Reasonably clean neighbourhood | Reasonably clean neighbourhood |
| General Appearance | - | Floating matter | No Floating matter | Floating matter | No Floating matter | Floating matter | No Floating matter |
| Transparency | m | 0.60 | 0.60 | 0.40 | 0.40 | 0.50 | 0.40 |

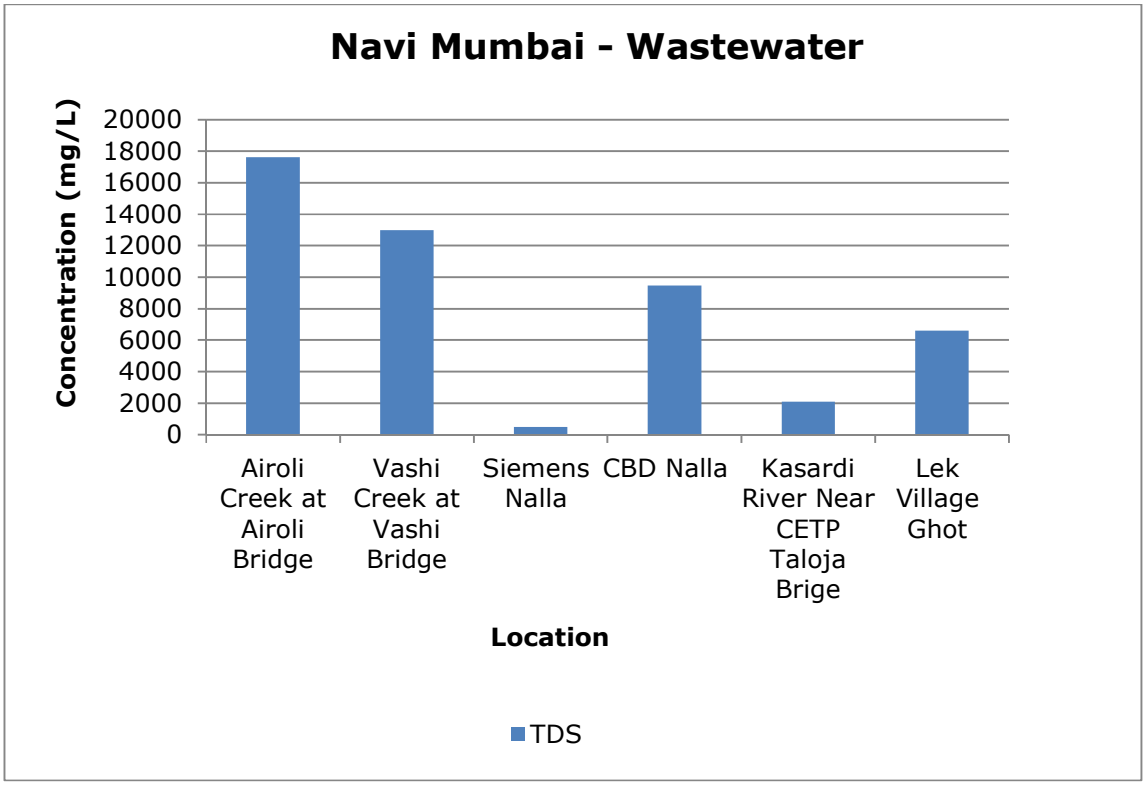
| Parameters | Unit | Results | | | | | |
|---|---|---|---|---|---|---|---|
| | | Airoli Creek at Airoli Bridge | Vashi Creek at Vashi Bridge | Siemens Nallah | CBD Nallah | Kasardi River Near CETP Taloja Bridge | Lek Village Ghot |
| Temperature | °C | 29 | 28 | 28 | 29 | 27 | 27 |
| Colour | Hazen | 2 | 1 | 3 | 1 | 2 | 1 |
| Smell | - | BLQ | BLQ | BLQ | BLQ | BLQ | BLQ |
| pH | - | 6.77 | 6.73 | 6.82 | 6.71 | 6.75 | 7.16 |
| Oil & Grease | mg/L | BLQ | BLQ | BLQ | BLQ | BLQ | BLQ |
| Suspended Solids | mg/L | 33 | 28 | 51 | 48 | 45 | 25 |
| Total Dissolved Solids | mg/L | 17613 | 12982 | 489 | 9463 | 2085 | 6601 |
| Dissolved Oxygen (% Saturation) | % | 41.33 | 48.00 | 46.00 | 50.67 | 45.00 | 47.00 |
| Chemical Oxygen Demand | mg/L | 147 | 73 | 112 | 87 | 70 | 58 |
| Biochemical Oxygen Demand (3 days,27°C) | mg/L | 47 | 20 | 35 | 25 | 20 | 16 |
| Electrical Conductivity (at 25 °C) | µmho/cm | 30733 | 22458 | 871 | 16516 | 3726 | 11402 |
| Nitrite Nitrogen (as $NO_2$) | mg/L | 0.06 | 0.09 | 0.04 | 0.04 | 0.05 | 0.06 |
| Nitrate Nitrogen (as $NO_3$) | mg/L | 1.23 | 1.40 | 2.67 | 2.10 | 3.59 | 1.24 |
| ($NO_2$ + $NO_3$)-Nitrogen | mg/L | 1.27 | 1.43 | 2.69 | 2.14 | 3.61 | 1.30 |
| Free Ammonia (as $NH_3$-N) | mg/L | BLQ | BLQ | BLQ | BLQ | BLQ | BLQ |
| Total Residual Chlorine | mg/L | BLQ | BLQ | BLQ | BLQ | 0.23 | 0.23 |
| Cyanide (as CN) | mg/L | BLQ | BLQ | BLQ | BLQ | BLQ | BLQ |
| Fluoride (as F) | mg/L | 4.17 | 3.33 | 0.83 | 2.63 | 1.37 | 2.23 |
| Sulphide (as $H_2S$) | mg/L | BLQ | BLQ | BLQ | BLQ | BLQ | BLQ |
| Dissolved Phosphate (as P) | mg/L | 0.32 | 0.33 | 0.56 | 0.61 | 0.75 | 0.27 |

