City Air Action Plan for Control of Air Pollution in Mira-Bhaindar: One of the Non-Attainment Cities of Maharashtra

MIRA-BHAINDAR

CLEAN AIR ACTION PLAN

Maharashtra Pollution Control Board
महाराष्ट्र प्रदूषण नियंत्रण मंडळ

Submitted to:

Maharashtra Pollution Control Board

मिरा भाईंदर महानगरपालिका

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INTRODUCTION:

Air pollution in India is a serious environmental issue. Of the 30 most polluted cities in the world, 21 were in India in 2019. As per a study based on 2016 data, at least 140 million people in India breathe air which is 10 times or more over the WHO safe limit and 13 of the world's 20 cities with the highest annual levels of air pollution are in India. 51% of the pollution is caused by industrial pollution, 27 % by vehicles, 17% by crop burning, and 5% by other sources. Air pollution contributes to the premature deaths of 2 million Indians every year. Emissions come from vehicles and industry, whereas in rural areas, much of the pollution stems from biomass burning for cooking and keeping warm. In autumn and spring months, large-scale crop residue burning in agriculture fields – a cheaper alternative to mechanical tilling – is a major source of smoke, smog, and particulate pollution. India has low per capita emissions of greenhouse gases but the country as a whole is the third largest greenhouse gas producer after China and the United States. A 2013 study on non-smokers found that Indians have 30% weaker lung function than Europeans.

Data from the country's major regulator the Central Pollution Control Board (CPCB), showed that 77% of Indian urban clusters exceeded the National Ambient Air Quality Standard (NAAQS) for respirable suspended particulate matter (RSPM or PM10) in 2010 (CPCB, 2012). Another key estimate from WHO pointed out that out of 20 world's worst particulate air polluted cities around 13 were in India including the capital Delhi, which has been the worst-ranked city in terms of air pollution (WHO, 2014). It is quite alarming to note that the satellite measures of fine particulates created for the entire of India reveal that our population living both in urban and rural areas is exposed to hazardously high levels of particulates. Almost 670 million people comprising 54.5% of the population reside in regions that do not meet the Indian NAAQS for fine particulate matter (Green Stone et al, 2015; Dey, 2012). Numerous studies have revealed a consistent correlation between particulate matter concentration with health and any other air pollutant. Studies show a statistically significant correlation between mortality and ambient particulate matter concentration (Lee et al, 2006).

The exposure to hazardous particulate matter pollution (PM2.5 and PM10) is alarmingly high in most Indian cities, with levels exceeding the National Ambient Air Quality Standards for most parts of the year. Several Indian cities such as Delhi, Gwalior, Raipur, Patna, Varanasi, Agra, and Kanpur exceed the PM2.5 levels by several times than the air quality guidelines recommended by the WHO. Health implications of air pollution are the driving forces that necessitate the management of air quality in urban spaces. Control measures and standards are primarily developed with concerns regarding the health of the citizens by creating sustainable and livable urban spaces. The World Bank Report (2016) highlighted that diseases associated with outdoor and household air pollution may have cost India as much as 8.5 percent of its GDP in 2013. As per WHO, direct health risks associated with exposure to pollutants vary with pollutant type, concentration, and time of exposure. Healthy people commonly experience breathing difficulties or respiratory irritation if exposed to the pollutants. However, adverse effects may result in individuals suffering from heart or respiratory ailments. Immediate health problems are caused by high levels of pollutants in the atmosphere even for the relatively shorter duration which could include:

respiratory illness such as asthma or bronchitis, aggravated cardiovascular ailments like a heart attack or congestive heart failure, increase in the probability of cancer. Permanent health effects that may be caused by long-term exposure to polluted air include accelerated aging of the lungs, loss of lung capacity and decreased lung function, development of diseases such as asthma, bronchitis, emphysema, and possibly cancer shortened life span. Health impacts associated with exposure to gaseous pollutants and toxic pollutants include significant damage to the lungs, heart, and nervous system. Exposure to ozone gas leads to irritation in the lungs, a decline in lung functioning, and increased disability-adjusted life years (DALYs). Fine particulate matter (particulate matter less than 2.5 microns in diameter) is of significant concern to human health since it can penetrate deep into the lungs. Other pollutants such as

Volatile Organic Compounds (benzene, butadiene, and aldehydes) or asbestos, and metals (such as mercury, lead, manganese, and chromium) are potentially toxic if upon recurrent exposure. A number of them are reported to be known as human carcinogens (e.g. benzene, butadiene, formaldehyde, asbestos), some are known to cause significant respiratory irritation (benzene, butadiene, formaldehyde, asbestos), and a few impacts the nervous system and the brain (e.g. the metals mercury) (HEI, 2007). Air pollution has huge economic consequences for agriculture, the ecosystem, and buildings it also has adverse impacts on the local weather. As per the study conducted by IITM, gases like NOx, CO & VOCs cause an increase in surface ozone, and long-term exposure to high concentrations of surface ozone damages vegetation with a substantial reduction in crop yields and crop quality. The worst-affected crop in India in terms of yield losses in wheat followed by rice (Beig, 2014).

AIR QUALITY IN MAHARASHTRA:

MAHARASHTRA has the second highest number of air pollution–related deaths in the country and, surprisingly, one of the big contributors to this unsavory claim to fame is the burning of garbage. Heaps of garbage along highways and roadsides are an everyday sight in many parts of the State. While urban areas have a definite waste management program that is more or less well implemented, rural and semi-rural Maharashtra still dumps its garbage in large open grounds or along roads.

Numerous heaps of burning garbage, which are ubiquitous along roadsides in areas surrounding Mumbai, are not identified as part of any specific initiative. These garbage dumps consist of mixed biomass and plastic and are a major contributing source of localized air pollution. Localized air pollution sources kill people even though [owing to weather patterns] they may not increase the overall AQI [Air Quality Index] level of a larger area to 'severe' levels. Burning plastic is especially toxic and can cause respiratory disease, cancer, liver failure, and other diseases

An Indian Council of Medical Research (ICMR) report released in December 2020 contains shocking data about premature air pollution–related deaths in the State. It said that 1,39,118 people lost their lives in Maharashtra in 2019 because of air pollution. This accounts for 16.7 percent of the overall deaths in the country caused by air pollution. The State is second only to Uttar Pradesh where air pollution took 3.5 lakh lives. The all-India figure was 17 lakh deaths.

In December 2020, Waatavaran, a Mumbai-based NGO that works on issues relating to the climate, the environment, and sustainability, conducted a one-month-long test on air pollution in Taloja and Panvel in Raigad district and Bhiwandi in Thane district and found that people were exposed to extremely high levels of air pollutants for 17 hours a day. A non-attainment area or city is one where the air quality is considered worse than the acceptable standards as defined by the Central Pollution Control Board, which requires all city municipal corporations to submit action plans to effectively tackle air pollution. Despite having action plans, 18 of Maharashtra's cities still fall below the accepted standards of air quality. The National Clean Air Programme (NCAP) aims to reduce PM2.5 concentrations by 20-30 percent by 2024 from 2017 levels. The Union Ministry of Environment, Forest and Climate Change launched the NCAP in 2019. It is a national-level strategy to reduce the levels of air pollution at both the regional and urban scales.

Air pollution is measured by quantifying total suspended particulate matter [PM] identified by the size of the particles. PM2.5 are minute particles 2.5 micrometers or less in diameter. The particles contain a mixture of solids and liquids and include acids such as sulphates and nitrates; ammonium; carbon; and mineral dust."

MANAGING AIR QUALITY INITIATIVES UNDERTAKEN:

National Ambient Air Monitoring Program (NAMP) with 631 stations in 262 cities across India to determine the status and trends of ambient air quality and ensure effective regulatory compliance. The NAMP stations are equipped to continuously monitor the concentration of four pollutants (Sulphur Dioxide (SO2), Nitrogen Dioxide (NO2), and Particulate Matter size equal to or less than 10 microns (PM10) and 2.5 microns (PM2.5) in the ambient air on a 24-hour basis (envfor.nic.in/division/air-pollution). Additionally, the autonomous institutions (e.g. Indian Institute of Tropical Meteorology (IITM), Pune) have also established monitoring stations in major cities to estimate the air quality. Megacities like Delhi and Mumbai are equipped with a strong monitoring network with 28 monitoring stations each. Also, a major low-cost monitoring network is being assessed and established with the potential to measure a few criteria pollutants in the country (India Spend 2015).

