

Winter Air pollution in cities of Madhya Pradesh and Chhattisgarh

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It is not only the North India that is in grip of severe winter pollution. Several cities in other regions such as Central India -- Madhya Pradesh and Chhattisgarh, are experiencing worsening of winter pollution, finds the latest analysis of the centre for Science and Environment (CSE).

Even though the real time air quality data is extremely limited in this region, the emerging jigsaw of real time data from only 17 cities of these two big states indicates a growing crisis and vulnerability to winter smog. This demands early and stronger multi-sector action at a regional scale to meet the clean air targets.

Gaps in air quality data and lack of quality control of data make it difficult to construct reliable air quality trends and do proper risk assessment. The worsening of air quality in the region has not drawn adequate public attention. In winter, air quality of cities like Singrauli, Gwalior, Jabalpur, Katna among others can be nearly three times worse than their annual average level.

CSE has analyzed air quality status in cities of Madhya Pradesh (MP) and Chhattisgarh. This is continuation of the air quality tracker initiative of the Urban Data Analytics Lab of CSE that was started last winter. The objective of this new analysis has been to understand the trend and magnitude of the winter pollution in major cities of different regions that have real time air quality monitoring systems.

This is an assessment of annual and seasonal trends in PM_{2.5} concentration for the period 1 January 2019 to 12th December 2021. This analysis is based on the real time data available from the current working air quality monitoring stations in Central India. A huge volume of data points have been cleaned and data gaps have been addressed based on USEPA method for this analysis. This analysis covers 18 continuous ambient air quality monitoring stations (CAAQMS) spread across 17 cities in two states: two stations in Gwalior and one station each in Bhopal, Damoh, Dewas, Indore, Jabalpur, Katni, Maihar, Mandideep, Pithampur, Ratlam, Sagar, Satna, Singrauli, Ujjain, Bilaspur.

Air quality monitoring is still very limited in the central region. MP cities have data available for over two years. But real time monitors in Chhattisgarh became operational only in later half of this year which limits the possibility of assessing long term trend. Therefore data is indicative of the current status of air quality and seasonal variation in particulate pollution in medium and smaller cities.

Analysis shows that air pollution during winter is a problem in all the cities in these two states with Gwalior and Singrauli having the worst air quality, as bad as the winter air quality of NCR and UP cities.

Even gases have begun to raise the ugly heads. Nitrogen dioxide (NO₂) pollution is also high in these cities with Indore recording the highest among the cities of this region. The limited air quality data in the region indicates that it has not changed much from the 2020 level. But due to limited historical data it is difficult to comment on the regional air quality trend.

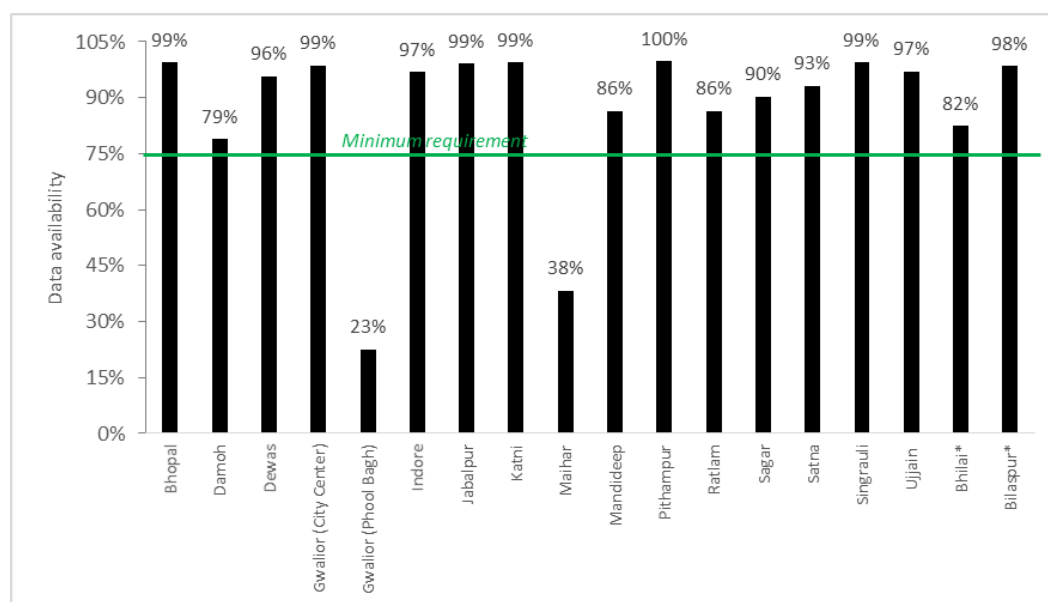
Summary highlights

Data quality remains poor despite automation: This central region has 18 real time monitors, 13 are operated by state pollution control boards while five are operated by private entities: Bhilai by Bhilai Steel Plant, Satna by Birla Cement, Maihar by KJS Cement, Ratlam by IPCA Lab, and Phool Bagh Gwalior by Mondelez Ind. Food. Most stations meet the minimum data availability of 75 per cent for this winter season this year (1 Jan – 12 Dec, 2021) (See Graph 1: Data availability at stations in 2021). Only stations that do not meet the minimum requirement are at Maihar (38 per cent) and Phool Bagh Gwalior (23 per cent). These are operated by private entities. Stations in Chhattisgarh only started operating in September (Bilaspur) and November (Bhilai) but they have reported data for more than 75 per cent of days since becoming operational.