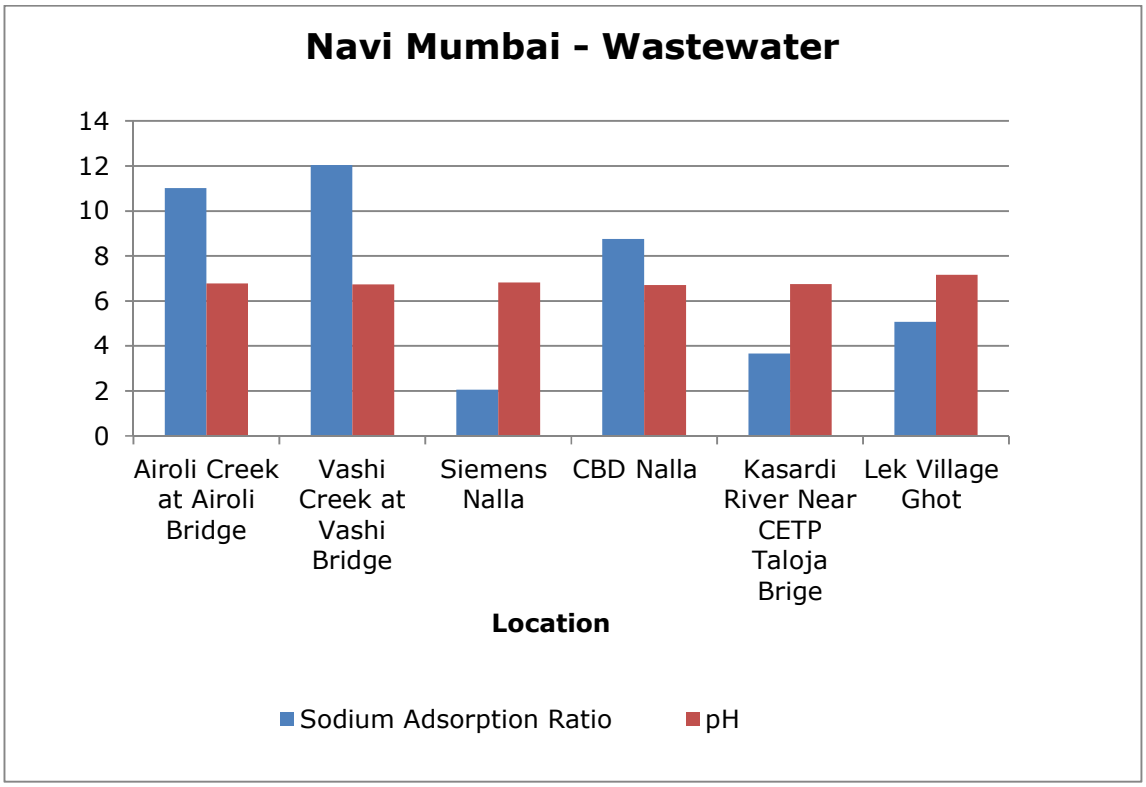
| Parameters | Unit | Results | | | | | |
|---|---|---|---|---|---|---|---|
| | | Airoli Creek at Airoli Bridge | Vashi Creek at Vashi Bridge | Siemens Nallah | CBD Nallah | Kasardi River Near CETP Taloja Bridge | Lek Village Ghot |
| Sodium Adsorption Ratio | - | 11.01 | 12.04 | 2.06 | 8.75 | 3.66 | 5.07 |
| Total Coliforms | MPN Index/ 100 ml | 810 | 804 | 933 | 1247 | 1074 | 1020 |
| Faecal Coliforms | MPN Index/ 100 ml | 467 | 274 | 433 | 723 | 848 | 477 |
| Total Phosphate (as P) | mg/L | 0.38 | 0.39 | 0.65 | 0.68 | 0.82 | 0.30 |
| Total Kjeldahl Nitrogen (as N) | mg/L | 2.05 | 0.93 | 2.24 | 2.61 | 1.49 | 1.12 |
| Total Ammonia ($NH_4$+$NH_3$)-Nitrogen | mg/L | 1.49 | 0.22 | 1.39 | 1.51 | 0.67 | 0.38 |
| Total Nitrogen | mg | 3.33 | 2.36 | 4.30 | 4.75 | 5.10 | 2.01 |
| Phenols (as $C_6H_5OH$) | mg/L | BLQ | BLQ | BLQ | BLQ | BLQ | BLQ |
| Anionic Detergents (as MBAS Calculated as LAS, mol.wt.288.38) | mg/L | BLQ | BLQ | BLQ | BLQ | BLQ | BLQ |
| Organo Chlorine Pesticides | µg/L | BLQ | BLQ | BLQ | BLQ | BLQ | BLQ |
| Polynuclear aromatic hydrocarbons (as PAH) | mg/L | BLQ | BLQ | BLQ | BLQ | BLQ | BLQ |
| Polychlorinated Biphenyls (PCB) | mg/L | BLQ | BLQ | BLQ | BLQ | BLQ | BLQ |
| Zinc (as Zn) | mg/L | BLQ | BLQ | 0.10 | BLQ | BLQ | BLQ |
| Nickel (as Ni) | mg/L | BLQ | 0.03 | 0.01 | 0.02 | 0.02 | 0.01 |
| Copper (as Cu) | mg/L | BLQ | BLQ | BLQ | BLQ | BLQ | BLQ |
| Hexavalent Chromium (as $Cr^{6+}$) | mg/L | BLQ | BLQ | BLQ | BLQ | BLQ | BLQ |
| Total Chromium (as Cr) | mg/L | 0.05 | 0.06 | 0.03 | 0.03 | 0.03 | BLQ |

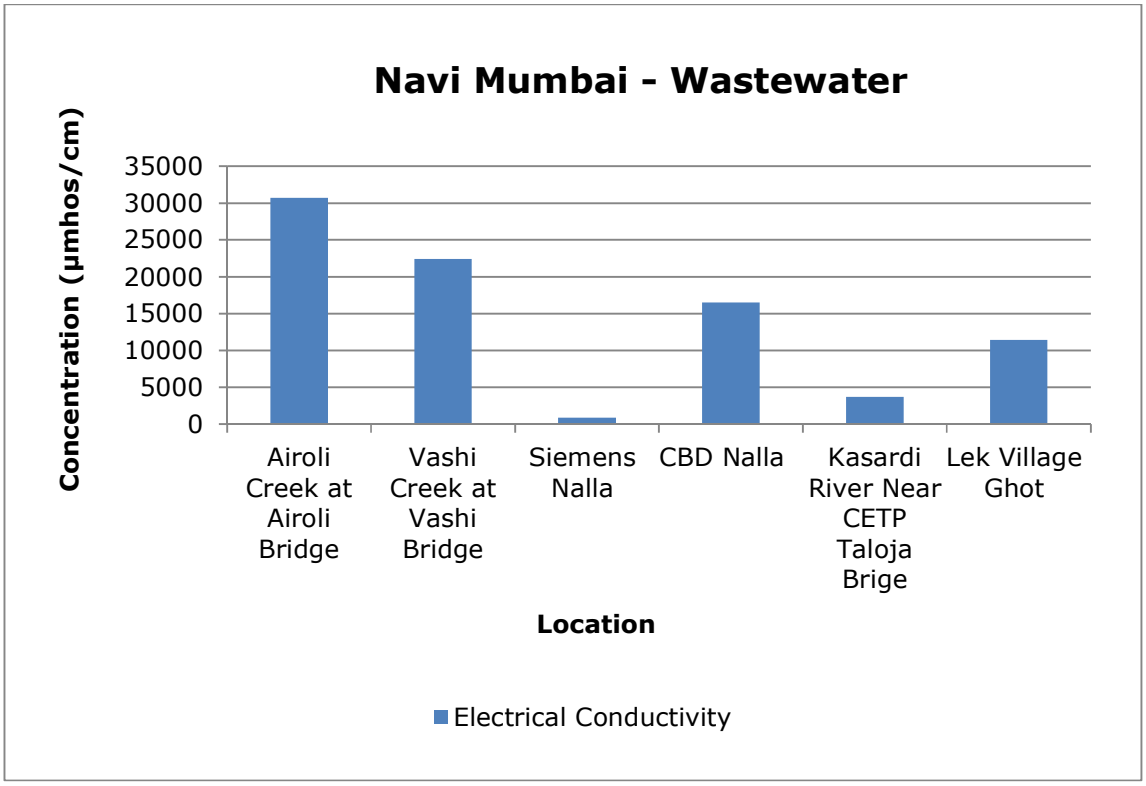
| Parameters | Unit | Results | | | | | |
|---|---|---|---|---|---|---|---|
| | | Airoli Creek at Airoli Bridge | Vashi Creek at Vashi Bridge | Siemens Nallah | CBD Nallah | Kasardi River Near CETP Taloja Bridge | Lek Village Ghot |
| Total Arsenic (as As) | mg/L | BLQ | 0.02 | 0.02 | BLQ | BLQ | BLQ |
| Lead (as Pb) | mg/L | BLQ | BLQ | BLQ | BLQ | BLQ | BLQ |
| Cadmium (as Cd) | mg/L | BLQ | BLQ | BLQ | BLQ | 0.00 | BLQ |
| Mercury (as Hg) | mg/L | BLQ | BLQ | BLQ | BLQ | BLQ | BLQ |
| Manganese (as Mn) | mg/L | 0.35 | 0.12 | 0.09 | 0.42 | 0.52 | 0.33 |
| Iron (as Fe) | mg/L | 0.18 | 0.37 | 0.33 | 0.71 | 0.81 | 0.12 |
| Vanadium (as V) | mg/L | 0.02 | 0.01 | 0.03 | 0.03 | 0.02 | 0.03 |
| Selenium (as Se) | mg/L | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | BLQ |
| Boron (as B) | mg/L | BLQ | BLQ | BLQ | BLQ | 0.24 | BLQ |
| Bioassay Test on fish | % survival | 93 | 100 | 97 | 93 | 90 | 87 |

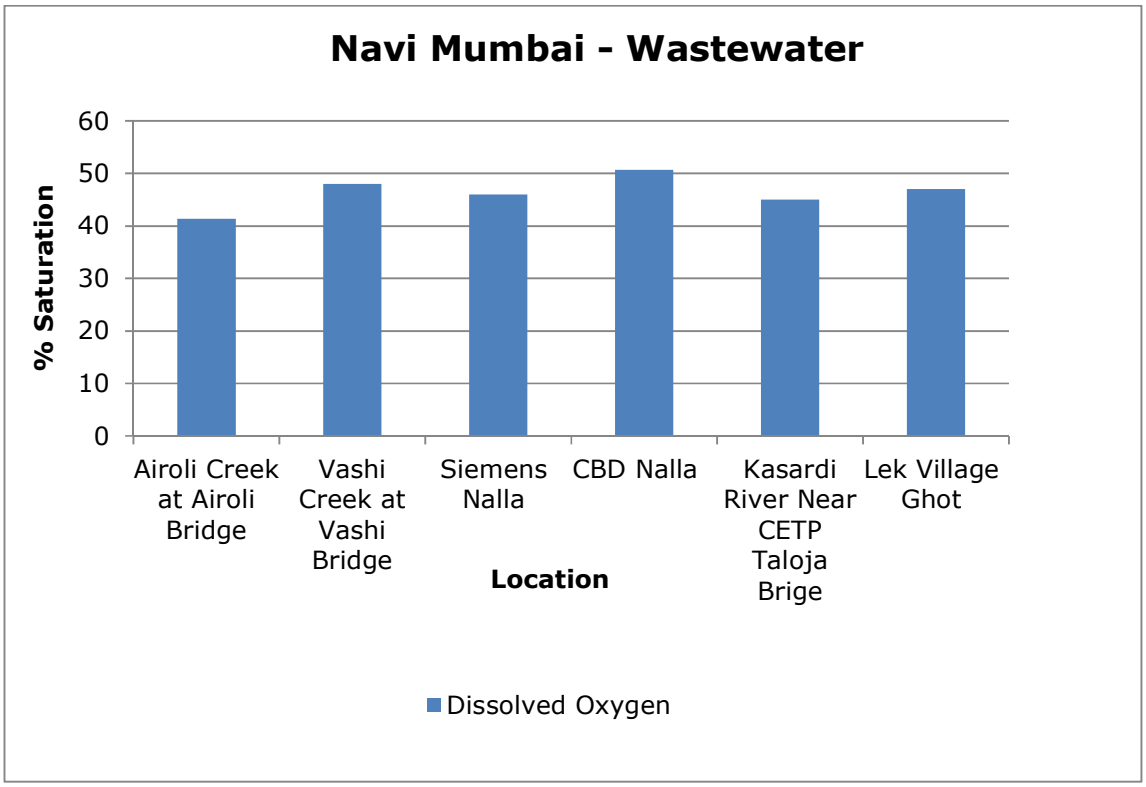
**Graphs - Surface Water Quality of Navi Mumbai**