Subsequently, in 2015 the Government launched the National Air Quality Index (NAQI) aimed at providing effective protection to citizens against health risks from air pollution. AQI categories associated with health impacts on a scale of 0-500 and 10 communicate air pollution levels to citizens. Eight sub-indices monitor the level of a specific pollutant: PM10, PM2.5, Nitrogen Dioxide (NO2), Sulphur Dioxide, Ozone, Carbon Monoxide (CO), Ammonia (NH3), and Lead (Pb). Based on the concentration of each pollutant, a sub-index is calculated for each, and the worst sub-index determines the overall AQI value for that particular day. Currently, the AQI display is in 24 cities and is also accessible through app downloads on social media.

In the absence of any concrete and robust action plan, the number of cities classified as non-attainment under the NAAQS has continuously been on a rise in the country. There are approximately 94 cities in India that are under the non-attainment list of NAAQS for the past five years. As per Section 18 (1) of the Air Act, the CBCP has directed the SPCBs of the respective states to prepare the action plan and implement it to comply with the NAAQS. Yet, no such action plans are formulated and put into force. However, only recently the Delhi Pollution Control Committee (DPCC) and CPCB developed the Graded Responsive Action Plan (GRAP) which is applicable only during the exigency period for the city, and actions described in GRAP can come into force as and when directed by the authority. In Aug 2017 MPCB proposed Clean Air Mission- Maharashtra 2022 for undertaking Air Quality Monitoring, Emission Source Apportionment, and Air Quality Improvement Plans for 17 cities in the State of Maharashtra and Surat City, Gujarat.

Recently, the Maharashtra Pollution Control Board (MPCB) developed first of its kind five-star rating system in India to measure pollution for industries in collaboration with MIT's Jameel Poverty Action Lab (J-PAL). The objective is to collect data (particulate matter) from approximately 20,000 stacks and make the data publicly available and increase transparency. The industries will be rated between one and five stars depending upon their performance on the pollution front and aid in pollution abetment strategies and plans for non-performing units. Furthermore, the city of Ahmedabad in support of the local Government developed the first Indian monitoring and early warning system for air pollution in May 2017 with the purpose to minimize health impacts and deaths from air pollution. As a part of what is called the Air Information and Response (AIR) plan, daily AQI will be accessible to citizens through 11 LED screens across the city. Under this plan, medical professionals will be trained to respond during air pollution episodes and the warning system will notify people of excessive pollution days.

High pollution levels combined with dense population in urban areas result in high mortality and health costs. Conditions in developing Asian cities such as low average 11 incomes, poor health facilities along with inadequate awareness about the sources and treatment of health problems, further contribute to the loss of many lives every year. The Global Burden of Disease recognized that in 2013 approximately 660,000 deaths in India were on account of outdoor air pollution (IHME, 2015). Addressing India's air pollution and ensuring the right to clean air for all requires a comprehensive national action plan with

targets and timelines, along with strict measures and monitoring plans for reducing air pollution emissions from major polluting sectors such as power generation, industry, transport, and agriculture. However, our cities constantly face the problem of insufficient information on air quality management as data on air pollution is not easily available. This has resulted in poor public awareness and insufficient measures to reduce air pollution (Apte et al, 2011; Kaushik and Borah, 2016).

To manage air quality better, there is a need to have a comprehensive understanding of the status and gaps in the air quality management of a city. Unfortunately, air quality information is often limited, fragmented between different organizations, and not easily understood by the public. In addition, India's fast-growing economy is confronted with many development challenges, like energy security, economy, and traffic congestion, which are further compounded by climate change. As the global climate change agreements and national policies and targets trickle down to the cities, there will be a tremendous capacity gap to deal with climate change while continuing to address air pollution and other development issues.

INTRODUCTION TO MIRA-BHAINDAR:

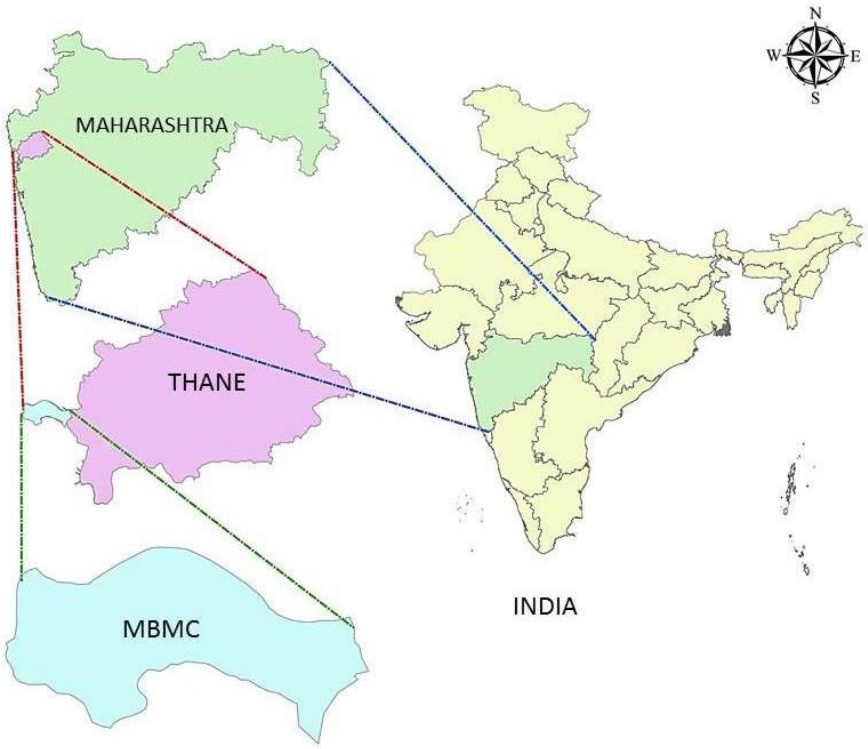
- **City Overview**

  Mira Bhaindar is a historical town in the Bassien Fort with a rich cultural and historical heritage. It has grown up economically to be one of the leading townships in Maharashtra with its own governing Municipal Corporation, MBMC. It is situated at the northern threshold of the Brihan Mumbai Metropolis. It is an important residential area in the Mumbai suburbs due to lower living costs with industrial development too within the township. Under the jurisdiction of MBMC, there are nineteen villages viz. Khari, Ghoddeo, Ghodbunder, Pen-pada, Mira, Kashi, Navghar, Bhaindar, Mahajan Wadi, Chene, Varsave, Rai Murdha, Murdha, Morva, Uttan, Dongri and Tarodi Pali Chowk. Bhaindar and Mira are divided into two parts each east and west. Bhaindar west is mainly a residential area, while the east is predominantly an industrial area. There is an extension of the residential population further south into Mira Road but restricted by salt pans and marshlands. Mira road has been only developed on the east part while the west on the other side is covered by government-owned salt pans and mangroves.

- **Location Map**

  The location map for Mira Bhaindar is shown in Figure 1-1.

Figure 1-1: Location map of Mira Bhaindar Municipal Corporation



- **Topography**

Mira-Bhaindar city covers an area of 79 sq. km in the district of Thane, in the western state of Maharashtra, India. It is located around 20 km north of the Mumbai-Ahmedabad highway which is between 18°42’ N to 20°20’ N latitude and 0°25’ E to 73°44’ E.

It lies to the west of the Sahyadri hills in the northern part of the Konkan hills. The town is a plain level land. Vasai creek surrounds the city from east to west, followed by the Arabian Sea to the west. Onthe southwest lies the city of Mumbai, south is the Sanjay Gandhi national park and, on the south, eastlies thane city. Ghodbunder and Uttan are the hilly regions while the rest of the city is plain terrain mostly waterlogged and marshy.

