



# Air Pollution Bulletin

## March, 2017

**For more information, contact**  
**Ankita Jyoti**  
**[Ankita@ceedindia.org](mailto:Ankita@ceedindia.org)**

## Highlights

1. *The 24-hour average concentration of particulate matter (PM<sub>2.5</sub>) in Patna exceeded the national standard, and on instances were 9 times higher the national prescribed limits.*
2. *542µg/m<sup>3</sup> is the maximum concentration of particulate matter (PM<sub>2.5</sub>) observed at Patna on November 5th ,2016 while the lowest concentration was noted on 28th January 2017, with figure noted as low as 63.1µg/m<sup>3</sup> .*
3. *Monthly mean concentration of particulate matter (PM<sub>2.5</sub>) was recorded to be highest in the month of December (263 µg/m<sup>3</sup>) followed by November (253 µg/m<sup>3</sup>).*
4. *Not a single day was found under 'Good' to 'Satisfactory' category during the study period in Patna. The maximum number of days ie. **56% of the total monitored days** during November to January have been observed under the 'Very Poor' category.*
5. *The rest of the total monitored days, **6%, 21% and 17%** were noted under 'Moderate', 'Poor' and 'Severe' category respectively.*
6. *The calculated monthly mean concentration of particulate matter in Patna was found to be higher than the concentration witnessed in Delhi by 10% to 20% in the period between December to February.*
7. *As an immediate response to the state of ambient air quality in Patna, the government must must formulate clean air action plan with each action plan in a time bound manner.*
8. *Government must inform residents about the air quality and should also issue health advisory for people.*
9. *Vehicular emissions must be given special attention. The pollution check should be strengthened.*

## Background

The concentration of particulate matter especially during the winter months became an issue all across the country, with vast area of the Indo-Gangetic plain becoming the worst victim. Bihar is the most affected area in the plain; its capital city, Patna, maintains the position of the most polluted city since the last three years[1].

Patna, like many other cities of Indo-Gangetic Plain, witnesses high level of air pollution during winter months because of the combined impacts of seasonal increase in biomass burning for heating purposes and the phenomenon of thermal inversion. During thermal inversion, a layer of warmer air caps a stable layer of cooler air. The condition is often associated with light or calm

winds, resulting in stagnation of the air mass. As the condition sets in, the fine particulate matter is trapped in the air, the exposure level increases, and potentially results in serious health problems. Therefore, due to the significantly higher levels of air pollutants, the health impacts of pollution is more pronounced in winters as compared to summer.

The purpose of this report is to summarize the ambient air quality of Patna during the winter months (November to February) for the year 2016-2017, and also to investigate the level of exposure of air pollution. Further, the report assesses and presents a trend in air quality that might reflect winter use policy. This air pollution bulletin also presents a comparative picture of ambient air quality existing in the two most polluted cities of the world, Delhi and Patna. The data from Central Pollution Control Board (CPCB) monitoring stations was used and were further analyzed using varied statistical tools and technique. The period undertaken for study is November to February.

Ambient air quality data trends for Patna are presented using line graphs and bar graphs.

## Findings

### **I. Trend of monthly mean concentration of particulate matter (PM<sub>2.5</sub>) in Patna during winter months**

The particulate matter is continuously monitored at Continuous Air Quality Monitoring device installed at the Planetarium in Patna. The monitoring site is located in close proximity to traffic intersection and also near to the major commercial centre of Patna. Some residential houses are also nearby the monitoring station.

