



#CleanAirForAll

Air Quality Monitoring In Kharghar-Taloja-Panvel

Background

Located on the outskirts of Mumbai, Panvel, more popularly known as the gateway of the Konkan coast, is the most crowded locality in Raigad district of Maharashtra. Despite the drastic growth of population owing to urbanization, very little attention is being paid to high levels of air pollution in the region.

It is crucial to address the issue of air pollution as it has been considered the greatest environmental risk to health and has been [declared](#) as a global health emergency by the World Health Organization. In fact as per the ['State of Global Air 2020' report](#) long-term exposure to air pollution contributed to around 6.7 million deaths globally from stroke, heart attack, diabetes, lung cancer, chronic lung diseases, and neonatal diseases in 2019. India alone accounted for 1.6 million of such deaths. With 18 cities including Mumbai, Maharashtra tops the environment ministry's list of non-attainment cities where pollution levels are not meeting the set standards. Of these, Navi Mumbai is the most polluted city across the state and 51st polluted city across the globe as highlighted in the [Air Visual Report](#), 2019. Just like their counterparts in Navi Mumbai, residents of Panvel too are suffering due to poor air quality. On several occasions residents have woken up to a foul and pungent smell and the air filled with smog. While transport and construction contribute to poor air quality, industries located at MIDC, Taloja contribute significantly. Despite complaining for years, even today there is no regulatory grade Continuous Air Quality Monitoring Station (CAAQMS) in this region, which falls under the jurisdiction of Panvel Municipal Corporation (PMC).

Maharashtra Pollution Control Board (MPCB) installed [trial meters](#) in this region. However, the data is not available in the public domain. It helps in assessing the level of pollutants in relation to the ambient air quality standards. Regular and robust monitoring is the first step to frame effective policies and ensure their timely implementation. Monitoring air quality throughout the region could help to reveal how pollution travels and could help identify pollution "hot spots." Hence, Waatavaran decided to monitor the air quality in this region with the help of citizens.

“It is important to involve local citizens in air quality monitoring campaigns. This will not only help to raise awareness on key environmental issues, but it may also foster learning opportunities.”

BHAGWAN KESBHAT

Founder, Waatavaran Foundation

The Technology

These low-cost monitors are built using IoT-enabled PM1, PM2.5 and PM10 sensor based that uses the laser-scattering principle to measure particulate matter concentration in ambient air. The monitor has an internal fan and the sensor at any given time contains 0.1 litre of ambient air from which the PM concentration is measured. The fan enables continuous exchange of air. The monitor has wireless connectivity to transmit the PM data in real-time every 1 minute to a fast time-series Big Data server which provides the air quality data in Open Data format via real-time APIs and graph-based visualizations.

Scientific field evaluations of the Atmos device have found the correlation R2 of the device to be between 0.7 to 0.95 with the sensor values within ~ 11% of the reference values. As the averaging period is increased (1hr or 2hr averages) reduced the error percentage to around 5% to 8%. The accuracy increases as the averaging time-period is increased.



Deployment of Air Quality Sensors

Five Real-Time Air Quality Monitors were deployed across the Kharghar-Panvel-Taloja region that and air quality was monitored from 13th November 2020 to 13th December 2020.

One air quality monitor was placed within the MIDC, Taloja area, while the other four were placed in residential areas.

The following factors were considered before deployment of air quality monitors in residential areas:

1. Residents complained of air pollution (problems include visibility and foul and pungent smell in the early hours of morning and late in the evening).
2. The distance of residential areas from the MIDC, Taloja area.
3. The distance of residential areas from highways and parks/green spaces.