- **Climate**

The city experiences a typical monsoon climate with three distinct seasons – summer, winter, and rainy, as elsewhere in India. The average temperature is 26°C and min 15°C, max 30°C the wind direction in the city is from the western side about 5 km/hr. The climate in the month of October is wet and hot followed by cool and pleasant weather from December to February and dry and hot weather from March to June. The climate of Mira-Bhaindar is typically coastal sultry and not hot. Thereare virtually two distinct seasons, namely monsoon and dry season. The latter covers both summer and winter.

Rainfall

The rainy season starts at the beginning of June and ends in the last week of September. Annualrainfall is around 3,670.4 mm. The maximum rainfall is in the month of July averaging 800 mm.

Humidity

The relative humidity in the atmosphere is about 45% to 85% with the highest humidity in the monthof July.

- **Demography**

The population of Mira-Bhaindar, according to the latest census 2011 is 8,09,378. The division ofpopulation as per sex ratio and literacy is given below.

Table 1-1: Demography Data of Mira Bhaindar Municipal Corporation

Mira Bhaindar City	**Total**	**Male**	**Female**
City Population	809378	429,260	380,118
Children (0-6)	88,015	46,375	41,640
Literates	656,293	356,434	299,859
Average literacy (%)	90.98	93.09	88.59
Sex Ratio		886	
Child Sex Ratio		898	

- **Land Use Pattern**

The area of Mira-Bhaindar Corporation is 79.40 sq. km. Only 26.88 % of the total municipal has beendeveloped and the remaining 73.12% consists of water bodies, marshy land and salt pans, forest, andhills, which cannot be developed. Out of the total developed area, 54.24% (14.58% of the total area) is under residential use. The area under commercial use is 2.5% of the developed area and 6.48% is under industrial use. Roads constitute 16.6% of the developed area.

The open space and recreational grounds are the lungs of the town and they cater active and passive recreation needs of the city. In Mira-Bhaindar gardens and open spaces provide recreational areas.Large varieties of trees are planted on the roadside, in open spaces, and gardens.

- **Ground Water:**

Groundwater is used for domestic purposes in residential as well as industrial areas. The groundwater level and quality are the primary concerns for the township of Mira-Bhaindar. Primarily sewage and various industrial effluents have contributed the maximum in polluting the groundwater.

- **Lakes and Ponds**

There are 3 major lakes in the city namely Murdha Ram Mandir lake, Uttan Moh lake, and Raani Ram Mandir lake. These lakes are facing issues of encroachment from all sides. Indiscriminate dumping ofmunicipal solid waste has led to the deterioration of the water quality of lakes. Further, the natural water streams are also obstructed due to human activities resulting in the drying of these lakes.

- **Coastal Waters: Creek**

Thane district, on the western side, is dominated by a coastline and associated coastal features such as creeks, small creek-lets, marshy land, etc. Mangrove plants along the coastline reduce the impactsof coastal flooding, and hence the mangrove population should be conserved. Solid waste disposal and the release of domestic and industrial wastewater in the creeks will have adverse impacts on the aquaticlife of these coastal areas.

- **Biodiversity Study**

Mira - Bhaindar is located adjacent to Sanjay Gandhi National Park thus high diversity of the species found in the region. Around 18% of the total municipal land is used as salt pans in the region, comprising 1390 hectares of land. Shallow man-made ponds were designed as salt pans to producesalt from seawater. The sea water is fed into large pans and water is drawn out through natural evaporation which allows the salt to be subsequently harvested.

The flora in the region mainly comprises the following:
Southern Tropical Moist Mixed Deciduous: The land vegetation is observed as the southern tropicalmoist deciduous forest. The major tree species found in this area are *Tectona grandis, Salmalia malbaricum, Terminalia alata, Madhuca indica, Mangifera indica*, etc. Bamboo is also spotted in smallpatches in this region.

Western Subtropical Hill Forest is represented by the species like *Terminalia chebula, Adina cordifolia, Syzygium cumini,* and *Mangifera indica* are the predominant species. Species like *Ficus hipsida, and Morinda citrifolia* are also present.

Estuarine Vegetation is found along the banks of Ulhas Creek flowing adjacent to the cities of Dombilivi and Thane, consisting of mangrove species such as *Avicennia officinalis, Avicennia marina,Aegiceras corniculatum, Exoecaria agallocha, Sonneratia apetala,* etc.

- **Municipal Solid Waste Management**

MBMC is responsible for the collection, treatment, and disposal of Municipal Solid Waste (MSW) generated within the municipal corporation. Approximately 500 MT of Municipal Solid Waste is generated every day within the boundaries of MBMC, which is collected and transported to the Integrated Solid Waste Management (ISWM) facility at Uttan, Mira Bhaindar. This treatment facility at Uttan receives a total of 500 MT of mixed waste daily. After processing in the front-end operations of the Materials Recovery Facility (MRF), it is assumed that about 80% of the waste is recovered. The rest 20%, i.e., the unrecoverable fraction of the waste is disposed on the landfill.

The project activities mainly scientifically involve MSW management at the Uttan treatment facility. Management activities might affect different environmental components during the operation period if not scientifically managed. Contamination of surface and subsurface water sources, the release of harmful landfill gases, the breeding of disease-spreading organisms, etc. are some of the consequences of unscientific management of a landfill.

Air Pollution

Central Pollution Control Board (CPCB) has specified standard limits for various pollutants. Emissions from vehicles, construction work, etc. are the main sources of air pollution as they emit sulphur dioxides, nitrogen dioxides, carbon monoxide, suspended particulate matter, etc.

Air pollution is the presence of one or more contaminants in the atmosphere in such quantity and forsuch duration, as is injurious, or tends to be injurious, to human health or welfare, animal or plant life. It is the contamination of air by the discharge of harmful substances. Air pollution can cause health problems and it can also damage the environment and property. It has caused thinning of theprotective ozone layer of the atmosphere, which is leading to climate change. Modernization and progress have led to air getting more and more polluted over the years. Industries, vehicles, increasein the population, and urbanization is some of the major factors responsible for air pollution.

Sources of Air Pollution

Air pollutants are primarily gaseous, liquid, or solid particles dispersed in the air and deteriorating their quality. The concentration of these pollutants in and near urban areas has raised serious concerns. The largest sources of human-created air pollution are energy generation, transportation,and industries that use plenty of energy sources. Depending on their source and interactions with other components of the air, they can have different chemical compositions and health impacts.Since these pollutants are generally concentrated in and around urban areas, outdoor urban pollution levels are far higher than in rural areas. Fires are another major source of air pollution and can lead to severe problems if the smoke is inhaled for some time. These fires can either be forest fires, oil well fires, burning of leaves in the backyard, or as in the case of rural areas, large-scale burning of agricultural waste. Other sources include industries and power plants located in these areas. The various types of sources are discussed below:

- **Point Sources:** Any single identifiable source of pollution from which pollutants are discharged, such as a pipe, ditch, ship or factory smokestack, power plants, dry cleaners, and degreasing operations.
- **Line Sources:** An air pollution line source is an idealized geometric emitter, which can be represented by an emission source consisting simply of a straight line, which may be of finite orinfinite length. The utility of this model is the ability to serve as a proxy for roadway, railway, or aircraft air pollution sources.
- **Area Sources:** Area sources are sources of pollution that emit a substance or radiation from a specified area. Area sources are mainly domestic sources of fuel (Coal, Wood, Kerosene, LPG) burning, trash/ MSW burning, bakeries, hotels/restaurants, markets, etc.