Quick examination of data indicates that stations operated by industry actors tend to report very low concentration numbers or have massive data gaps compared to stations operated by state pollution control board. Station at Satna operated by Birla Cement especially stands out for uncannily low

values, in fact annual average for 2020 for this particular station works out to be about 50 per cent lower than what is reported by two manual stations of the city in annual NAMP report. It is not clear why such deviation occurs in Satna's realtime monitor data.

Graph 1: Data availability at stations in 2021

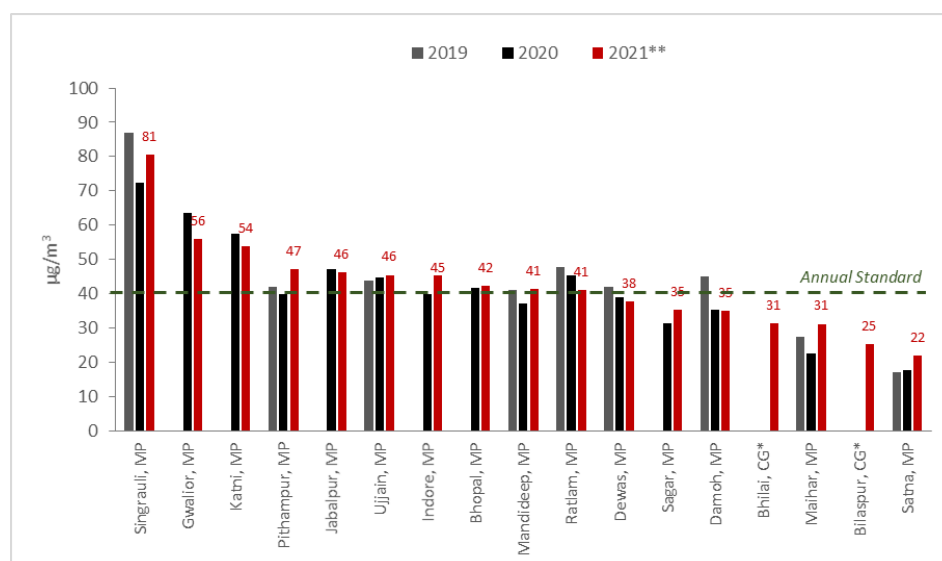


Source: CSE analysis of real time data from CPCB website

Singrauli and Gawlior have the most polluted air in Central India: Singrauli, a small town in eastern MP but designated as critically polluted areas by the Central Pollution Control Board, has the most polluted air in the region with 2021 average of 81 ug/m³. It is followed by Gwalior and Katni that have 2021 average of 56 ug/m³ and 54 ug/m³ respectively (See Graph 2: PM2.5 trend among cities of Central India). The 2021 average has bypassed the 2020 average in all major cities i.e. Bhopal, Indore, Jabalpur and Ujjain and they don't meet the annual standard as well. Satna has the lowest 2021 average value but quality of data from the city's only station is of suspect nature.

Bilaspur, Bhilia and Maihar do not have adequate data for computation of annual values.