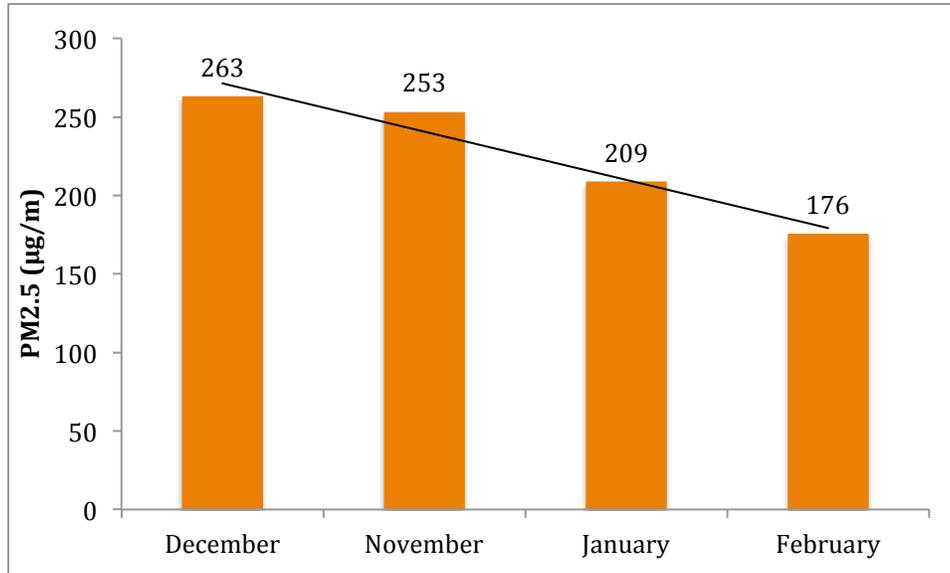
The monthly mean values for the period of study (November- February) demonstrate a general downward trend from December to February[2]. December reported higher concentrations as compared to other months that reflect a highly active biomass-burning seasons. The period also experienced the lowest monthly mean ambient temperature among all months<sup>1</sup>, leading to more stable air and pollutant trap. **Among the four months, the monthly mean concentrations of PM<sub>2.5</sub> was observed to be highest for December. The average concentration was calculated**

---

<sup>1</sup> In December the monthly mean ambient temperature was 16.0 degree celsius while November, January and February experienced average temperature 18.5, 18.5 and 22.9 degree celsius respectively.

as  $263 \mu\text{g}/\text{m}^3$ , while the other months' monthly mean concentration were  $253 \mu\text{g}/\text{m}^3$ ,  $209 \mu\text{g}/\text{m}^3$  and  $176 \mu\text{g}/\text{m}^3$  respectively for November, January and February[3].

February's monthly mean concentration is comparatively lesser than the other three months. The reason might be the lesser number of monitoring days; particulate matter was only monitored for 7 days in February by the CPCB monitoring stations.



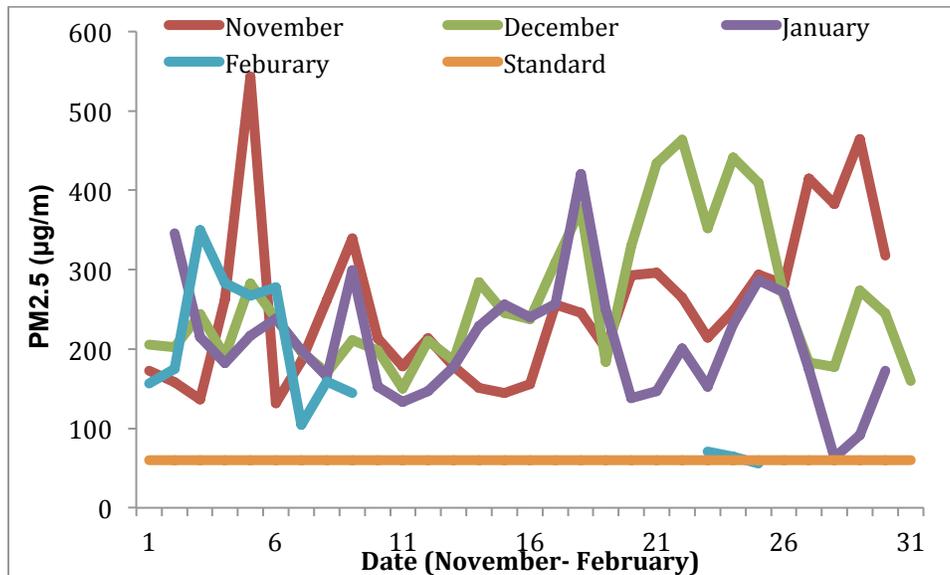
*Figure 1: Monthly mean concentration of Particulate matter (PM<sub>2.5</sub>)*