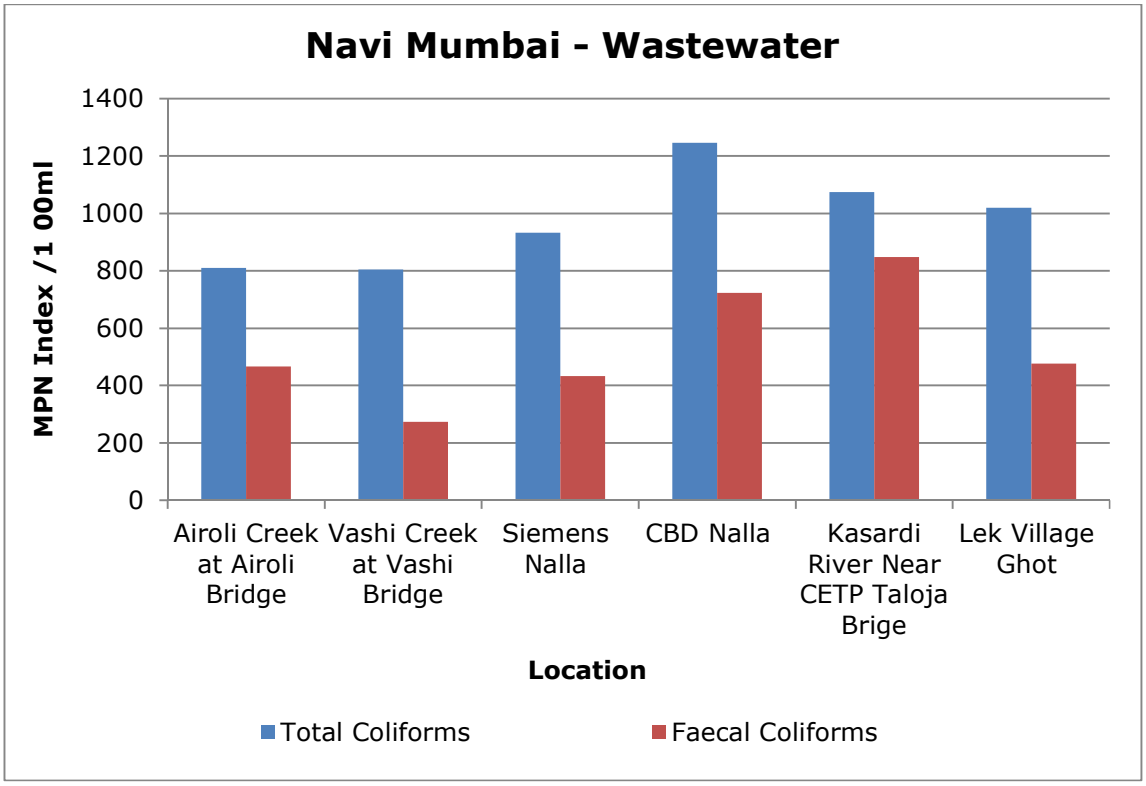


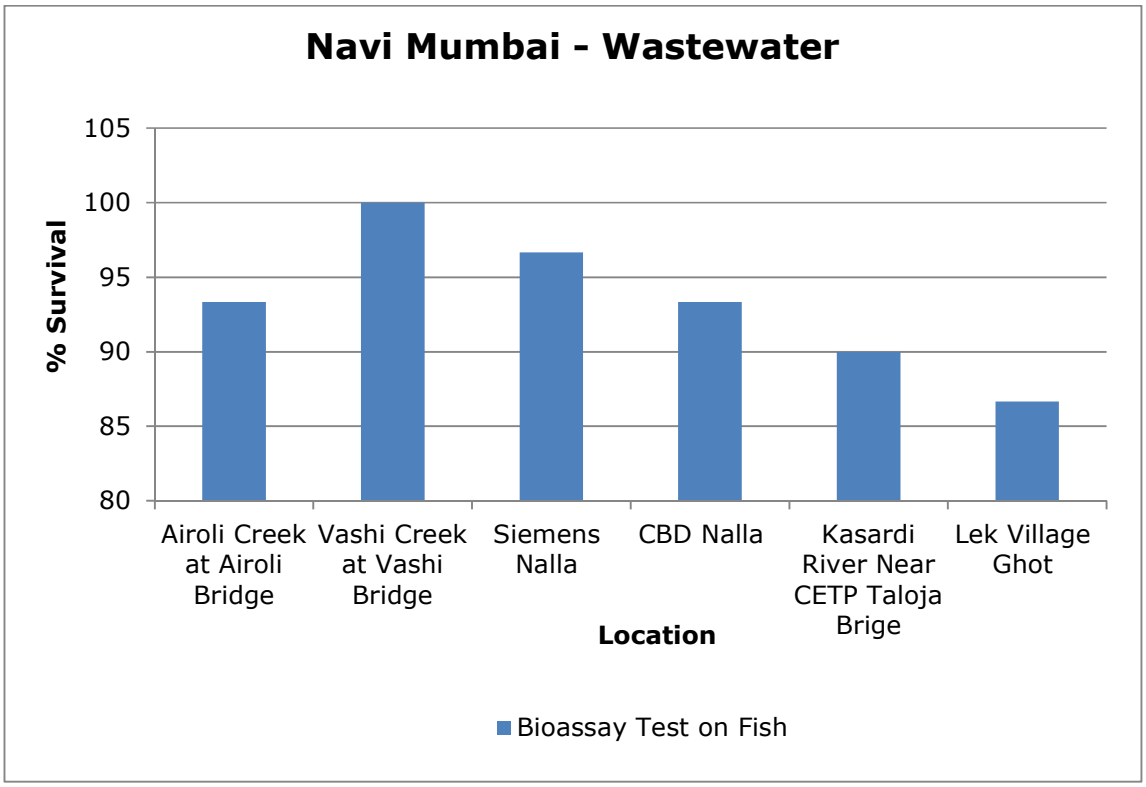

Navi Mumbai - Wastewater
Concentration (mg/L)
20000
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
Airoli Creek at Airoli Bridge
Vashi Creek at Vashi Bridge
Siemens Nalla
CBD Nalla
Kasardi River Near CETP Taloja Brige
Lek Village Ghot
Location
TDS


Navi Mumbai - Wastewater
14
12
10
8
6
4
2
0
Airoli Creek at Airoli Bridge
Vashi Creek at Vashi Bridge
Siemens Nalla
CBD Nalla
Kasardi River Near CETP Taloja Brige
Lek Village Ghot
Location
Sodium Adsorption Ratio
pH


Navi Mumbai - Wastewater
Concentration (µmhos/cm)
35000
30000
25000
20000
15000
10000
5000
0
Airoli Creek at Airoli Bridge
Vashi Creek at Vashi Bridge
Siemens Nalla
CBD Nalla
Kasardi River Near CETP Taloja Brige
Lek Village Ghot
Location
Electrical Conductivity


Navi Mumbai - Wastewater
% Saturation
60
50
40
30
20
10
0
Airoli Creek at Airoli Bridge
Vashi Creek at Vashi Bridge
Siemens Nalla
CBD Nalla
Kasardi River Near CETP Taloja Brige
Lek Village Ghot
Location
Dissolved Oxygen


Navi Mumbai - Wastewater
MPN Index /1 00ml
1400
1200
1000
800
600
400
200
0
Airoli Creek at Airoli Bridge
Vashi Creek at Vashi Bridge
Siemens Nalla
CBD Nalla
Kasardi River Near CETP Taloja Brige
Lek Village Ghot
Location
Total Coliforms
Faecal Coliforms


Navi Mumbai - Wastewater
% Survival
105
100
95
90
85
80
Airoli Creek at Airoli Bridge
Vashi Creek at Vashi Bridge
Siemens Nalla
CBD Nalla
Kasardi River Near CETP Taloja Brige
Lek Village Ghot
Location
Bioassay Test on Fish

# 7. Land Environment

For studying the land Environment of Navi Mumbai area, ground water was collected from Bore well. Dug well, and Hand Pump. A total of 6 samples were collected from i) Dugwell at Turbhe Gaon (ii) MSW Dumping Ground (iii) MSW TTC Area (iv) TTC WMA (v) TTC Plot no. 142 MIDC (vi) Mumbai Waste Management Ltd. (MWML) site.

