

Review of air quality in Pune city

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ABSTRACT

Air Pollution is the condition in which air is contaminated by foreign substances, or the substances themselves. Air pollution consists of gaseous, liquid, or solid substances that, when present in sufficient concentration, for a sufficient time, and under certain conditions, tend to interfere with human comfort, health or welfare, and cause environmental damage. The most widespread pollutants include carbon monoxide, volatile organic compounds (VOCS), ozone, nitrogen dioxide (NO_x), sulfur dioxide (SO₂) and fine and coarse particles. These substances are used as indicators of air quality in cities. Air pollution causes a number of health problems that include respiratory diseases such as asthma and bronchitis, or increase the risk of respiratory problems. According to a study by Environment Status Report (ESR) in July 2010, air pollution in Pune has become a serious problem. The respiratory suspended particulate matter (PM₁₀) in the air is more than the standard national level. About 93,000 commercial properties which include hotels, malls and hospitals emit 204 tons PM₁₀ every year. The major cause of pollution in Pune is transport. Its emission has increased by 12.15% in the past three years. At present there are 31 National Ambient Air Quality Monitoring Stations (NAQMS) in Maharashtra. In Pune there are four which include Pimpri- Chinchwad, Bhosari, Nal Stop, Karve Road and Swargat. There is measurement of SO₂, NO_x and RSPM daily.

Keywords: Air pollution, asthma, bronchitis, VOCS, NO_x, SO₂, PM₁₀, NAQMS, Pune.

I. INTRODUCTION

Air pollution is defined as the introduction of particulates, biological molecules, and many harmful substances into Earth's atmosphere, causing diseases, allergies, death to humans, damage to other living organisms such as animals and food crops, or the natural or built environment. Any substance which causes air pollution is called air pollutant. An air pollutant is a substance in the air that can have adverse effects on humans and the ecosystem. It can be solid particles, liquid droplets, or gases. A pollutant can be of natural origin or man-made.

According to the recent study held by WHO in 2016, about 34 Indian cities figured in the list of the 100 most polluted ones, and 22 Indian cities found their names among the top 50 most polluted cities in the world. A research conducted by the World Health Organization revealed that around 2.4 million people die every year because of air pollution. Every year, air pollution causes 527,700 fatalities in India.^[1] In 2012, air pollution was linked with 1 out of every 8 deaths, globally – or around

7 million people. Around 600,000 of those were children under 5 years old, globally. Almost one million children die from pneumonia each year, more than half of which are directly related to air pollution.^[2]

Pune city is located at 559 mtrs from the mean sea level. It is located between 18.32° North and 73.51° east. Pune city is located in the Deccan Plateau and is about 100 kms east from Konkani coast and at a distance of about 160 kms from Mumbai. It is located at the confluence of Mula-Mutha River. Out of the total area, 38.6% is residential area, 1.8% is commercial area, 9.5% is defense area, 11% is Industrial area, 9.7% is recreational area etc. The temperature of city ranges between Minimum 12°C & Maximum 37°C. The average rainfall recorded is 600 to 700 mm. The maximum rainfall is observed in June to September months.^[3]

The Indian Institute of Topical Meteorology (IITM) has revealed that Pune's pollution level is over twice that of the prescribed national air quality standards. There are many reasons why pollution levels in the city is double the national standards as shown by the IITM. Vehicular

emission is one of the reasons, but the city also has a number of industrial pockets. There is a chemical industry zone in Sinhagad area along with other chemical factories in and around the city. So many industries are spread across Pune, which cannot be relocated. It is a known fact that Pune's public transport is not up to the mark and adds to it the traffic chaos and mismanagement on the city roads. The carbon rating is going to increase due to all these issues of vehicular emission.

II. Measurement of Air Pollution

Air Quality Index

Air Quality Index is a tool for effective communication of air quality status to people in terms, which are easy to understand. It transforms complex air quality data of various pollutants into a single number (index value), nomenclature and colour.

There are six AQI categories, namely Good, Satisfactory, Moderately polluted, Poor, Very Poor, and Severe. The proposed AQI will consider eight pollutants (PM₁₀, PM_{2.5}, NO₂, SO₂, CO, O₃, NH₃, and Pb) for which short-term (up to 24-hourly averaging period) National Ambient Air Quality Standards are prescribed.^[10]

An **air quality index** (AQI) is a number used by government agencies to communicate to the public how polluted the air currently is or how polluted it is forecast to become. As the AQI increases, an increasingly large percentage of the population is likely to experience increasingly severe adverse health effects. Different countries have their own air quality indices, corresponding to different national air quality standards.

The Minister for Environment, Forests & Climate Change Shri Prakash Javadekar launched The National Air Quality Index (AQI) in New Delhi on 17 September 2014 under the Swachh Bharat Abhiyan. It is outlined as 'One Number- One Colour-One Description' for the common man to judge the air quality within his vicinity. Here is a table which includes values for SO₂, NO_x, PM₁₀ and PM_{2.5}.

Pollutant µg/m ³	Time weighted Average 24 hours	Concentration in Ambient Air	
		Industrial, Residential, Rural and Other Areas	Ecologically Sensitive Area (notified by Central Government)
Sulphur Dioxide (SO ₂), µg/m ³	Annual	50- 80	20 -80
Nitrogen Dioxide (NO ₂), µg/m ³	Annual	40- 80	30- 80
Particulate Matter (size less than 10 µm) or PM ₁₀ µg/m ³	Annual	60 -100	60- 100
Particulate Matter (size less than 2.5 µm) or PM _{2.5} µg/m ³	Annual	40 -60	40 -60

Table 1. National Ambient Air Quality Standards

Source – Gazette of India 18Nov. 2009

Air Quality Index and health impacts.