## II. 24 hour average concentration of Particulate matter in Patna

**On a daily scale, the 24-hour average concentration of PM<sub>2.5</sub> has been generally 6-9 times above the prescribed national standard[4].** The maximum concentration of PM<sub>2.5</sub> across the sample period was noted on 5<sup>th</sup> November 2016, the value recorded was  $542 \mu\text{g}/\text{m}^3$ . Interestingly on the same day Delhi had also witnessed the worst air quality in the four-month long winter season. **In the month of December, the maximum concentration of PM<sub>2.5</sub> was noted on 22<sup>nd</sup> December 2016, with a concentration of  $463 \mu\text{g}/\text{m}^3$ . January and February[5] witnessed highest peaks on 18<sup>th</sup> ( $420 \mu\text{g}/\text{m}^3$ ) and 3<sup>rd</sup> ( $349 \mu\text{g}/\text{m}^3$ ) respectively.**

To understand the rationale behind the peak found during study period, the ambient temperature and wind speed observed during the period was also considered. The main conclusion drawn from the analysis is that the high concentration of particulate matter on those days is mainly because of temperature effect. At all peak events of particulate matter, the ambient temperature

dips to lowest values. However, the analysis is hinting towards colder weather, the other reasons need to be evaluated more exhaustively.

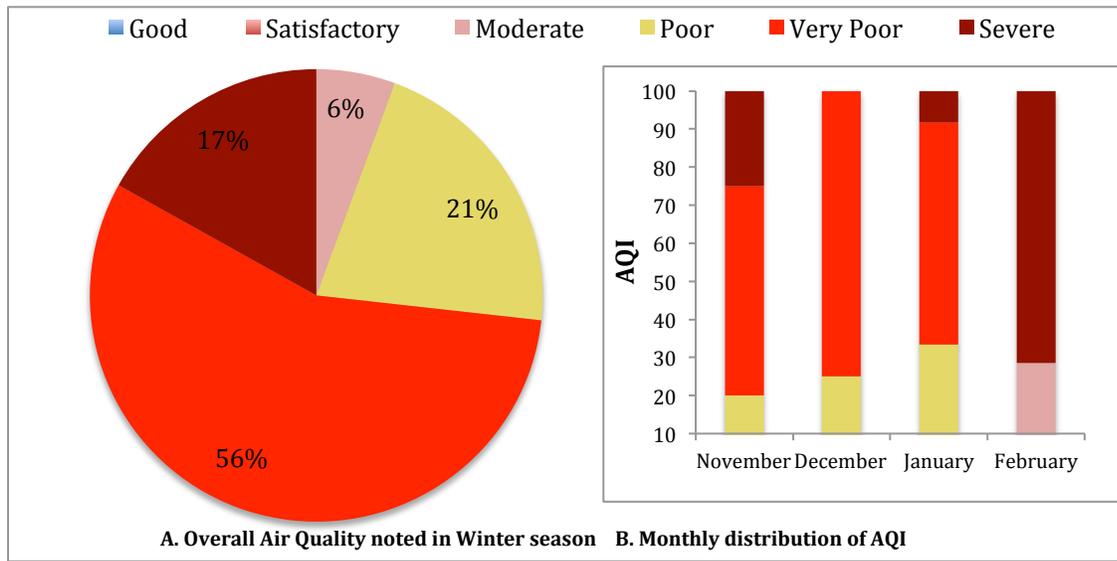


*Figure II: 24 hour average concentration of Particulate matter in Patna*

### III. Good day versus bad days in Patna

The number of days with varied Air Quality Index values vis a vis their month is elaborated in the graph. The color-coding of bar graph is in accordance with CPCB’s AQI category[6]. **It was observed that none of the days during the winter months were under ‘Good’ to ‘Satisfactory’ category.** Overall, the vast majority of days (55%) in November have relatively high levels of pollution and the air quality was under ‘**Very Poor**’ category. 25% of the total days monitored have witnessed ‘**Severe**’ air quality while the rest 20% were in ‘**Poor**’ category in November.