Six ground water samples were collected from MIDC Navi Mumbai region.

- All the water samples collected are found acceptable in general appearance, colour, smell and transparency.
- General parameters like suspended solids, TDS, electrical conductivity, BOD, and COD are also observed well within the limits in all the collected samples.
- pH is found in the range of 6.69 to 7.45.
- In Fish Bioassay, out of 6 water samples 2 samples achieved 100% fish survival.
- All metals like Arsenic, Nickel, Copper, Iron, Hexavalent Chromium ($Cr^{6+}$), etc. were also observed either below the limit quantification or below their standard limits.
- Parameters like Total Residual Chlorine, Cyanide, Fluoride, Sulphide, Dissolved Phosphate, Total Ammonical Nitrogen and Phenolic compounds, also met the criteria as prescribed by CPCB.
- Organo Chlorine Pesticides, Polynuclear aromatic hydrocarbons (PAH) and Polychlorinated Biphenyls (PCB) were below the limit quantification in all studied samples.

**Table 7.1 Details of Sampling Location of Ground Water**

| Sr. No. | Name of Monitoring Location | Latitude | Longitude | Date of Sampling | | |
|---|---|---|---|---|---|---|
| | | | | Round-1 | Round-2 | Round-3 |
| 1. | Dug Well at Turbhe Gaon | N19°04'16.30" | E 73°0'34.09" | 30.05.2023 | 01.06.2023 | 03.06.2023 |
| 2. | Navi Mumbai MSW Dumping Ground Borewell Water Turbhe | N19$^0$04'42.97" | E73$^0$01'36.71" | 30.05.2023 | 01.06.2023 | 03.06.2023 |
| 3. | MSW, TTC Area Borewell | N19$^0$04'40.94" | E73$^0$08'15.11" | 30.05.2023 | 01.06.2023 | 03.06.2023 |
| 4. | TTC WMA Site Borewell | N19$^0$06'31.05" | E73$^0$01'49.67" | 30.05.2023 | 01.06.2023 | 03.06.2023 |
| 5. | TTC Plot no. 142 Borewell | N19$^0$05'46.58" | E73$^0$01'27.10" | 30.05.2023 | 01.06.2023 | 03.06.2023 |
| 6. | Mumbai Waste Management limited Borewell MIDC Taloja | N19$^0$05'48.65" | E73$^0$06'56.03" | 30.05.2023 | 01.06.2023 | 03.06.2023 |

**Fig: Geographical Locations of Groundwater Sampling in Navi Mumbai**

**Table 7.2 Results of Ground Water**

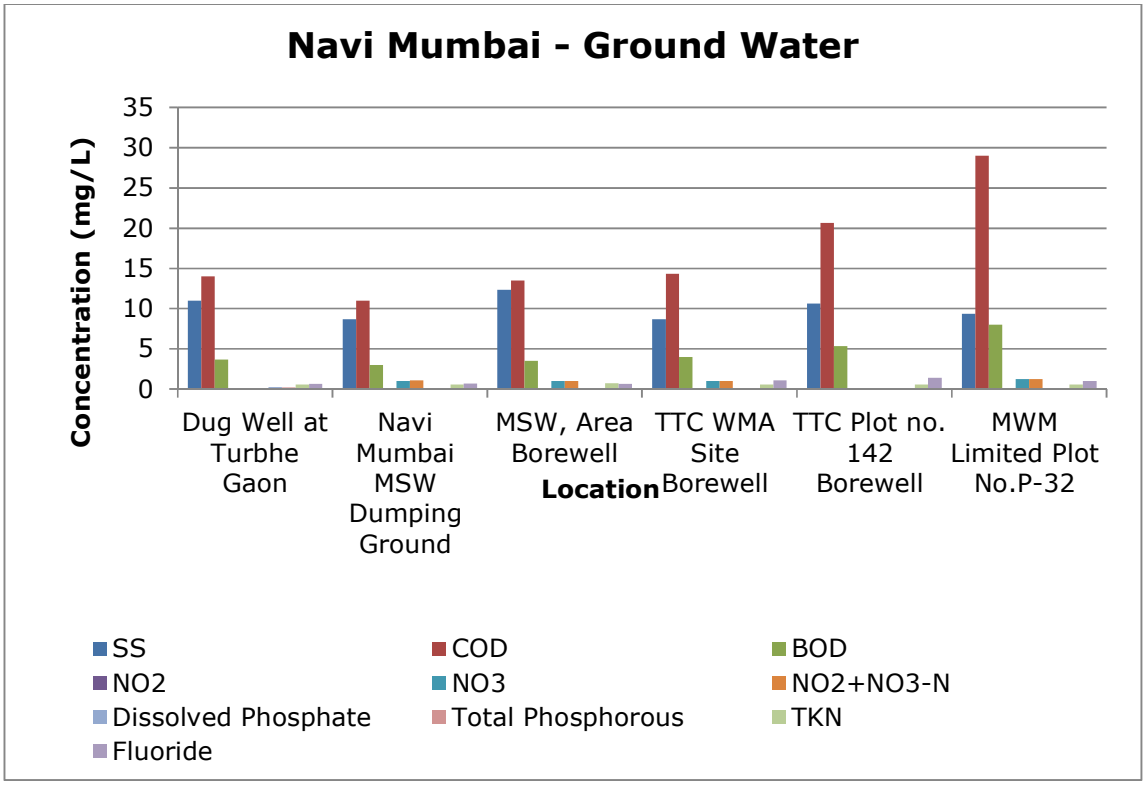
| Parameters | Unit | Results | | | | | |
|---|---|---|---|---|---|---|---|
| | | **Dug Well at Turbhe Gaon, Navi Mumbai** | **Navi Mumbai MSW Dumping Ground Borewell Water Turbhe Navi Mumbai** | **MSW, Area Borewell Navi Mumbai** | **TTC WMA Site Borewell** | **TTC Plot no. 142 Borewell** | **Mumbai Waste Management Limited Plot No. P-32 and P-32 Part MIDC, Taloja** |
| Sanitary Survey | - | Reasonably clean neighbourhood | Reasonably clean neighbourhood | Reasonably clean neighbourhood | Reasonably clean neighbourhood | Reasonably clean neighbourhood | Reasonably clean neighbourhood |
| General Appearance | - | No Floating matter | No Floating matter | No Floating matter | No Floating matter | No Floating matter | No Floating matter |
| Transparency | m | Not Applicable | Not Applicable | Not Applicable | Not Applicable | Not Applicable | Not Applicable |
| Temperature | °C | 28 | 28 | 28 | 28 | 29 | 28 |
| Colour | Hazen | 1 | 1 | 1 | 1 | 1 | 1 |
| Smell | - | BLQ | BLQ | BLQ | BLQ | BLQ | BLQ |
| pH | - | 6.80 | 6.76 | 7.23 | 7.45 | 6.69 | 6.70 |