Air pollution can be formed through both natural and man-made processes. Some examples of theseare listed below:

- *Man-Made Sources:*
  - **Transport - Roads and Rails:** Vehicles like cars, vans, buses, and Lorries run on petrol or diesel.When these fuels are burnt in the engine, pollutants are released out through the exhaust ofthe vehicles. This means road traffic is one of the biggest sources of air pollution. Roads are sources of pollutants such as nitrogen oxides, sulphur dioxide, carbon monoxide, and particulate matter.
  - **Trains** cause a lot less pollution than the same journey made by car. However, trains still pollute the environment. Electric trains use the electricity which is generated at power stations. When these fuels are burnt, pollutants like nitrogen oxides, sulphur dioxide, and particulate matter are released into the atmosphere.
  - **Agriculture and Livestock:** Agricultural waste residues when disposed of unscientifically, undergo a certain amount of anaerobic decomposition which results in the release of methane gas. Animals like cows and sheep release a massive amount of methane through belching and breaking wind. Methane is produced in their stomachs when bacteria break down the food that they eat. Across the whole world, livestock is one of the biggest sources of methane. Methane is the second most important greenhouse gas which can cause climatechange.
  - **Industry:** Particulate matter (like dust, fly ash, etc.), nitrogen dioxide, and sulphur dioxide are the main pollutants associated with industrial processes
  - **Waste:** Methane from waste disposal is one of the largest emitters, with agriculture and livestock coming second. Methane is released into the atmosphere when the waste that we throw away decomposes. Methane is the second most important greenhouse gas after carbondioxide, which means that it also contributes to climate change. Burning of old or freshmunicipal solid waste also has the potential to release numerous toxic gases.
  - **Street sweeping:** Street sweeping causes resuspension of the already deposited dust particles, which increases particulate matter (PM2.5 and PM10) emissions in the vicinity and ultimately causes several health impacts.
- **Natural sources:** Air pollutants are released during catastrophes such as volcanic eruptions and forest fires. Large amounts of harmful gases and smoke are released which can increase background pollution levels for years - even in areas far away from the source. Ozone isone of the most common natural air pollutants.

Indoor air pollution

Indoor air pollution can be particularly hazardous to health as it is released near people. It is stated that a pollutant released indoors is many times more likely to reach the lung thanthat released outdoors. In developing countries, a fairly large portion of the population is dependent on biomass for their energy requirements. These include wood, charcoal, agricultural residue, and animal waste. Open fires used for cooking and heating are commonly found in the household both in rural and urban areas. The stove is often at floor level, adding to the risk of accidents and the hygiene factor. In addition, they are often not

fitted with a chimney to remove pollutants. In such households, the children and women are most likely to be affected, as they arethe group that spends more time indoors. The main pollutant in this environment is the SPM. Death due to indoor air pollution, mainly particulate matter, in the rural areas of India, is one of thehighest in the world. Many of the deaths are due to acute respiratory infections in children; others are due to cardiovascular diseases, lung cancer, and chronic respiratory diseases in adults. If emissions are high and ventilation is poor, household use of coal and biomass can severely affect indoor air quality.

Pollutant emissions per meal are also very high compared to those of other fuels. Household use of fossil fuels is also fairly common in developing countries, particularly coal. These are particularly damaging as they burn inefficiently and emit considerable quantities of air pollutants. If emissions are high and ventilation poor, then the exposure levels to the gases emitted are far higher. The mostharmful gases and agents that are emitted are particulate matter, carbon dioxide, polycyclic organic matter, and formaldehyde. The indoor concentrations of these pollutants are far higher thanacceptable levels and are cause for concern in rural areas.

Health Effects

Long-term exposure to polluted air can have permanent health effects such as Accelerated aging ofthe lungs. Loss of lung capacity and decreased lung function. Development of diseases such as asthma, bronchitis, emphysema, and possibly cancer. shortened life span

Even healthy people can experience health impacts from polluted air including respiratory irritation or breathing difficulties during exercise or outdoor activities. Your actual risk of adverse effects depends on your current health status, the pollutant type and concentration, and the length of yourexposure to the polluted air.

- High air pollution levels can cause immediate health problems including:
  - ✓ Aggravated cardiovascular and respiratory illness.
  - ✓ Added stress to the heart and lungs, which must work harder to supply the body withoxygen.
  - ✓ Damaged cells in the respiratory system.
  - ✓ Some of these gases can seriously and adversely affect the health of the population andshould be given due attention by the concerned authority. The gases mentioned beloware mainly outdoor air pollutants but some of them can and do occur indoors dependingon the source and the circumstances.
- Those most susceptible to severe health problems from air pollution are:
  - ✓ Individuals with heart disease, coronary artery disease, or congestive heart failure
  - ✓ Individuals with lung diseases such as asthma, emphysema, or chronic obstructivepulmonary disease (COPD)
  - ✓ Pregnant women

- ✓ Outdoor workers
- ✓ Older adults and the elderly
- ✓ Children under the age of 14
- ✓ Athletes who exercise vigorously outdoors
- ✓ People in these groups may experience health impacts at lower air pollution exposure levels, or their health effects may be of greater intensity.

❖ **Ground-level Ozone:** Ground-level ozone is formed when volatile organic compounds (VOCs) and oxides of nitrogen (NOx) react with the sun's ultraviolet rays. The primary source of VOCs and NOx is mobile sources, including cars, trucks, buses, construction equipment, and agricultural equipment. Ground-level ozone reaches its highest level during the afternoon and early eveninghours. High levels occur most often during the summer months. It is a strong irritant that can cause constriction of the airways, forcing the respiratory system to work harder to provide oxygen.

- ➢ It can also cause other health problems including:
  - ✓ Aggravated respiratory diseases such as emphysema, bronchitis, and asthma
  - ✓ Lung damage, even after symptoms such as coughing or a sore throat disappear
  - ✓ Wheezing, chest pain, dry throat, headache, or nausea
  - ✓ Reduced resistance to infections
  - ✓ Increased fatigue
  - ✓ Weakened athletic performance

❖ **Particulate Matter (PM) and Wildfire Smoke:** Particulate Matter is a complex mixture that maycontain soot, smoke, metals, nitrates, sulphates, dust, water, and tire rubber. It can be directly emitted, as in smoke from a fire, or it can form in the atmosphere from reactions of gasessuch as nitrogen oxides. The size of particles is directly linked to their potential for causing health problems. Small particles (known as PM2.5 or fine particulate matter) pose the greatest problems because they bypass the body's natural defences and can get deep into your lungs andpotentially your bloodstream. Exposure to such particles can affect both your lungs and your heart.

❖ **SPM (suspended particulate matter):** Suspended matter consists of dust, fumes, mist, and smoke. The main chemical component of SPM that is of major concern is lead, others being nickel, arsenic, and those present in diesel exhaust. These particles when breathed in, lodge in our lung tissues and cause lung damage and respiratory problems. The importance of SPM as a major pollutant needs special emphasis as - a) it affects more people globally than any other pollutant continuously is more monitoring data available on this than any otherpollutant, and c) more epidemiological evidence has been collected on the exposure to this thanto any other pollutant.

- ➢ Long-term exposure to particulate pollution can result in significant health problems including:

- ✓ Increased respiratory symptoms, such as irritation of the airways, coughing, or difficultybreathing
- ✓ Decreased lung function
- ✓ Aggravated asthma
- ✓ Development of chronic respiratory disease in children
- ✓ Development of chronic bronchitis or chronic obstructive lung disease
- ✓ Irregular heartbeat
- ✓ Nonfatal heart attacks
- ✓ Premature death in people with heart or lung disease, including death from lung cancer

➢ Short-term exposure to particulate pollution can:

- ✓ Aggravate lung disease causing asthma attacks and acute bronchitis
- ✓ Increase susceptibility to respiratory infections
- ✓ Cause heart attacks and arrhythmias in people with heart disease

➢ Even if you are healthy, you may experience temporary symptoms, such as:

- ✓ Irritation of the eyes, nose, and throat
- ✓ Coughing
- ✓ Chest tightness
- ✓ Shortness of breath

❖ **Respirable Suspended Particulate Matter:** Particulate matter is characterized according to size

- mainly because of the different health effects associated with particles of different diameters.Particulate matter (PM) is a complex mixture of tiny particles that consists of dry solid fragments, solid cores with liquid coatings, and small droplets of liquid. It includes aerosols, smoke, fumes, dust, ash, and pollen. These particles vary greatly in shape, size, and chemical composition, and can be made up of many different materials such as metals, soot, soil, and dust. Particles 10 microns or less in diameter are defined as" Respirable Suspended Particulate Matter". Respirableparticulates, lodge in the lung capillaries and alveoli, causing adverse health effects. The composition of particulate matter varies with place, season, and weather conditions.