The AQI values and corresponding ambient concentrations (health breakpoints) as well as associated likely health impacts for the identified eight pollutants are as follows.

0 - 50	Good	Air quality is considered satisfactory, and air pollution poses little or no risk
51 - 100	Moderate	Air quality is acceptable; however, for some pollutants there may be a moderate health concern for a very small number of people who are unusually sensitive to air pollution.
101- 150	Unhealthy for Sensitive Groups	Members of sensitive groups may experience health effects. The general public is not likely to be affected.
151- 200	Unhealthy	Everyone may begin to experience health effects; members of sensitive groups may experience more serious health effects
201-	Very	Health warnings of emergency

300	Unhealthy	conditions. The entire population is more likely to be affected.
300+	Hazardous	Health alert: everyone may experience more serious health effects

Source " Central Pollution Control Board ".
Retrieved 2 Jan. 2017.

Average emission of SO₂, NO_x and R.S.P.M. in Pune (Karve Road)

Here is a data of SO₂, NO_x and RSPM measured at Karve Road station. It shows pollution level change for the years 2012,2013,2014,2015 and 2016.

Year	SO ₂ (µg/m ³)	NO _x (µg/m ³)	RSPM (µg/m ³)
	Average	Average	Average
2012	19.09	45.05	64.48
2013	9.86	85.03	97.6
2014	14.85	NA	111
2015	34.35	65.13	146.48
2016	15.76	87.6	151.24
2017	28.15	48.89	

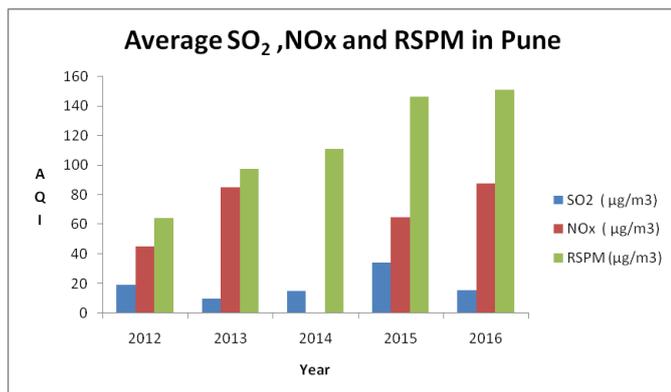


Figure 3. Average emission of SO₂, NO_x and R.S.P.M. in Pune (Karve Road)

(Source- <http://mpcb.gov.in/envtdata/demoPage1.php>)
The measurement of SO_x, NO_x and RSPM in the five places recorded in October 2017 is given below.

Name of the Station	SO _x	NO _x	RSPM
Karve Road	27.14	48.78	76.07
Nal Stop	15	59.18	126
Swargate	21	61.22	93.56
Bhosari	17.33	53.22	100.78
Pimpri Chinchwad	16.15	54.04	104.46

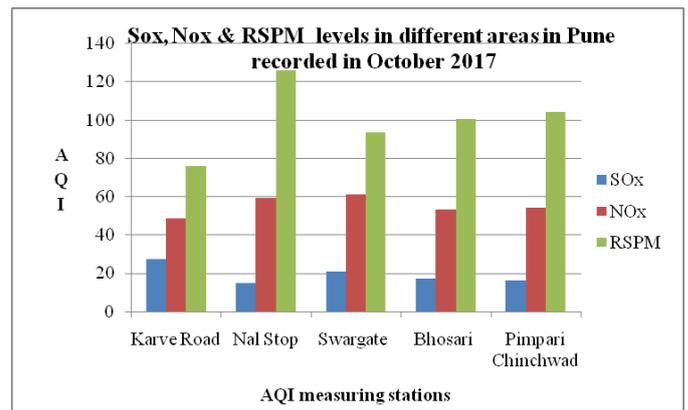


Figure 4. SO_x, NO_x and RSPM levels recorded in October 2017

(Source - <http://mpcb.gov.in/envtdata/demoPage1.php>)

III. Conclusion

It can be seen that SO₂ levels in the city are lower and NO_x levels are much higher. They are really worry some. The main and serious concern is the respirable suspended particulate matter (RSPM).They are nearly twice the normal range. It is mainly affecting the health of residents in Pune.

The main cause of pollution in Pune is the vehicular emission. Pune has highest number of vehicles in the country. The air quality is fast deteriorating because of bad public transport. The only solution to the issue is that we need more efficient public transport, so that it discourages citizens to use private vehicles. Increasing the green cover in the city will not reduce particle pollution. We have to reduce vehicular emission, which is the biggest source of pollution in the cities. The industries have been reducing pollution because it is related to their profit margin. The more energy efficient they are all the more they will save. It is mainly the sheer number of vehicles on the city roads that is adding to the pollution. If our public transport is streamlined it will obviously discourage citizens from using private vehicles. By having a good metro rail and public bus network, the citizens will not only save time and money but also contribute to curbing pollution in the city.

The amount of RSPM is highest at Nal- Stop. this is due to huge number of vehicles on the road and less efficient public transportation. Bhosari and Pimpri Chinchwad areas is due to particulate emission from industrial processes in nearby MIDC. The higher RSPM at Swargate is due to the same reason as Nal-Stop.

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