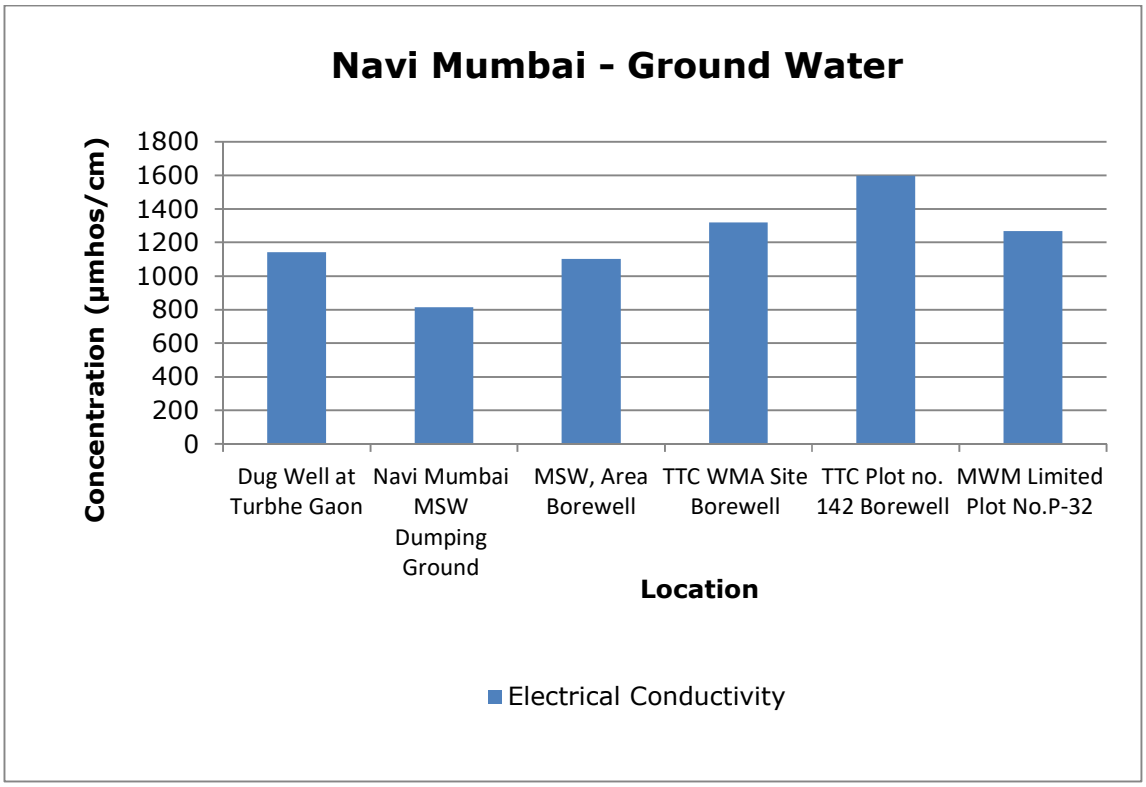
| Parameters | Unit | Results | | | | | |
|---|---|---|---|---|---|---|---|
| | | Dug Well at Turbhe Gaon, Navi Mumbai | Navi Mumbai MSW Dumping Ground Borewell Water Turbhe Navi Mumbai | MSW, Area Borewell Navi Mumbai | TTC WMA Site Borewell | TTC Plot no. 142 Borewell | Mumbai Waste Management Limited Plot No. P-32 and P-32 Part MIDC, Taloja |
| Oil & Grease | mg/L | BLQ | BLQ | BLQ | BLQ | BLQ | BLQ |
| Suspended Solids | mg/L | 11 | 9 | 12 | 9 | 11 | 9 |
| Total Dissolved Solids | mg/L | 641 | 455 | 616 | 736 | 895 | 711 |
| Chemical Oxygen Demand | mg/L | 14 | 11 | 14 | 14 | 21 | 29 |
| Biochemical Oxygen Demand (3 days,27°C) | mg/L | 4 | 3 | 4 | 4 | 5 | 8 |
| Electrical Conductivity (at 25 °C) | µmho/cm | 1141 | 814 | 1102 | 1319 | 1599 | 1269 |
| Nitrite Nitrogen (as $NO_2$) | mg/L | 0.04 | 0.07 | 0.02 | BLQ | BLQ | BLQ |
| Nitrate Nitrogen (as $NO_3$) | mg/L | BLQ | 1.00 | 1.00 | 1.00 | BLQ | 1.24 |
| ($NO_2$ + $NO_3$)-Nitrogen | mg/L | BLQ | 1.07 | 1.02 | 1.00 | BLQ | 1.24 |
| Free Ammonia (as $NH_3$-N) | mg/L | BLQ | BLQ | BLQ | BLQ | BLQ | BLQ |
| Total Residual Chlorine | mg/L | 0.26 | 0.23 | 0.24 | BLQ | BLQ | BLQ |
| Cyanide (as CN) | mg/L | BLQ | BLQ | BLQ | BLQ | BLQ | BLQ |
| Fluoride (as F) | mg/L | 0.63 | 0.70 | 0.67 | 1.10 | 1.43 | 1.00 |
| Sulphide (as $H_2S$) | mg/L | BLQ | BLQ | BLQ | BLQ | BLQ | BLQ |
| Dissolved Phosphate (as P) | mg/L | 0.26 | 0.11 | 0.11 | 0.11 | 0.11 | BLQ |
| Sodium Adsorption Ratio | - | 2.35 | 1.78 | 2.32 | 2.51 | 2.56 | 1.92 |
| Total Coliforms | MPN Index/ 100 ml | 643 | 847 | 593 | 1071 | 1600 | 887 |

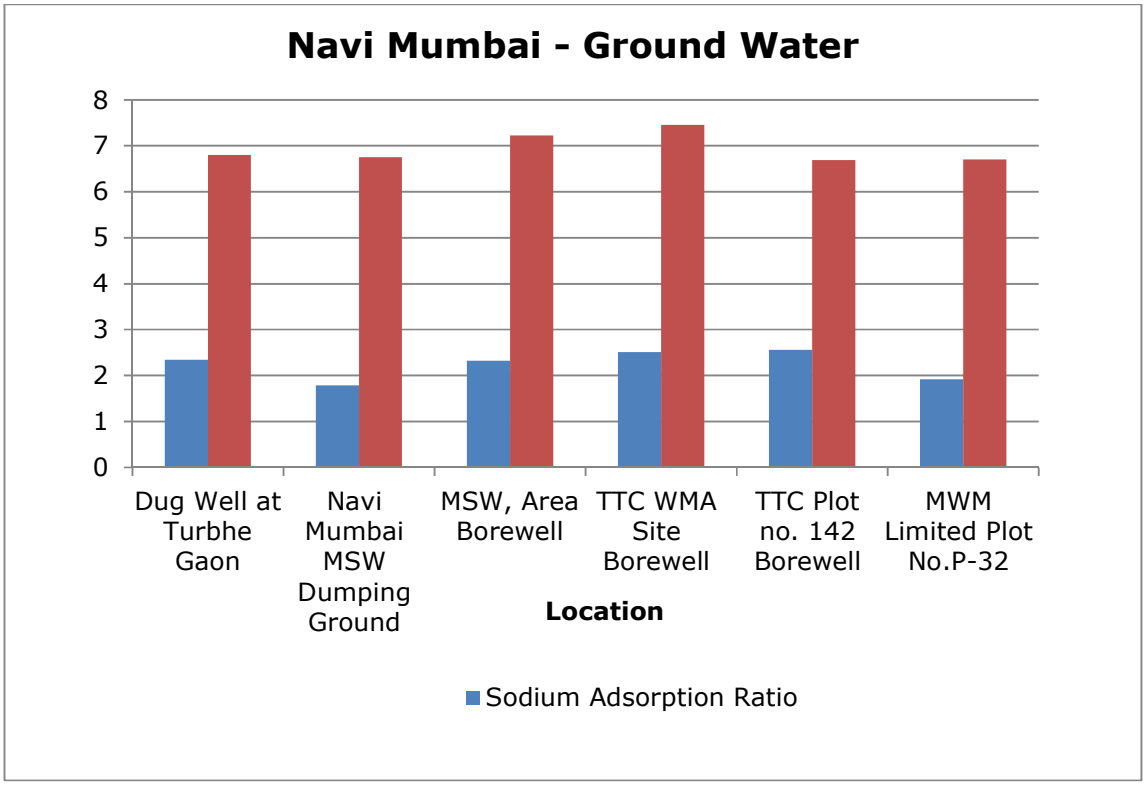
| Parameters | Unit | Results | | | | | |
|---|---|---|---|---|---|---|---|
| | | Dug Well at Turbhe Gaon, Navi Mumbai | Navi Mumbai MSW Dumping Ground Borewell Water Turbhe Navi Mumbai | MSW, Area Borewell Navi Mumbai | TTC WMA Site Borewell | TTC Plot no. 142 Borewell | Mumbai Waste Management Limited Plot No. P-32 and P-32 Part MIDC, Taloja |
| Faecal Coliforms | MPN Index/ 100 ml | 350 | 654 | 322 | 1260 | 730 | 234 |
| Total Phosphate (as P) | mg/L | 0.21 | 0.16 | 0.13 | 0.14 | 0.16 | 0.12 |
| Total Kjeldahl Nitrogen (as N) | mg/L | 0.56 | 0.56 | 0.75 | 0.56 | 0.56 | 0.56 |
| Total Ammonia ($NH_4+NH_3$)-Nitrogen | mg/L | 0.13 | 0.13 | 0.13 | BLQ | BLQ | BLQ |
| Total Nitrogen | mg/L | 1.02 | 1.01 | 1.53 | 1.06 | 1.06 | 0.93 |
| Phenols (as $C_6H_5OH$) | mg/L | BLQ | BLQ | BLQ | BLQ | BLQ | BLQ |
| Anionic Detergents (as MBAS Calculated as LAS, mol.wt.288.38 ) | mg/L | BLQ | BLQ | BLQ | BLQ | BLQ | BLQ |
| Organo Chlorine Pesticides | µg/L | BLQ | BLQ | BLQ | BLQ | BLQ | BLQ |
| Polynuclear aromatic hydrocarbons (as PAH) | mg/L | BLQ | BLQ | BLQ | BLQ | BLQ | BLQ |
| Polychlorinated Biphenyls (PCB) | mg/L | BLQ | BLQ | BLQ | BLQ | BLQ | BLQ |
| Zinc (as Zn) | mg/L | BLQ | BLQ | BLQ | 0.08 | BLQ | BLQ |
| Nickel (as Ni) | mg/L | 0.02 | 0.01 | 0.01 | 0.01 | 0.01 | 0.03 |
| Copper (as Cu) | mg/L | BLQ | 0.06 | BLQ | BLQ | BLQ | 0.04 |
| Hexavalent Chromium (as $Cr^{6+}$) | mg/L | BLQ | BLQ | BLQ | BLQ | BLQ | BLQ |
| Total Chromium (as Cr) | mg/L | 0.04 | BLQ | 0.03 | 0.03 | 0.03 | 0.05 |
| Total Arsenic (as As) | mg/L | BLQ | BLQ | BLQ | BLQ | 0.01 | BLQ |