❖ **Nitrogen oxides:** A nitrogen oxide, or NOx, is the generic term for a group of highly reactive gases, all of which contain nitrogen and oxygen in varying amounts. Many of the nitrogen oxidesare colorless and odorless. However, one common pollutant, nitrogen dioxide (NO_2) along with particles in the air can often be seen as a reddish-brown layer in many urban areas. Nitrogenoxides form when fuel is burned at high temperatures, as in a combustion process. The primarymanmade sources of NOx are motor vehicles, electric utilities, and other industrial, commercial,and residential sources that burn fuels.

NOx can also be formed naturally.

- **Sulphur dioxide:** Sulphur dioxide, or SO_2, belongs to the family of sulphur oxide gases (SOx). These gases dissolve easily in water. Sulphur is prevalent in all raw materials, including crude oil,coal, and ore that contain common metals like aluminum, copper, zinc, lead, and iron. SOx gases are formed when fuel containing sulfur, such as coal and oil, is burned, and when gas online is extracted from oil, or metals are extracted from the ore. SO_2 dissolves in water vapor to form acid and interacts with other gases and particles in the air to form sulfates and other products that can be harmful to people and their environment.

Ambient Air Quality Monitoring

Sampling Locations

Mira-Bhayandar air pollution monitoring is being done at various locations, which include solid waste disposal sites, and residential, commercial & industrial areas. Ambient Air Quality Monitoring (AAQM) sampling is carried out at twelve locations in a month and their details are as follows:

1. *Kashimira Chowk, Near Chhatrapati Shivaji Maharaj Statue*
2. Near Bhayandar Police Station
3. *Mira Road Railway station*
4. Bhayandar west, Railway Station
5. *S.K. stone Chowk*
6. Near Pali, St. Andrew Chowk
7. *Bhayandar East, Cabin Road*
8. Bhayandar East B.P. Road
9. *Bhayandar St. East Navghar Road*
10. Uttan naka Bus Stop chowk
11. *Kanakia Police station Mira Road*
12. Mira-Bhayandar corporation ghankachra vyavasthapan

Sampler

An instrument called a high-volume air sampler is used to collect total suspended particle (TSP) samples. The high-volume air sampler draws a large known volume of air through a pre-weighed filterfor 24 hours. As shown in the illustration, the sampler filter traps the TSP particles as air passes through the instrument. The filter is later weighed to estimate the particulate concentration.

Absorbing solutions in impingers, enclosed in gas kits are used to sample SO_x and NO_x from the air. The air passing through the filter paper is passed through the absorbing solution and later these solutions are analyzed to estimate the SO_x and NO_x concentrations.

Figure 2-1: Ambient Air Quality Monitoring using High Volume Sampler

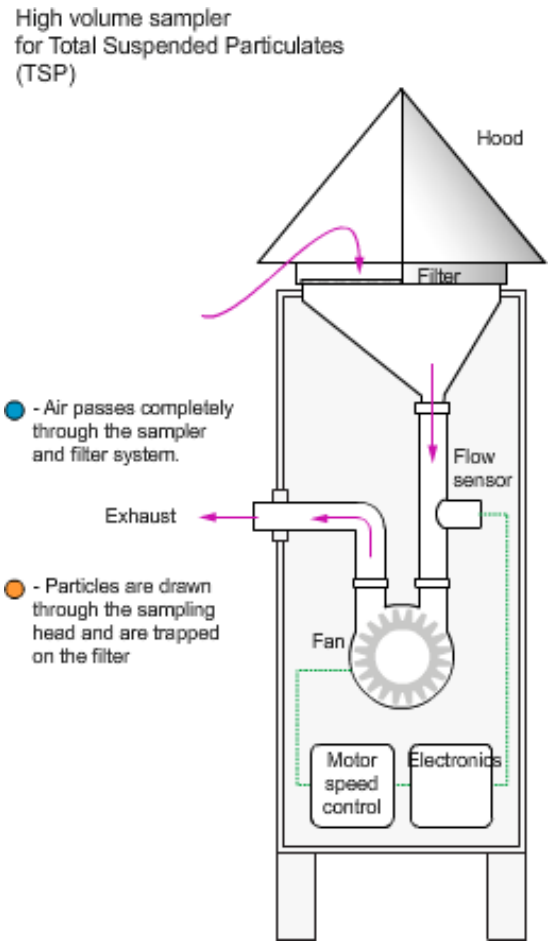
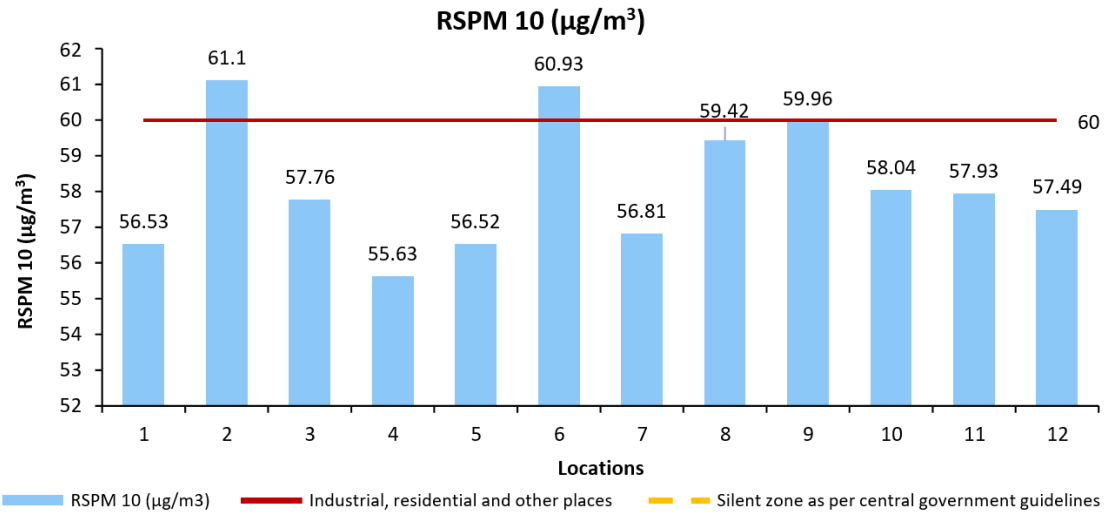


Figure 2-2: On-field ambient air quality monitoring

Results

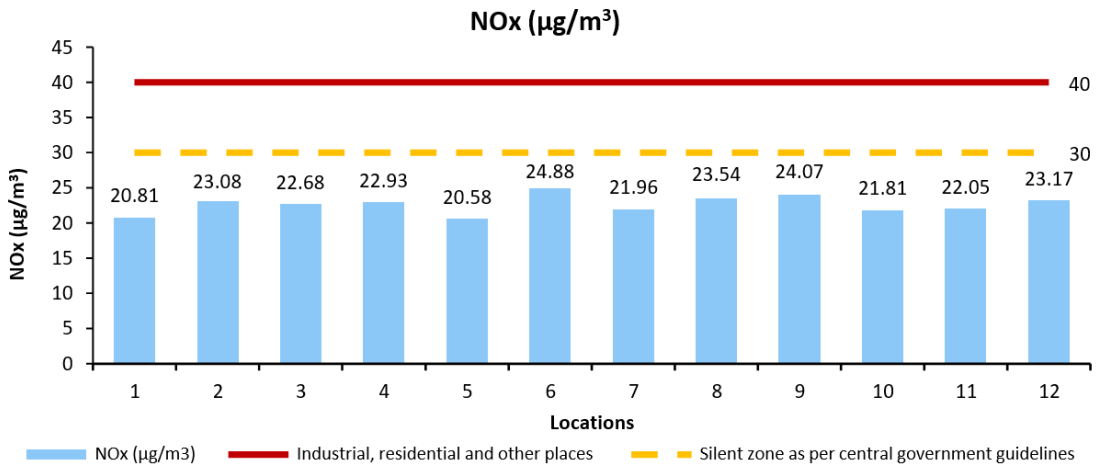
The analysis results of the ambient air quality monitoring are discussed below. The analysis has beenaveraged from an of period one year, which is, from July 2020 to June 2021. Respirable suspended particulate matter, NO_X and SO_2 have been monitored and analyzed.