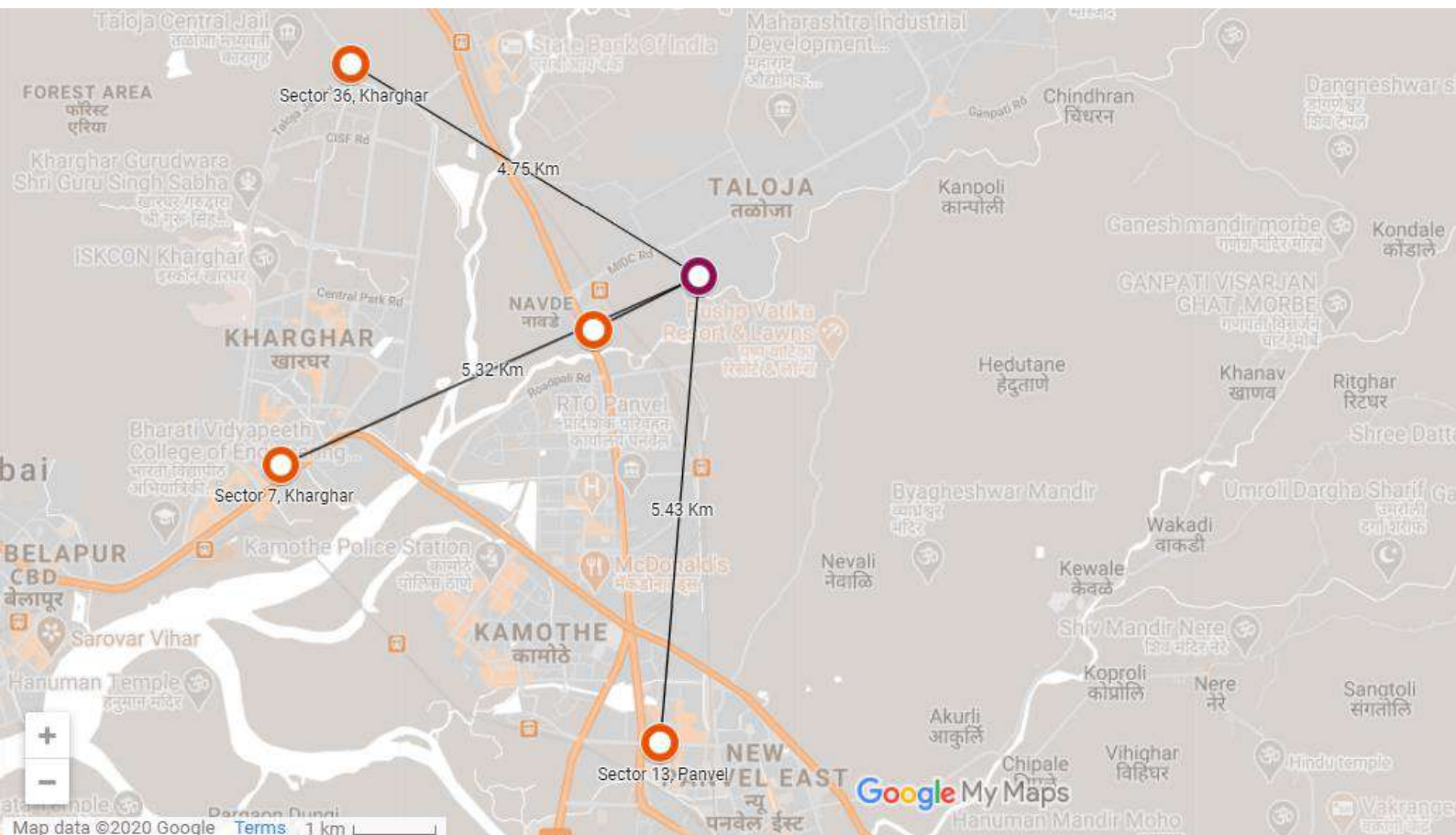


Image 1: [Location](#) of air quality monitors deployed in Kharghar-Taloja-Panvel region

	Location	Location type	Distance from AQM placed at MIDC, Taloja
AQM 1	MIDC, Taloja	Within Industrial area	0 Km
AQM 2	Sec. 13, Panvel	Residential area	5.43 Km
AQM 3	Navade, Taloja	Residential area + major traffic route	1.37 Km
AQM 4	Sec. 36, Kharghar	Residential area	4.75 Km
AQM 5	Sector 7, Kharghar	Residential area + moderate traffic route	5.32 Km