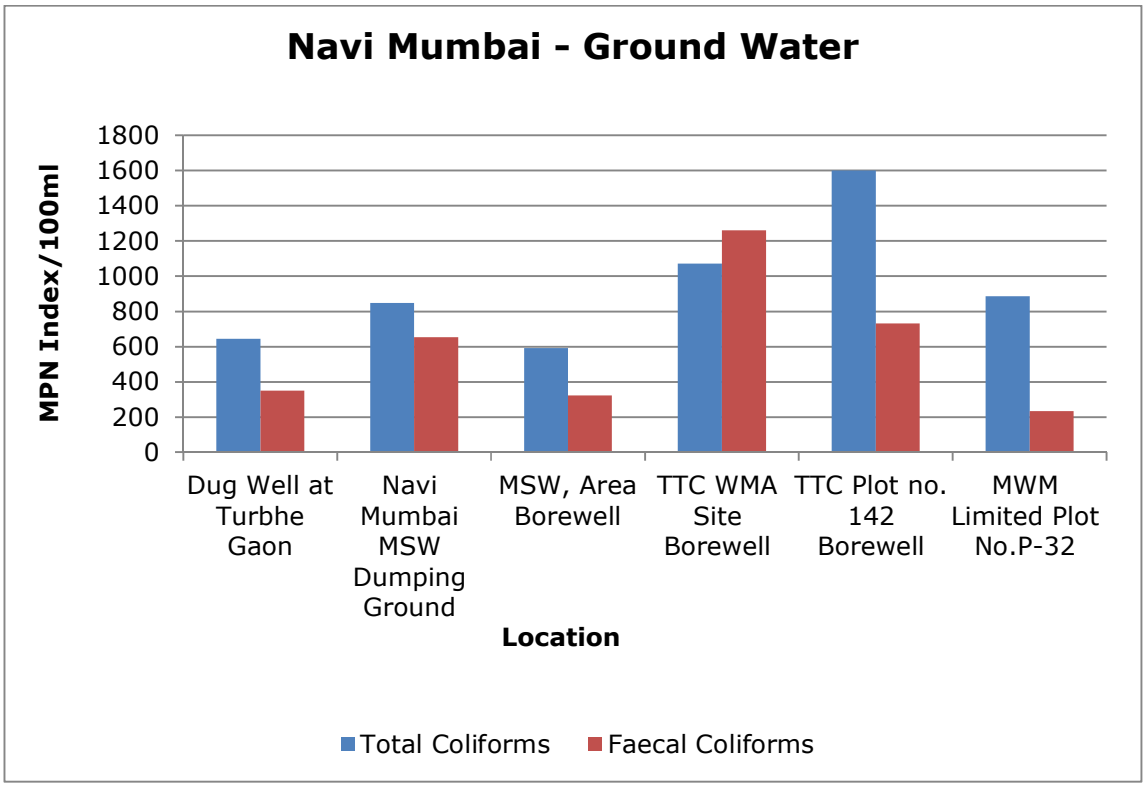
| Parameters | Unit | Results | | | | | |
|---|---|---|---|---|---|---|---|
| | | Dug Well at Turbhe Gaon, Navi Mumbai | Navi Mumbai MSW Dumping Ground Borewell Water Turbhe Navi Mumbai | MSW, Area Borewell Navi Mumbai | TTC WMA Site Borewell | TTC Plot no. 142 Borewell | Mumbai Waste Management Limited Plot No. P-32 and P-32 Part MIDC, Taloja |
| Lead (as Pb) | mg/L | BLQ | BLQ | BLQ | BLQ | BLQ | BLQ |
| Cadmium (as Cd) | mg/L | BLQ | BLQ | BLQ | BLQ | BLQ | BLQ |
| Mercury (as Hg) | mg/L | BLQ | BLQ | BLQ | BLQ | BLQ | BLQ |
| Manganese (as Mn) | mg/L | 0.10 | 0.08 | 0.06 | 0.06 | 0.07 | 0.14 |
| Iron (as Fe) | mg/L | 0.40 | 0.32 | 0.38 | 0.35 | 0.27 | 0.35 |
| Vanadium (as V) | mg/L | BLQ | 0.03 | 0.01 | 0.01 | 0.02 | 0.02 |
| Selenium (as Se) | mg/L | BLQ | BLQ | 0.01 | 0.02 | BLQ | BLQ |
| Boron (as B) | mg/L | BLQ | 0.15 | BLQ | BLQ | 0.15 | BLQ |
| Bioassay Test on fish | % survival | 100 | 90 | 100 | 97 | 97 | 93 |

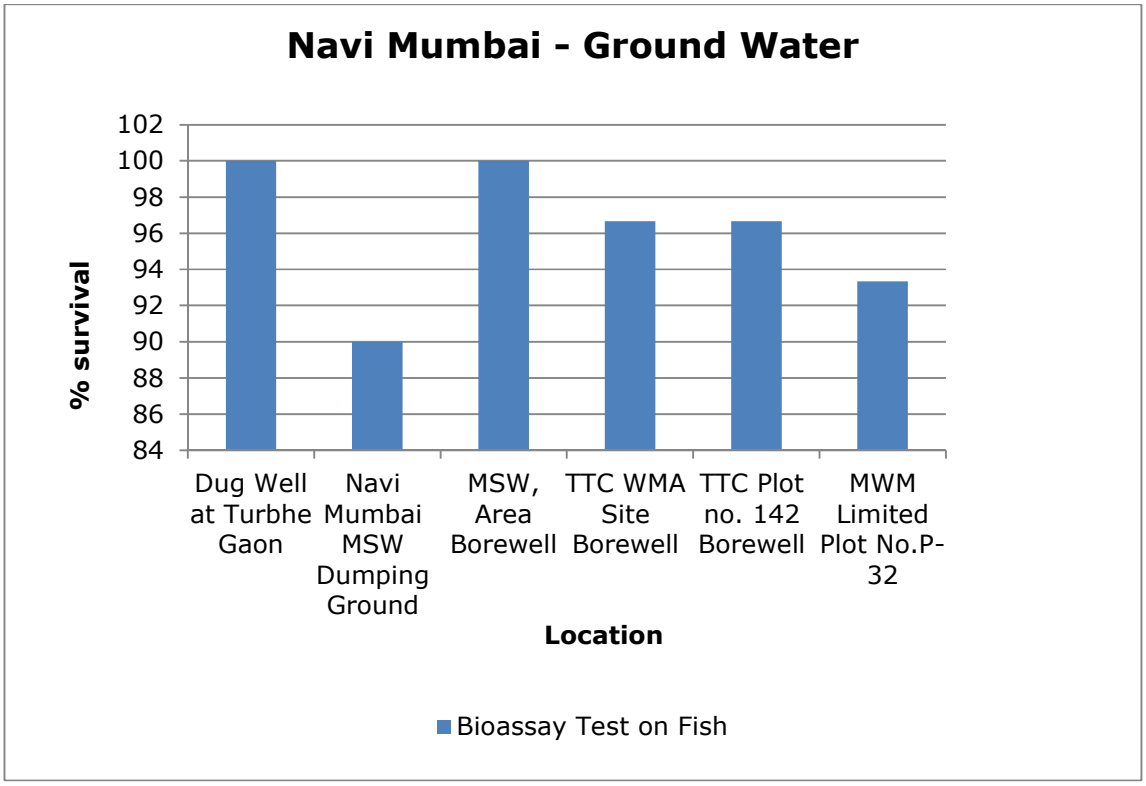
**Graphs - Ground Water Quality of Navi Mumbai**