Figure 2-3: Annual average concentration of RSPM in the ambient air at 12 monitoring locations



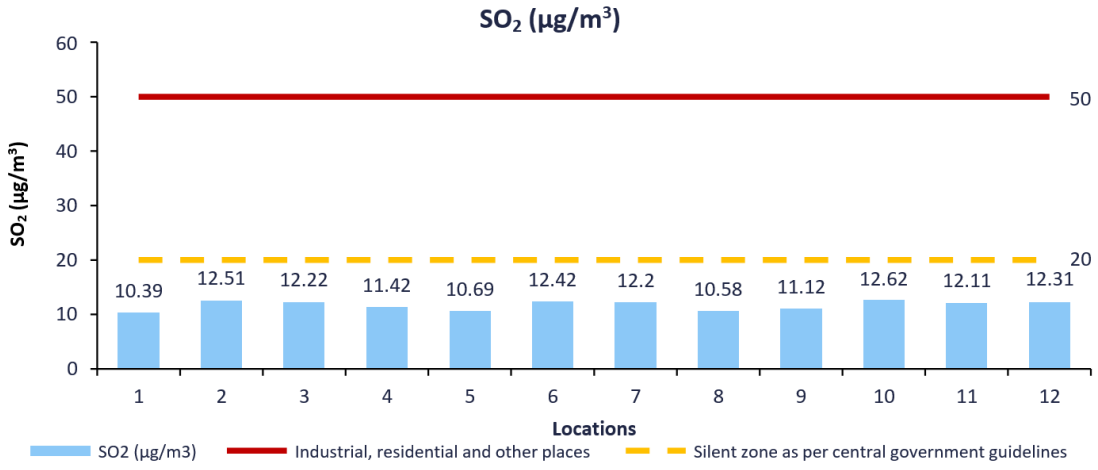
The graph above shows the variation of Respirable Suspended Particulate Matter (RSPM) at 12 different locations within Mira Bhaindar. The CPCB has suggested 60 µg/m^3 as the permissible limit forboth industrial and silenced zone. It was observed that the values of RSPM exceeded only at two locations whereas all the values were within the permissible standards as prescribed by CPCB.

Figure 2-4: Annual average concentration of NO_X in the ambient air at 12 monitoring locations



The above graph shows the variation of NOx at 12 different locations. The CPCB has suggested 40 µg/m^3 and 30 µg/m^3 as the permissible limit for industrial and silenced zone respectively. It was observedthat all the values observed fall within the standards given by CPCB.

Figure 2-5: Annual average concentration of SO_2in the ambient air at 12 monitoring locations



The above graph shows the variation of SO_2 at 12 different locations. The CPCB has suggested 50 µg/m^3 and 20 µg/m^3 as the permissible limit for industrial and silenced zone respectively. It was observedthat all the values observed fall within the standards given by CPCB.

All the air quality analysis observations (PM_{10}, SO_2, and NO_X) recorded were mostly within CPCB limits.However, RSPM is on the boundary of crossing the standard limit. Vehicular emission is a major source of air pollution. Efficient traffic management and tree plantation along the roadside can curb someof the air pollutions.

Action Plan for Control of Air Pollution in Mira Bhaindar

Table 3.1: Action Plan for the control of air pollution in Mira Bhaindar

Sl.No		Source group	Control option	Expected reduction and impacts	Technical feasibility	Requirement of financial resources	Implementation period(short/ mid/long-term)	Time target for implementation	Responsible agency(ies)	Any other information
1	(i)	Vehicle emission	Launch extensive drives against polluting vehicles for ensuring strict compliance	Awareness drives about CNG & Electrical Vehicles will be a benefit to impact reductionin pollution. As per GoI rules, 10 years old vehicles are to be monitored extensively through traffic patrolling and traffic police check posts. This will impact to focus on buying new vehicles in CNG or Electric and help to reduce pollution	Feasible	As per requirements	Mid term	12 - 18 months	RTO & Traffic Police	RTO can help to get the data from their portal
	(ii)		Launch public awareness campaigns for air pollution control, vehicle maintenance, minimising use of personal vehicles, lane discipline etc.	Awareness drives about CNG & Electrical Vehicles will be benefit to impact reduction in pollution. Awareness on use of cycle, public transport will benefit to reduce the traffic and reduce pollution. Regular cycle marathon will keep citizen engage in cycling and awareness about pollution. All these activities will impact the reduction of pollution and impact the environment steadily.	Feasible	25.00 lakhs	Mid term	Every month	MBMC	NA
	(iii)		Prevent parking of Vehiclesat non-designated areas	Reduction in traffic will impact in the reduction of pollution	Feasible	5.00 Cr	Mid term	12 - 18 months	MBMC	Smart parking best practiceimplement
	(iv)		Initiate steps for retrofitting of particulate filters in Diesel vehicles, when BS-VI fuels are available	Will significantly reduce the emissions on the city roads, this will directly impact in the reduction of pollution	Feasible		Long term	48 - 60 months	GoI, GoM	
	(v)		Prepare action plan to check fuel adulteration and random monitoring of fuel quality data	Will reduce the city pollution periodically	Feasible	As per requirements	Long term	12 - 18 months	RTO and GoI, GoM	Establishment of adulteration dedicated team and randomly checking through anti adulteration cell. This is a continuous process

Sl.No		Source group	Control option	Expected reduction and impacts	Technical feasibility	Requirement of financial resources	Implementation period(short/ mid/long-term)	Time target for implementation	Responsible agency(ies)	Any other information
	(vi)		Prepare action plan for widening of road and improvement of Infrastructure for decongestion of roads.	Help to traffic jam, also help to implementparking policies and this will impact reduction of pollution	Feasible	8.00 Cr	Short term	12 - 18 months	MBMC	
	(vii)		Prepare Plan for the construction of expressways/ bypass to avoid congestion	NA	NA	125.00 Cr	Long term	NA	NA	This is not applicable as western express way is already passing through city and no other pace to divert that because of Sanjay Gandhi National Park / Forest on other side.
	(viii)		Steps for promoting battery operated vehicles	Will reduce the city pollution periodically	Feasible	10 cr	Mid term	12 - 24 months	MBMC, RTO	Will promote and implement electricor battery inbuild cycle for citizen for to and from inside the city
	(ix)		Install weigh in motion bridges at the borders of thecities/ towns and states to prevent overloading of vehicles	Will reduce the city pollution periodically	Feasible	Rs 12 Lakhs	Mid term	12 - 18 months	MBMC, RTO	Will consult with RTO for installation of weighing check post
	(x)		Synchronize traffic movements/ introduce intelligent traffic systems for lane driving	Help to traffic jam, also help to implementparking policies and this will impact reduction of pollution	Feasible	Rs 75 lakhs	Mid term	12 - 18 months	MBMC, RTO, Traffic Police	
	(xi)		Installation of Remote Sensor based PUC systems	NA	NA	NA	NA	NA	RTO	This is very helpful system to understand the polluted vehicles andcan do data analysis.

Sl.No		Source group	Control option	Expected reduction and impacts	Technical feasibility	Requirement of financial resources	Implementation period(short/ mid/long-term)	Time target for implementation	Responsible agency(ies)	Any other information
	SCS-1		Sulphur reduction in diesel	Will reduce the city pollution periodically	Feasible		Long term	48 - 60 months	GoI, GoM	
	SCS-2		Introduction of new technology vehicles	Will reduce the city pollution periodically	Feasible		Long term	60 - 90 months	GoI	New technology vehicles will definitely reduce the pollution but this will take time to implement as many of the citizen are having old vehicles which very tough to replace at present
	SCS-3		Provide good public transport system	Help to prevent traffic jam and reduce the air pollution	Feasible		Mid term	12 - 18 months	MBMC	MBMC having already two local railway station which majorly helped to reduce the pollution
	SCS-4		Standards for new and In-use vehicles	Will significantly reduce the emissions on the city roads, this will directly impact reduce pollution	Feasible		Long term	48 - 60 months	GoI	
	SCS-5		Alternative fuels	Will significantly reduce the emissions on the city roads, this will directly impact reduce pollution	Feasible		Long term	48 - 60 months	GoI	Alternative fuels is the need of future India
	SCS-6		Implementation of BS – VI horms	Will significantly reduce the emissions on the city roads, this will directly impact reduce pollution	Feasible		Long term	24 - 36 months	GoI, GoM	MBMC has purchased all BSVI waste carrying vehicles from GeM portal. The delivery is expected in few months. Work order is already given to L1 bidder.