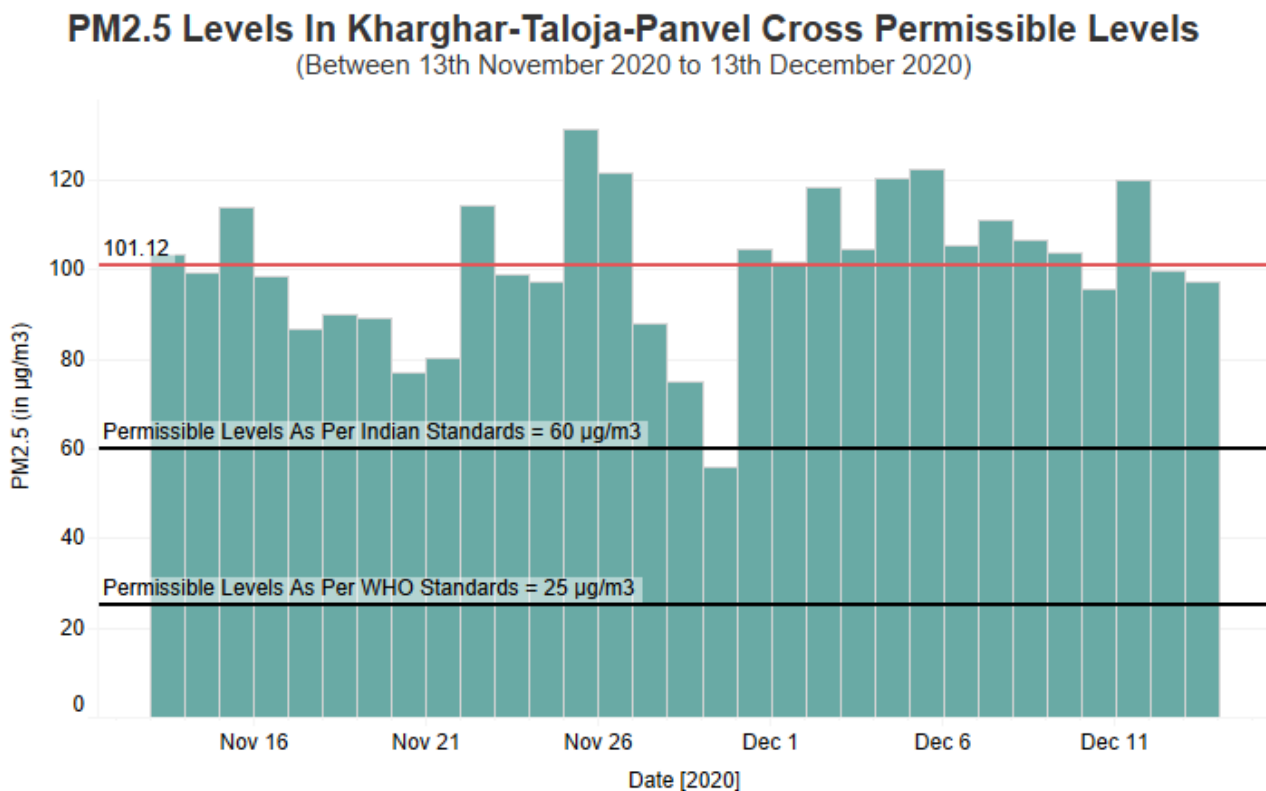
Table 1: Air quality monitors deployed in Kharghar-Taloja-Panvel region

The guidelines given below were followed while deploying the air quality monitors:

1. **Sensor location** – Sensor has to be installed away from all known point-sources of air pollution and away from all obstructions, in an open area.
2. **Sensor Height** – Sensor height plays a crucial role in collecting relevant data. If it is installed at ground level (breathing zone), then it may give data on the impact on human health. However, actual air quality information is at a higher level. So, sensors need to be installed at least at a height of 3-4 metres for capturing correct environment data.
3. **Sensor Distribution** – For city-wide environmental monitoring, it is important that the sensors are deployed strategically to cover various geographic locations like green parks, industrial areas, major traffic routes, residential areas, etc.