Navi Mumbai - Ground Water
8
7
6
5
4
3
2
1
0
Dug Well at Turbhe Gaon
Navi Mumbai MSW Dumping Ground
MSW, Area Borewell
TTC WMA Site Borewell
TTC Plot no. 142 Borewell
MWM Limited Plot No.P-32
Location
Sodium Adsorption Ratio


Navi Mumbai - Ground Water
MPN Index/100ml
1800
1600
1400
1200
1000
800
600
400
200
0
Dug Well at Turbhe Gaon
Navi Mumbai MSW Dumping Ground
MSW, Area Borewell
TTC WMA Site Borewell
TTC Plot no. 142 Borewell
MWM Limited Plot No.P-32
Location
Total Coliforms
Faecal Coliforms


Navi Mumbai - Ground Water
102
100
98
96
94
92
90
88
86
84
% survival
Dug Well at Turbhe Gaon
Navi Mumbai MSW Dumping Ground
MSW, Area Borewell
TTC WMA Site Borewell
TTC Plot no. 142 Borewell
MWM Limited Plot No.P-32
Location
Bioassay Test on Fish

**C: Receptor**

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

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

**Annexure – I Health Related Data enclosed.**

## 9. 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. The CEPI score have been calculated based on CPCB Letter No. B-29012/ESS (CPA)/2015-16 dated 26th April 2016. The scoring system involves an algorithm that considers the basic selection criteria. It is proposed to develop the 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.

**Table 8.1 CEPI score of the Pre-monsoon season 2023**

| | A1 | A2 | A | B | C | D | CEPI |
|---|---|---|---|---|---|---|---|
| **Air Index** | 4 | 4 | 16 | 0 | 10 | 10 | **36.00** |
| **Water Index** | 1.5 | 4 | 6 | 33.25 | 10 | 0 | **49.30** |
| **Land Index** | 1.5 | 4 | 6 | 0 | 10 | 0 | **16.00** |
| | | | | | | **Aggregated CEPI** | **52.20** |

**Table 8.2 Comparison of CEPI Scores**

| Year | Air Index | Water Index | Land Index | CEPI |
|---|---|---|---|---|
| **CEPI score June 2023** | 36.00 | 49.30 | 16.00 | **52.20** |
| **CEPI score March 2023** | 36.00 | 50.75 | 16.00 | **53.59** |
| **CEPI Score June 2021** | 35.00 | 48.25 | 39.25 | **55.36** |
| **CEPI Score March 2021** | 42.75 | 43.75 | 36.00 | **52.40** |
| **CEPI score March 2020** | 50.80 | 17.80 | 25.30 | **53.00** |
| **CEPI score June 2019** | 46.25 | 30.00 | 25.50 | **50.36** |
| **CEPI score March 2019** | 40.0 | 32.5 | 22.5 | **44.39** |
| **CEPI score June 2018** | 40.0 | 22.0 | 13.5 | **41.78** |
| **CEPI score March 2018** | 48.0 | 53.75 | 56.25 | **67.54** |

| | | | | |
|---|---|---|---|---|
| **CPCB CEPI score March 2018** | 56.00 | 63.00 | 16.00 | **66.32** |

**CEPI Score Calculations:**

**Ambient Air Analysis Report**

| **Pollutant** | **Group** | **A1** | **A2** | **A (A1 X A2)** |
|---|---|---|---|---|
| As | C | 3 | Large | |
| $PM_{10}$ | B | 0.5 | | |
| $PM_{2.5}$ | B | 0.5 | | |
| | | **4** | **4** | **16** |

| **Pollutant** | **Avg (1)** | **Std (2)** | **EF (3) [(3)=(1)/(2)]** | **No. of samples Exceeding (4)** | **Total no. of samples (5)** | **SNLF Value (6) [(6)=(4)/(5)x(3)]** | **SNLF score (B)** | |
|---|---|---|---|---|---|---|---|---|
| As | 0.3 | 6 | 0.05 | 0 | 8 | 0.00 | L | 0 |
| $PM_{10}$ | 65.8 | 100 | 0.66 | 0 | 8 | 0.00 | L | 0 |
| $PM_{2.5}$ | 18.2 | 60 | 0.30 | 0 | 8 | 0.00 | L | 0 |
| **B score = (B1+B2+B3)** | | | | | | | **B** | **0** |

| | | |
|---|---|---|
| **C** | **10** | **>10 %** |
| **D** | **10** | **A-A-IA** |

| | | |
|---|---|---|
| **Air CEPI** | **(A+B+C+D)** | **36.0** |

**Water Quality Analysis Report**

| **Pollutant** | **Group** | **A1** | **A2** | **A (A1 X A2)** |
|---|---|---|---|---|
| TDS | A | 1 | Large | |
| (NH4+ NH3)-N | A | 0.25 | | |
| Zn | A | 0.25 | | |
| | | **1.5** | **4** | **6** |

| **Pollutant** | **Avg (1)** | **Std (2)** | **EF (3) [(3)=(1)/(2)]** | **No. of samples Exceeding (4)** | **Total no. of samples (5)** | **SNLF Value (6) [(6)=(4)/(5)x(3)]** | **SNLF score (B)** | |
|---|---|---|---|---|---|---|---|---|
| TDS | 8205.6 | 2000 | 4.10 | 5 | 6 | 3.42 | C | 30 |
| (NH4+ NH3)-N | 0.94 | 1.5 | 0.63 | 1 | 6 | 0.10 | M | 3.25 |
| Zn | 0.02 | 0.3 | 0.07 | 0 | 6 | 0.00 | L | 0 |
| **B score = (B1+B2+B3)** | | | | | | | **B** | **33.25** |

| | | |
|---|---|---|
| **C** | **10** | **>10 %** |
| **D** | **0** | **A-A-A** |

| | | |
|---|---|---|
| **Water CEPI** | **(A+B+C+D)** | **49.3** |

**Ground Water Quality Analysis Report**

| **Pollutant** | **Group** | **A1** | **A2** | **A (A1 X A2)** |
|---|---|---|---|---|
| (NH4+ NH3)-N | A | 1 | Large | |
| F | A | 0.25 | | |
| TDS | A | 0.25 | | |
| | | **1.5** | **4** | **6** |

| **Pollutant** | **Avg (1)** | **Std (2)** | **EF (3) [(3)=(1)/(2)]** | **No. of samples Exceeding (4)** | **Total no. of samples (5)** | **SNLF Value (6) [(6)=(4)/(5) x(3)]** | **SNLF score (B)** | |
|---|---|---|---|---|---|---|---|---|
| (NH4+ NH3)-N | 0.13 | 0.5 | 0.26 | 0 | 6 | 0.00 | L | 0 |
| F | 0.92 | 1.5 | 0.61 | 0 | 6 | 0.00 | L | 0 |
| TDS | 675.56 | 2000 | 0.34 | 0 | 6 | 0.00 | L | 0 |
| **B score = (B1+B2+B3)** | | | | | | | **B** | **0** |

| | | |
|---|---|---|
| **C** | **10** | **>10%** |
| **D** | **0** | **A-A-A** |

| | | |
|---|---|---|
| **Land CEPI** | **(A+B+C+D)** | **16.0** |

**Water CEPI Score (im)** **49.3**

**Air CEPI Score (i2)** **36.00**

**Land Score (i3)** **16.00**

**Aggregated CEPI Score =** **im + {(100-im)*i2/100)*i3/100)}**

where, im = maximum sub index; and i2 and i3 are sub indices for other media

**CEPI Score** **52.2**

# 10. Conclusion

**Ambient Air Quality**

- In the present study, 08 AAQ stations were identified in the CEPI impact area to cover both upwind and cross wind directions and AAQ survey was conducted.
- All air quality parameters are observed well within the limits as per NAAQS, 2009.
- Concentration of PM10 is observed in the range of 57.33 µg/$m^3$ to 78.00 µg/$m^3$ and PM2.5 in the range of 15.67 to 22.00 µg/$m^3$ at the studied locations.
- In the CEPI score calculated for Air Environment by CPCB in March 2018, the concentration of $PM_{10}$ has exceeded at all the studied locations and which contributed to higher air index (56.00). However, in the present report, concentration of both PM10 and PM2.5 are found below permissible levels resulted in less exceedance factor, hence lower air index (36.00).

**Surface Water Quality**

- To understand the quality of treated effluent, samples were collected from six industries
- Higher concentration of BOD and Total phosphates was observed in the surface water samples collected which may be due to domestic wastewater, sewage, other localized activities.
- All the industries in Navi Mumbai region are either reusing the treated trade effluent as sewage in their process or gardening.
- In the CEPI score calculated for Water Environment by CPCB in March 2018, concentration values of total phosphorous were higher and exceeded at all the studied locations as observed in the present study also.