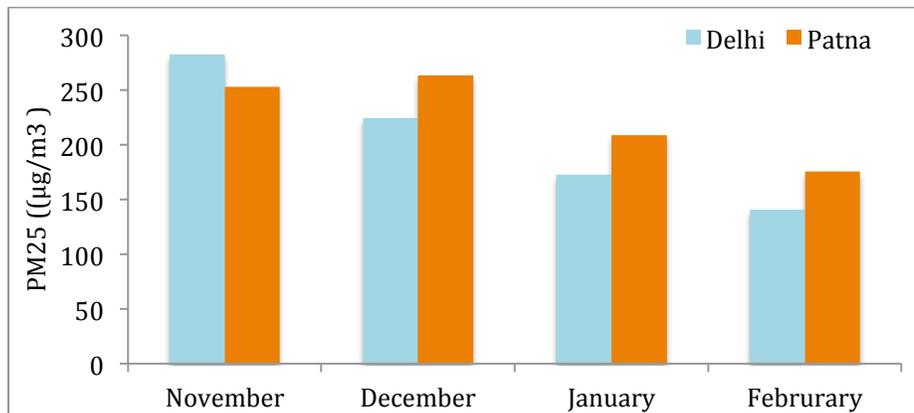
In the month of December, no days were observed under ‘**Severe**’ air quality; most of the days were fell under the category of ‘**Very Poor**’ which is 75% of the total days, while the rest were found under the category of “**Poor**”. Compared to the other three months, January observed better air quality days, with 8% of the total days observed under ‘**Severe**’ air quality category. The rest of the days in January witnessed ‘**Poor**’ to ‘**Very Poor**’ air quality. The air quality data in February was monitored for a very less number of days, but out of it most of the days (71%) were observed under ‘**Severe**’ air quality.



*Figure III: Category of Air Quality noted in Patna*

#### IV. Patna versus Delhi

The comparative historical trends of monthly mean concentrations of PM<sub>2.5</sub> for Delhi and Patna during November to February are presented in Figure IV. The calculated monthly mean concentration of particulate matter in Patna was found to be higher than Delhi during the entire period for a difference, except for the month of November. In November, the monthly mean concentration of particulate matter in Delhi was more than that in Patna. The probable reason for this finding needs to be investigated, but one can also attribute it to the fact that Delhi has taken some steps to reduce particulate matter levels, like vacuum cleaning of roads and closure of Badarpur thermal power plant, to name a few. Moreover, the intensive monitoring of air quality in Delhi also helps in controlling the menace of air pollution.



*Figure IV: Comparative trend of monthly mean concentration of particulate matter*

## Way Forward

**The deteriorating air quality and being inclusive among the list of country's most polluted cities, demand an urgent intervention. The Government of Bihar needs to chalk out an affirmative 'Clean Air Action Plan' in order to curb the rising levels of air pollution and adopt tools for improving the current air quality.** The Clean Air Action Plan must focus on developing regional scale plans to improve air quality with yearly targets, and integrate efforts across different departments. Clean Air Action Plan must list the key actions and roadmap for each section.

The plan must set out a strategy for data sharing by issuing health advisory and emergency preparedness structure. Going forward, the Clean Air Action Plan must set out timelines for Action Matrix, that shall chalk out detailed actions required for each of the major sources of pollution in the state.

As an immediate response to the state of ambient air quality in Patna, the government must consider following actions:

1. Government must inform residents about the air quality and should also issue health advisory for people. This will work as the first line of defence against air pollution health impacts, and is considered as the best practice, globally.
2. Government must formulate clean air action plan with each action plan in a time bound manner.
3. Vehicular emissions must be given special attention. The pollution check should be strengthened.

---

[1] WHO database, 2014 & 2016

[2] The total number of monitoring days varies for all four months

[3] In February month only 7 days were monitored.

[4] Central Pollution Control Board notified standard for PM<sub>2.5</sub> is 60 µg/m<sup>3</sup>

[5] In February month only 7 days were monitored.

[6] [http://cpcb.nic.in/FINAL-REPORT\\_AQI\\_.pdf](http://cpcb.nic.in/FINAL-REPORT_AQI_.pdf)

## **About CEED**

Centre for Environment and Energy development (CEED) is a solution driven non-profit organization that works towards creating inspiring solutions to maintain a healthy, rich and diverse environment. CEED is dedicated to finding solutions for Climate and Energy, hazardous free future and for Clean and safe water.

The idea of CEED was conceived by a group of young professionals with vast amount of experience in the field of environment. CEED was registered in November 2012 as non profit organization under section 25, Companies Act, 1956.

### **Contact:**

A1-248,Second floor Safdurjung Enclave, New-Delhi - 110029, India

B/194,Second floor Shri Krishna Puri, Patna - 800001. India

**Visit:** [www.ceedindia.org](http://www.ceedindia.org)

[www.facebook.com/ceedindia.org](https://www.facebook.com/ceedindia.org)

[www.twitter.com/ceed\\_india.org](https://www.twitter.com/ceed_india.org)

### **Write to us at**

[info@ceedindia.org](mailto:info@ceedindia.org)