Such scientific evidence obtained through real-time sampling and analysis would only strengthen the air pollution narrative and help in shaping policies further in pursuing this issue with implementing agencies. Every step in curbing this menace will benefit each and every person living in the area especially children, senior citizens and those suffering from respiratory illnesses who are most vulnerable.

Findings

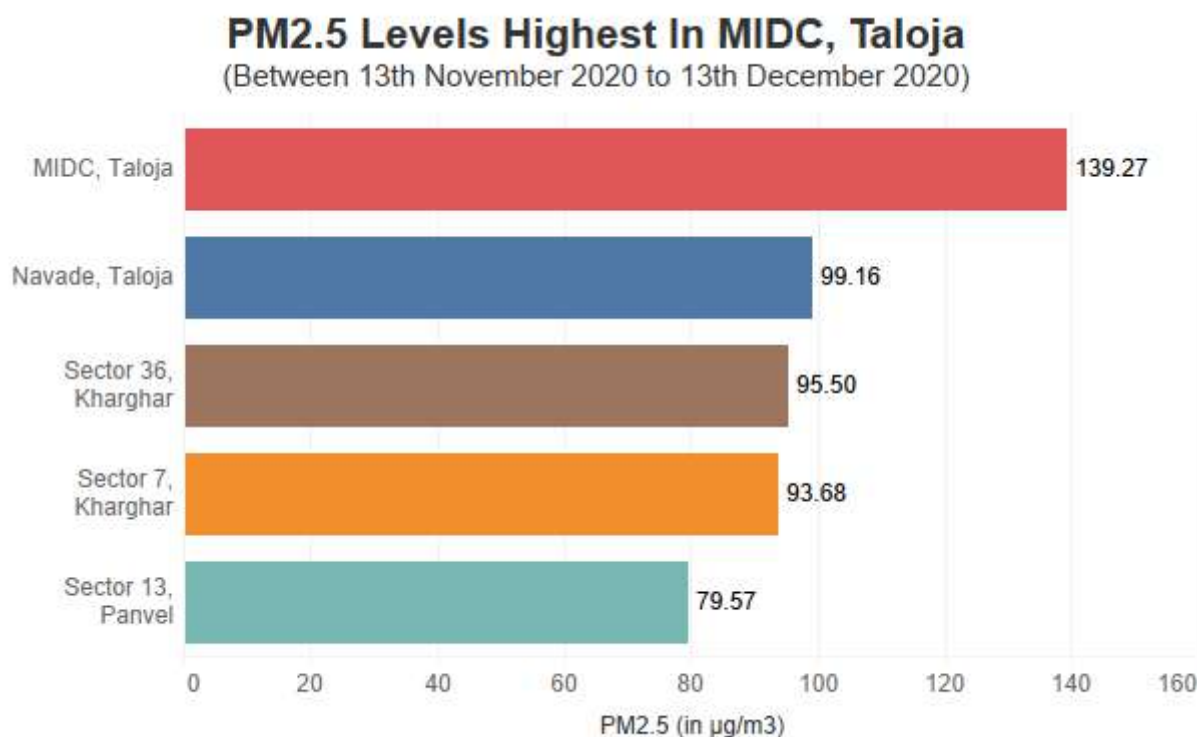


Graph 1: PM2.5 Levels In Kharghar-Taloja-Panvel Cross Permissible Levels

As per the **WHO guidelines** the 24-hour permissible limits of PM2.5 is 25 µg/m3 and as per **Indian standards** it is 60 µg/m3. An average of data collected across five locations along the Kharghar-Taloja-Panvel belt indicates that Panvel has been consistently crossing the permissible levels of particulate matter. **It crossed the permissible limit of PM2.5 on 30 of the 31 days that the air quality was monitored (as per Indian standards).**

The average PM2.5 level recorded by the monitors* across five locations at Panvel over this 31-day period was **101.12 µg/m3**, which is 1.7 times the Indian standard and 4 times the WHO standard. During the same duration the average PM2.5 levels as recorded by the MPCB monitoring stations** located at Nerul was **88.2 µg/m3** and Mahape was **79.8 µg/m3**.