Sl.No		Source group	Control option	Expected reduction and impacts	Technical feasibility	Requirement of financial resources	Implementation period(short/ mid/long-term)	Time target for implementation	Responsible agency(ies)	Any other information
	SCS-7		Electric/ hybrid vehicles	Will significantly reduce the emissions onthe city roads, this will directly impact reduce pollution	Feasible	50.00 Cr	Long term	48 - 60 months	GoI, GoM, MBMC	Need to arrange awareness activities across the city and Procurement of Electric Buses for public transport is in discussion
	SCS-8		OE-CNG for new public transport buses	Will significantly reduce the emissions onthe city roads, this will directly impact reduce pollution	Feasible	50.00 Cr	Long term	48 - 60 months	MBMC	Procurement of CNG public transportbuses is in discussion
	SCS-9		Ethanol blending (E10 – 10%blend)	Will significantly reduce the emissions onthe city roads, this will directly impact reduce pollution	Feasible		Long term	48 - 60 months	GoI	
	SCS-10		Bio-diesel (B5/B10: 5 – 10% blend)	Will significantly reduce the emissions onthe city roads, this will directly impact reduce pollution	Feasible		Long term	48 - 60 months	GoI	
	SCS-11		Retro-fitment of Diesel Oxidation Catalyst (DOC) in 4-wheeler public transport (BS–II and BS-III)	Will significantly reduce the emissions onthe city roads, this will directly impact reduce pollution	Feasible		Long term	48 - 60 months	GoI	
	SCS-12		Retro-fitment of Diesel Particulate Filter in 4-wheeler public transport(BS – III city buses)	Will significantly reduce the emissions onthe city roads, this will directly impact reduce pollution	Feasible		Long term	48 - 60 months	GoI	
	SCS-13		Banning of 10-year-old commercial vehicles	Will significantly reduce the emissions on the city roads, this will directly impactreduce pollution	Feasible		Mid term	24 -48 months	GoI, RTO	Need to check the fitness of such vehicles and ban on those vehicles toreduce emission
	SCS-14		Inspection/ maintenance toall BSII & BSIII commercial Vehicles	Will significantly reduce the emissions onthe city roads, this will directly impact reduce pollution	Feasible		Mid term	24 - 48 months	GoM, RTO	

Sl.No		Source group	Control option	Expected reduction and impacts	Technical feasibility	Requirement of financial resources	Implementation period(short/ mid/long-term)	Time target for implementation	Responsible agency(ies)	Any other information
	SCS-15		Restrict commercial vehiclesentering city by having ring roads	Will reduce the traffic which lead reducethe air pollution	Feasible	same as point no.1 (Vii)	Mid term	12 - 24 months	RTO	MBMC is having western express highway which is passing through city. This is very difficult to divert because of less space and national park / forest on other side.
2	(i)	Resuspension	Prepare plan for creation ofgreen buffers along the Traffic corridors	This will directly impact the reduction of air pollution in the city.	Feasible	10.Cr	Short term	12 - 24 months	MBMC	MBMC has already planted many trees along the side road inside the city. MBMC is also planning to plantation in many residential area'sroad under the Majhi Vasundhara Abhiyan
	(ii)		Maintain pothole free roadsfor free flow traffic	Will reduce the traffic which lead reducethe air pollution and also help people to park vehicle in dedicated areas	Feasible	50.Cr	Long Term	12 - 24 months	MBMC	Maintenance of pothole free road is in progress. Many works have been done under Swachh Bharat Mission and Majhi Vasundhara Abhiyan. PwD, MBMC is also monitoring free pothole roads in the city.

Sl.No		Source group	Control option	Expected reduction and impacts	Technical feasibility	Requirement of financial resources	Implementation period(short/ mid/long-term)	Time target for implementation	Responsible agency(ies)	Any other information
	(iii)		Introduce water fountains atmajor traffic intersection, wherever feasible	This will directly impact the reduction of air pollution in the city.	Feasible	1.00 Cr	Mid term	12 - 24 months	MBMC	Newly construction and repairing of old water fountains is in the progress.MBMC is using treated waste water generated from STP for this water fountains which will help to reuse of treated water
	(iv)		Greening of open areas, garden, community places, schools and housing societies	This will directly impact the reduction of air pollution in the city.	Feasible	50.00 Cr	Mid term	12 - 24 months	MBMC	Greening of many areas are been already done in many wards of MBMC. Under the Majhi Vasundhara,MBMC is planning to implement 10 green zone areas to reduce the city pollutions
	(v)		Blacktopping of metaled Roads including pavement of Road shoulders	This will reduce the city pollution	Feasible	10.00 Cr	Long term	12 - 24 months	MBMC	
	SCS-1		Wall to wall paving (brick)	This will reduce the city pollution	Feasible	Rs. 100 / sq. ft.	Long term	12 - 24 months	MBMC	
	SCS-2		Road design improvement	This will reduce the city pollution	Feasible	As per requirements	Long term	12 - 24 months	MBMC	

Sl.No		Source group	Control option	Expected reduction and impacts	Technical feasibility	Requirement of financial resources	Implementation period(short/ mid/long-term)	Time target for implementation	Responsible agency(ies)	Any other information
3	(i)	Biomass/ trash burning, landfill waste burning	Launch extensive drive against open burning ofbiomass, crop residue, garbage, leaves etc.	Awareness activity will help to educate citizen of Mira Bhayandar. And this will helpto reduce the city pollution	Feasible	5.00 Cr	Mid term	12 - 24 months	MBMC	MBMC is already imposing fines on open burning of waste in many areas as per guidelines of MPCB.
	(ii)		Regular check and control, of burning of MunicipalSolid waste	This will reduce the emission of methane	Feasible	As per requirement	Mid term	12 - 18 months	MBMC	MBMC is already imposing fines on open burning of waste in many areas as per guidelines of MPCB.
	(iii)		Proper collection of Horticulture waste and itsdisposal following composting –cum – gardening approach	This will reduce the air emission	Feasible		Short term	12 - 18 months	MBMC	Installed bio composting bed in gardens of all 24 wards
	(iv)		Ensure ban on burning of agricultural waste and cropresidues and its Implementation	NA	NA	NA	NA	NA	NA	No agriculture waste
	SCS-1		Strict compliance of ban onopen burning	This will reduce the air emission	Feasible		Short term	12 - 18 months	MBMC	MBMC is already imposing fines on open burning of waste in many areas as per guidelines of MPCB.