**Ground Water Quality**

- Six ground water samples were collected from different Dug well, well and Bore well in the region.
- Ground water of the studied regions was found to be safe for drinking with a very low concentration of TDS, iron, chromium and other general as well as carcinogenic parameters.
- In the CEPI score calculated for Land Environment by CPCB in March 2018 also there is no critical pollutant exceeding in any water sample collected.

**CEPI Score**

- The CEPI Score pre-monsoon season is 52.2.
- During calculation of CEPI score, water Index is calculated highest with 49.3, followed by the Air Index 36.00 and Land index as 16. The parameters of surface water and ground water in Navi Mumbai region is well within the limits. Hence, aggregated CEPI score is calculated as 52.2, which is lower than the CPCB CEPI score 2018 i.e. 66.32.

- In CEPI score of CPCB 2018, the air index and water Index was higher as compared to the present (pre-monsoon 2023) indices.
- As per the CPCB CEPI calculation revised in 2016, Health statistics represented by Receptor C in CEPI Calculation, also plays an important role.
- For analysing the health data collected from hospitals, more than 10% increase in air and water borne disease cases is observed in the consecutive years of 2020-2021 and 2021-2022. Hence score for receptor C is considered as 10 for all three environments.
- Collective efforts of regional office of MPCB, NMMC, administration and environmental organizations are resulting in significant reduction in pollution level.
- Efforts taken to reduce the pollution level is represents factor D in CEPI Calculation, which also affects the overall CEPI score.
- The present study is the compilation of pre-monsoon season, which results in dilution of environmental samples resulting in lower pollution load, hence also affects the total score.
- In conclusion, approximately 21% decrease in CEPI score is observed from 66.32 in 2018 to 52.2 in June 2023.

## 11. Efforts taken by MPCB to Control and Reduce Environmental Pollution Index

- Drive against open burning of biomass, crop residue, garbage, leaves, etc.
- Organic Waste Compost Machines Malls, Infrastructure projects, Large scale hospitals & Hotels has installed OWC.
- Waste collection and segregation centres: Provided by NMMC at all wards.
- Construction of Common Effluent Treatment Plant (CETP): 1 CETP of 27 MLD capacity is already operational and complied.
- Installation of CEMS installed for Air and Water in Large and Medium scale RED category industries: 63 Nos. of unit has installed CEMS & connected to CETP server.
- Arrangement of scientific collection and treatment of sewage generated: 04 Nos of STP having total capacity as 256.5 MLD with adequate capacity of collection sumps are provided by NMMC.
- Installation of CAAQMS station: Total 4 Nos. (1 old + 3 new) of CAAQMS stations are operational.
- Number of Monitoring stations under National Water Quality Monitoring Programme (NWMP): 1 (Vashi Creek at Vashi Bridge).
- Steps are taken for industrial area/other units to recycle 100% treated effluent to achieve Zero Liquid Discharge (ZLD): 11 Nos of Industries has adapted ZLD.
- Steps are taken to reduce dust emission: Concretization of Roads and twice daily sweeping of Roads by NMMC authority. Presently NMMC has proccured2 Nos. of fogging machines. NMMC is already having 6 Nos. of mechanical sweeping machines.
- Around 1 lakh trees are planted in last one year (2021-2022).
- Directions issued to the industries to switch over on clean fuel.

| | |
|---|---|
| **Continuous Ambient Air Quality Monitoring Station (CAAQMS)** | **Ambient Air Quality Monitoring (AAQM) Van** |

## 12. Photographs

**Ambient Air Sampling at Ashi India Glass**

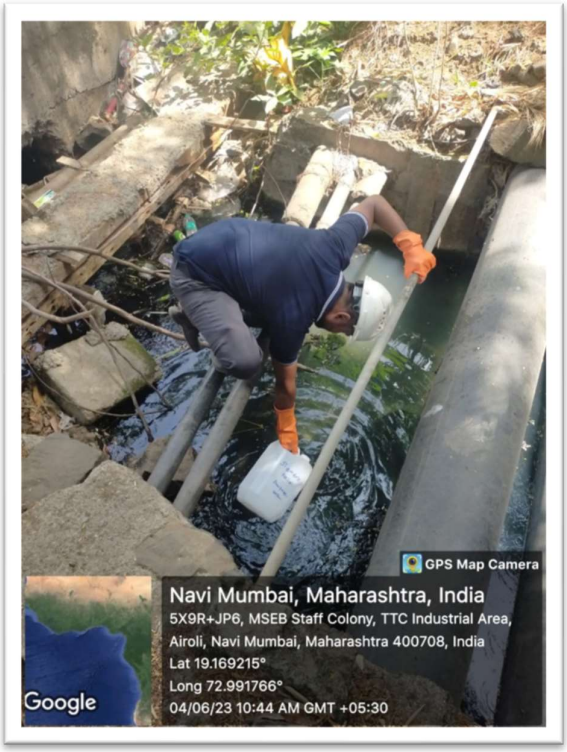
**Ambient Air Sampling at D Y Patil Hospital**

**Ambient Air Quality Monitoring CETP Koparkharine**

**Ambient Air Quality Monitoring at Deepak Fertilizers and Petrochemicals**

**Surface Water Sampling – CBD Nallah**

**Surface Water Sampling – Kasardi River near CETP Taloja**




**Surface Water Sampling – Siemens Nallah**

**Surface Water Sampling – Vashi Creek at Vashi Bridge**

**Groundwater Sampling – MSW Borewell**

**Groundwater Sampling – Mumbai Waste Management Limited**

**Groundwater Sampling – TTC plot no. 142**

**Groundwater Sampling – Dug well Turbhe**

# HEALTH STATISTICS

**Required for Comprehensive Environmental Pollution Index (CEPI) Study by Maharashtra Pollution Control Board (MPCB)**

| | |
|---|---|
| Name of the Polluted Industrial Area (PIA) | NAVI MUMBAI |
| Name of the major health center/ organization | E.S.I.S Hospital |
| Name and designation of the Contact person | |
| Address | |

| S No. | Diseases | No. of Patients Reported | |
|---|---|---|---|
| | | 2022 (Jan-Dec) | 2021 (Jan-Dec) |
| **AIRBORNE DISEASES** | | | |
| 1. | Asthma | 516 | 218 |
| 2. | Acute Respiratory Infection | 484 | 204 |
| 3. | Bronchitis | 218 | 84 |
| 4. | Cancer | 109 | 88 |
| **WATERBORNE DISEASES** | | | |
| 1. | Gastroenteritis | 184 | 17 |
| 2. | Diarrhea | 148 | 68 |
| 3. | Renal diseases | 425 | 312 |
| 4. | Cancer | 179 | 116 |

Date:

Signature

MEDICAL SUPERINTENDENT
E.S.I.S. HOSPITAL, VASHI,
Navi Mumbai-400703

नवी मुंबई
महानगरपालिका
1ला माळा, प्रशासकिय विभाग, सार्वजनिक रुग्णालय वाशी, नवी मुंबई 400703 .
दूरध्वनी क्र : 2899901,02,03

Navi Mumbai
Municipal Corporation
1st FLOOR, ADMINISTRATIVE OFFICE,
GENERAL HOSPITAL VASHI
NAVI MUMBAI – 400703.
TEL. No. : 27899901,02,03

बेटी बचाओ
save the girl child

जा.क्र. नमुंमपा/सा.रु.वाशी/ 499 /2023
दि. 01 / 02 / 2023

प्रति,

मा.उप-प्रादेशिक अधिकारी,
महाराष्ट्र प्रदुषण नियंत्रण मंडळ,नवी मुंबई

**विषय- रुग्णालयातील आरोग्यविषयक रुग्णांचे विविध आजारांची माहीती बाबत.**
संदर्भ - १) MPCB/SRONM-1/230117-FTS-0172

महोदय,

उपरोक्त संदर्भिय पत्रान्वये रुग्णालयातील आरोग्यविषयक रुग्णांचे विविध आजारांची माहीती मागविण्यात आलेली आहे. त्याअनुसार सदरची माहिती खालीलप्रमाणे आहे.

| अ.क्र. | Disease | No Of Patient Reported | |
|---|---|---|---|
| | | 2022(Jan To Dec) | 2021(Jan To Dec) |
| AIRBORN DISESSES | | | |
| 1 | Asthma | 382 | 202 |
| 2 | Acute Respiratory Infection | 1109 | 562 |
| 3 | Bronchitis | 215 | 124 |
| 4 | Cancer | 39 | 35 |
| WATERBORN DISESSES | | | |
| 1 | Gastroenteritis | 206 | 151 |
| 2 | Diarrhea | 282 | 143 |
| 3 | Renal Diseases | 157 | 146 |
| 4 | Cancer | ——— | ——— |

(डॉ. प्रशांत जवादे)
वैद्यकिय अधिक्षक
सार्वजनिक रुग्णालय, वाशी
नवी मुंबई महानगरपालिका
सेक्टर १०ए, वाशी, नवी मुंबई