*NOTE: *One monitor did not record data points for 2 days; **Monitoring stations did not record data points for 3 days*



Graph 2: PM2.5 Levels Highest in MIDC, Talaja

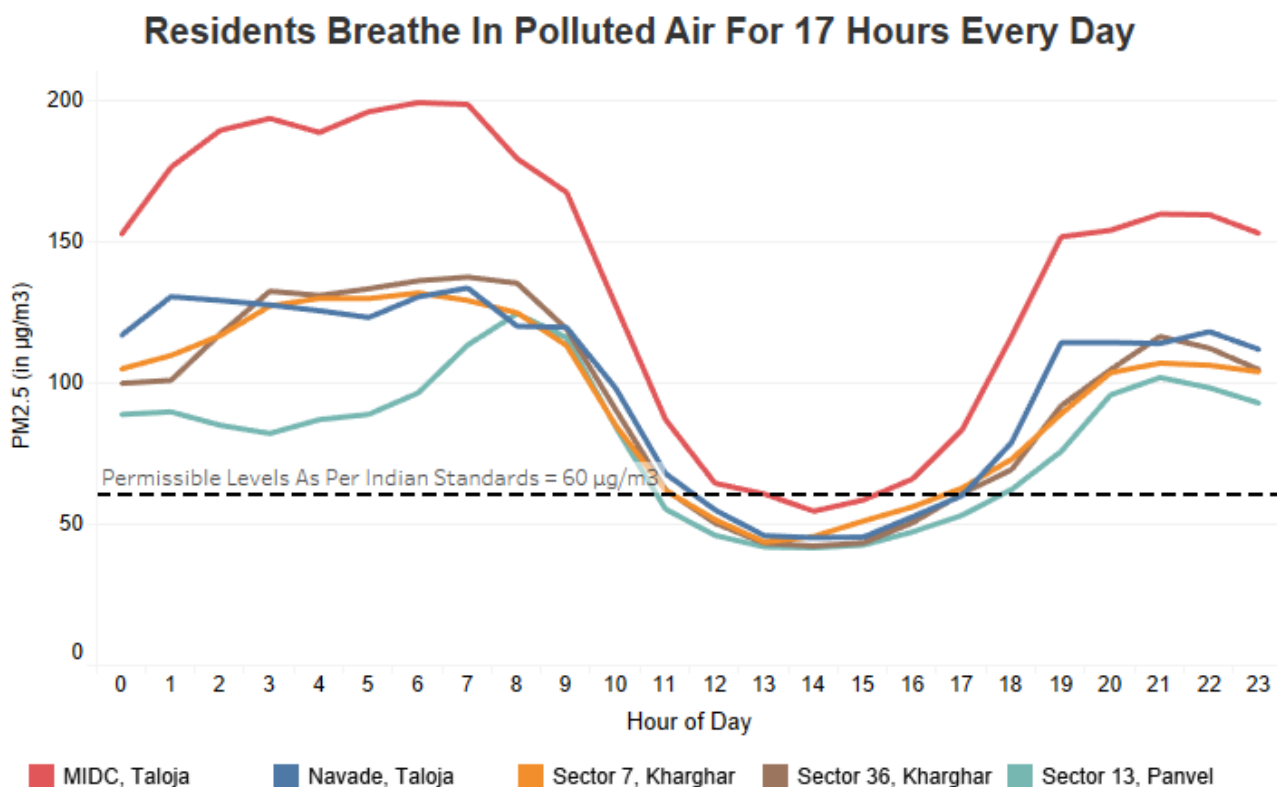
Of the five monitors, the one located in the MIDC, Talaja recorded the highest levels of both PM2.5. The average PM2.5 level over this 31-day period was **139.27 $\mu\text{g}/\text{m}^3$** . This is 2.3 times the Indian standard and 5.5 times the WHO standard.

The lowest levels of PM2.5 were recorded at Sector 13, Panvel. The average PM2.5 level over this 31-day period was **79.57 $\mu\text{g}/\text{m}^3$** . This is 1.3 times the Indian standard, it is 3.18 times the WHO standard.

“Air pollution at any given location is a function of local emissions, pollution coming from nearby and distant places and the meteorology governing it, the only thing in our control is to reduce the emissions at source and that’s the best way to achieve breathable air quality.”