Sl.No		Source group	Control option	Expected reduction and impacts	Technical feasibility	Requirement of financial resources	Implementation period(short/ mid/long-term)	Time target for implementation	Responsible agency(ies)	Any other information
4	(i)	Industry	Identification of brick kiln and their regular monitoring including use of designated fuel and closure of unauthorized units	This will reduce the air emissions	Feasible	MPCB to undertake	Short term	12 - 24 months	MBMC, MPCB	
	(ii)		Conversion of natural draft brick kilns to induced draft	This will significantly reduce the air emission	Feasible		Long term	36 - 48 months	MBMC, MPCB	
	(iii)		Action against non-complying industrial units	This will significantly reduce the air emission	Feasible	MPCB to undertake	Short term	12 - 24 months	MPCB	
	SCS-1		Sulphur reduction in fuel	This will significantly reduce the SO2emission			Short term	12 - 18 months	MPCB	
	SCS-2		Improved Combustion technology	This will significantly reduce the air emission			Short term	12 - 18 months	GoM	
	SCS-3		Alternate fuel	This will significantly reduce the air emission	Feasible	As per requirement	Short term	12 - 18 months	GoM	Alternate fuel such as solar panel on industries
	SCS-4		Promoting cleaner industries	This will significantly reduce the emission	Feasible		Short term	12 - 18 months	MBMC	
	SCS-5		Location specific emission reduction	This will significantly reduce the emission	Feasible		Short term	12 - 18 months	MBMC	Will asked 3rd party to audit on this
	SCS-6		Fugitive emission control	This will significantly reduce the emission	Feasible		Short term	12 - 18 months	MBMC	
	SCS-7		Banning of new industries inexisting city limit	This will significantly reduce the emission	Feasible	MPCB to undertake	Short term	12 - 18 months	MBMC, MPCB	MBMC already monitor such activity
	SCS-8		Source wise cause analysis of Air pollution	This will generate the data which help tomonitor and control air pollution	Feasible	2.50Cr	Mid term	15 - 18 months	MBMC	MBMC is in discussion to implement air pollution control system at various location in city
	SCS-9		Use of high-grade coal	This will significantly reduce the emission	Feasible		Short term	12 - 18 months	GoM	

Sl.No		Source group	Control option	Expected reduction and impacts	Technical feasibility	Requirement of financial resources	Implementation period(short/ mid/long-term)	Time target for implementation	Responsible agency(ies)	Any other information
	SCS-10		Regular audit of stack emissions for QA/QC	This will significantly reduce the emission	Feasible	Rs. 10 - 20 lac per industry	Short term	12 - 18 months	MBMC, MPCB	
5	(i)	Construction and Demolition Activities	Enforcement of construction & demolition rules	This will significantly reduce the emission	Feasible	5.00 Cr	Short term	12 - 18 months	MBMC	Already having public notification on the same, 5000 is the penalty amount
	(ii)		Control measures for fugitive emissions from material handling, conveying and screening operations through water sprinkling, curtains, barriers and suppression units	This will significantly reduce the emission	Feasible		Short term	12 - 18 months	MBMC	MPCB HQ issued direction on 12/03/2018 for implementation and compliance of Construction and Demolition Waste Management Rules 2016.
	SCS-1		Better construction practices with PM reductionof 50%	This will significantly reduce the emission	Feasible		Short term	12 - 18 months	MBMC	
	(iii)		Action against non-complying industrial units0=	This will significantly reduce the air emission	Feasible	MPCB to undertake	Short term	12 - 24 months	MPCB	
	SCS-1		Sulphur reduction in fuel	This will significantly reduce the SO2emission			Short term	12 - 18 months	MPCB	
	SCS-2		Improved Combustion technology	This will significantly reduce the air emission			Short term	12 - 18 months	GoM	
	SCS-3		Alternate fuel	This will significantly reduce the air emission	Feasible	As per requirement	Short term	12 - 18 months	GoM	Alternate fuel such as solar panel on industries
	SCS-4		Promoting cleaner industries	This will significantly reduce the emission	Feasible		Short term	12 - 18 months	MBMC	

Sl.No		Source group	Control option	Expected reduction and impacts	Technical feasibility	Requirement of financial resources	Implementation period(short/ mid/long-term)	Time target for implementation	Responsible agency(ies)	Any other information
	SCS-5		Location specific emission reduction	This will significantly reduce the emission	Feasible		Short term	12 - 18 months	MBMC	Will asked 3rd party to audit on this
	SCS-6		Fugitive emission control	This will significantly reduce the emission	Feasible		Short term	12 - 18 months	MBMC	
	SCS-7		Banning of new industries in existing city limit	This will significantly reduce the emission	Feasible	MPCB to undertake	Short term	12 - 18 months	MBMC, MPCB	MBMC already monitor such activity
	SCS-8		Source wise cause analysis of Air pollution	This will generate the data which help tomonitor and control air pollution	Feasible	2.50Cr	Mid term	15 - 18 months	MBMC	MBMC is in discussion to implement air pollution control system at various location in city
	SCS-9		Use of high-grade coal	This will significantly reduce the emission	Feasible		Short term	12 - 18 months	GoM	
	SCS-10		Regular audit of stack emissions for QA/QC	This will significantly reduce the emission	Feasible	Rs. 10 - 20 lac per industry	Short term	12 - 18 months	MBMC, MPCB	
5	(i)	Construction and Demolition Activities	Enforcement of construction & demolition rules	This will significantly reduce the emission	Feasible	5.00 Cr	Short term	12 - 18 months	MBMC	Already having public notification on the same, 5000 is the penalty amount
	(ii)		Control measures for fugitive emissions from material handling, conveying and screening operations through water sprinkling, curtains, barriers and suppression units	This will significantly reduce the emission	Feasible		Short term	12 - 18 months	MBMC	MPCB HQ issued direction on 12/03/2018 for implementation and compliance of Construction and Demolition Waste Management Rules 2016.
	SCS-1		Better construction practices with PM reductionof 50%	This will significantly reduce the emission	Feasible		Short term	12 - 18 months	MBMC	

Sl.No		Source group	Control option	Expected reduction and impacts	Technical feasibility	Requirement of financial resources	Implementation period(short/ mid/long-term)	Time target for implementation	Responsible agency(ies)	Any other information
	SCS-2		Banning of operation of brick kilns in city area	This will significantly reduce the emission	Feasible		Short term	12 - 18 months	MBMC	
	SCS-3		Ensure carriage of construction material in closed /covered Vessels	This will significantly reduce the emission	Feasible		Short term	12 - 18 months	MBMC, RTO	MPCB HQ issued direction on 12/03/2018 for implementation and compliance of Construction and Demolition Waste Management Rules 2016.
6	SCS-1	Domestic fuelburning	Shift to LPG from solid fuel &kerosene for domestic applications	This will significantly reduce the emission	Feasible	Ujjawala scheme (Rs. 500/ cyl. refilling)	Short term	12 - 18 months	GoM	
	SCS-2		Better cook-stove designs	This will significantly reduce the emission	Feasible	Rs. 2000/stove for residential only	Short term	12 - 18 months	GoM	
7	SCS-1	Mining	Effort for good mining practices	NA	NA	NA	NA	NA	NA	NA
	SCS-2		Greenbelt for activity zone and the buffer zone for each mining area	NA	NA	NA	NA	NA	NA	NA
	SCS-3		Maintenance of mine area roads	NA	NA	NA	NA	NA	NA	NA

Sl.No		Source group	Control option	Expected reduction and impacts	Technical feasibility	Requirement of financial resources	Implementation period(short/ mid/long-term)	Time target for implementation	Responsible agency(ies)	Any other information
8	(i)	DG sets	Monitoring of DG sets and action against violations	This will significantly reduce the emission	Feasible	Rs. 5 Lacs	Short term	12 - 18 months	MBMC, MPCB	Need to identify DG set and monitor the same. Also need to engaged 3rd party to audit and check
	SCS-1		Reduction in DG set operation/ Un-interrupted power supply	This will significantly reduce the emission	Feasible	15 KVA (NG based)-3.7 lakhs, 100 KVA (NG based)- 14 lakhs	Short term	12 - 18 months	GoM	
9	SCS-1	Bakeries/ crematoria	Use of LPG in Hotels and “dhabas”	This will significantly reduce the emission	Feasible	Cyl. (commercial) cost per unit-Rs. 1000 approx.	Short term	12 - 18 months	MBMC	Need to monitor hotels and dhabas and issue notice regarding the same
10	(i)	Others	Installation of solar panels on all government buildings and commercial centers	This will significantly reduce the dependence on electricity produced fromfossil fuels and reduce the associated air pollution	Feasible	As per requirement	Mid term	12 – 18 months	MBMC, GoM	
	(ii)		Electric vehicle charging station	This will encourage the citizens to adopt EVs over the conventional fossil fuel burningvehicles	Feasible	2 charging station of Rs 15 lacs each	Mid term	12-18 months	MBMC	
	(iii)		Source wise cause analysis will be carried out: • Air profiling of the city • Hotspot identification of the city • Source apportionment of the corporation area • Emission inventory – IT based • Long-term Mitigation Plan	This will provide a long-term mitigation plan and action plan for improvement in air quality.	Feasible	Rs. 2.5 Cr	Long term	12 – 15 months	MBMC	