SUNIL DAHIYA

Analyst, Centre for Research on Energy and Clean Air



Graph 3: Residents Breathe in Polluted Air For 17 Hours Every Day

The data exhibits a classical diurnal pattern. The PM levels start increasing late in the evening, are highest in the early hours of the morning and start reducing only post 8:00 am. The lowest PM levels were recorded post noon.

At an average of **141.1 µg/m³** for five monitors placed across Panvel, the highest PM_{2.5} levels were recorded at 7:00 am in the morning. Though highest levels of PM were recorded in the early hours of morning, residents spend nearly two thirds of their day breathing in polluted air.

“Such spatial and temporal understanding of air quality is crucial as it helps to identify hotspots in the region. Availability of such data can help citizens to make timely decisions on times of the day which should be best avoided to be outdoors.”

RONAK SUTARIA
Founder, Respirer Living Science

Inference

1. Panvel witnessed '*bad air days*' throughout the one-month period, where most days had crossed the Indian standards of permissible levels of air quality.
2. Highest levels of PM were recorded in the MIDC, Taloja area which indicates that industries aren't complying with all emission standards. This is not only a huge health risk for the people working there, who are exposed to such high levels of air pollution but also for those residing in nearby areas
3. Going for a walk/jog in the morning in this region will do more harm than good since highest levels of PM were recorded between 6:00 am and 8:00 am.
4. Besides, data also suggests that residents are breathing in polluted air for 17 hours every day.
5. No unusual peak was observed during the Diwali week. This indicates that most concerned citizens actually adhered to the 'no-crackers' rule.
6. Data suggests that slight showers in the region between 11th and 13th December 2020 didn't affect the air pollution level in the region.
7. Though highest levels of PM were recorded at 7:00 am, data suggests that residents are breathing in polluted air for nearly two-thirds of the day. It is important to issue timely advisories to citizens that impact their health and well-being.

“This study clearly indicates that half a million people living in Panvel are constantly exposed to high levels of PM2.5. Exposure to such high levels of PM2.5 can cause several health problems, including recurrent lung infections, asthma, Chronic Obstructive Pulmonary Disease (COPD), heart ailments, and stroke in the elderly. Local authorities need to take up this issue seriously and plan strategies to reduce the levels of air pollution in Panvel.”

DR. SUNDEEP SALVI

MD, DNB, PhD(UK), FCCP(USA), Hon FRCP(Lon)

Director, Pulmocare Research and Education (PURE) Foundation

Conclusion

A one-month long preliminary assessment of the air quality was carried out in Panvel region to estimate the PM_{2.5} levels here. Data strongly indicates that the entire region is encompassed by poor air quality that threatens the health of lakhs of citizens either working or residing in the region. Tackling this health hazard will require collective and collaborative efforts.

We suggest the following actions that need to be taken up with priority to effectively address the issue of air pollution in the region.

1. There are no CAAQMS in Panvel due to which there is clearly a lack of authentic data. Monitoring of air quality in Panvel is the very first step towards mitigating measures for air pollution.
2. Real-time air quality data needs to be made available in the public domain and timely health advisories need to be issued to citizens.
3. Create a 'Clean Air Action Plan' focusing on Panvel with annual goals by including all implementing agencies and civil society organisations/ NGOs in the area. Involvement of citizens, elected representatives is crucial for the success of the clean air plan. This will ensure accountability and timely outcomes, while they participate in the processes.
4. Since a significant proportion of air pollutants come from industries, setting industry emission standards is key to reducing emissions and improving air quality. Besides, the 'Clean Air Action Plan' must also clearly enlist deadlines and legal implications if industries either fail to comply with emission standards or meet deadlines.
5. All implementing agencies, contractors need to follow the rules to ensure that dust-mitigation measures are followed during all kinds of construction activities. Besides, efforts also need to be taken to identify solutions to manage road dust pollution.
6. Make the entire Panvel region a 'Zero Waste Burning' city by enforcing proper Solid Waste Management Rules. No household or industrial waste should be burnt anywhere as it severely impacts air quality.