Graph 2: PM2.5 trend among cities of Central India

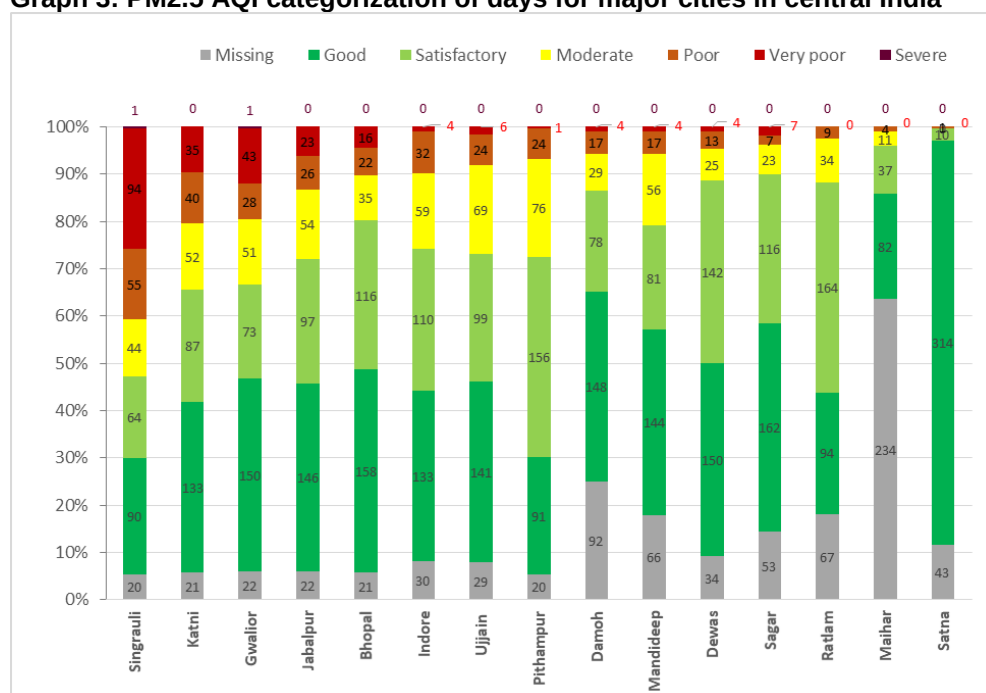


Note: PM2.5 values for Guwahati which has two monitoring stations is based on average of both stations. Data for only those stations is considered that have continuous and adequate data for complete assessment period. Data up till 30 November 2021.

Source: CSE analysis of real time data from CPCB website

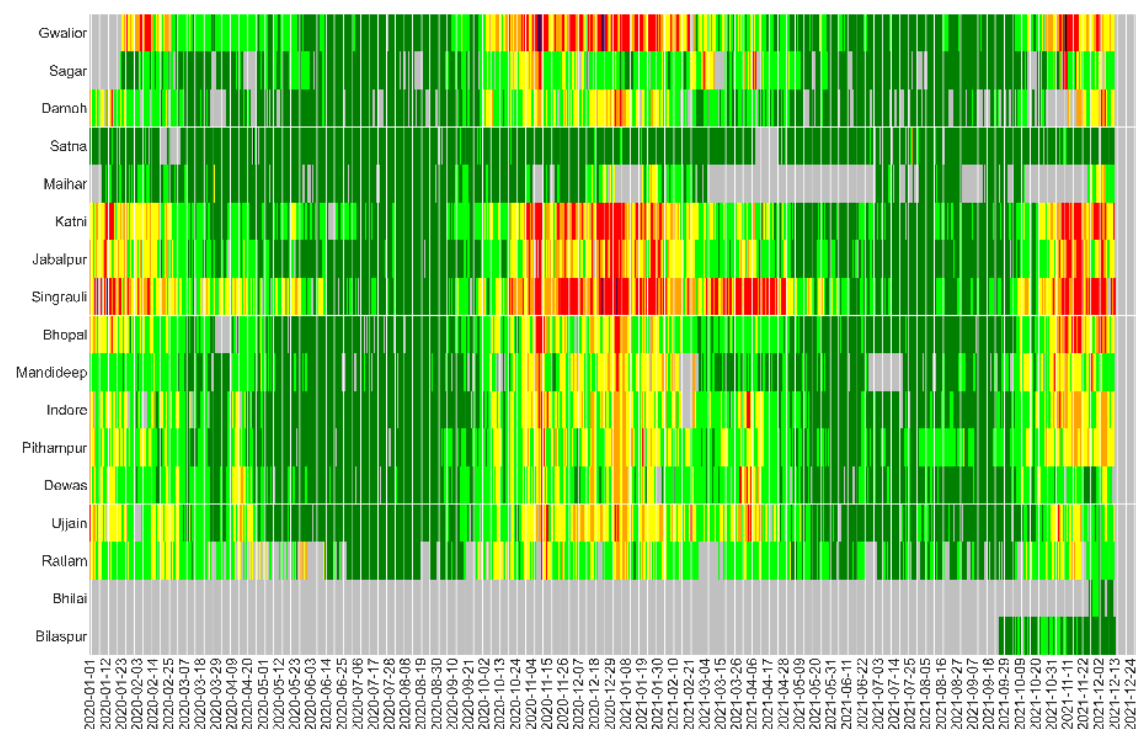
Singrauli have had over three months of very poor air quality days this year: This year so far number of days with air quality in very poor or severe category in Singrauli city stands at 95 days which is identical to Delhi – as of November 2021 (See Graph 3: PM2.5 AQI categorization of days for major cities in Central India). Singrauli has just one severe day. There is a constant high pollution in the city but it rarely gets tipped over to severe, which generally happens due to impact of additional factors like meteorology or external pollution source. Major cities like Bhopal (38 days), Indore (36 days), Gwalior (72 days), Jabalpur (49 days) and Ujjain (30 days) have recorded over a month of poor or worse air quality in 2021 so far. These bad air quality days are concentrated during winter months (See Graph 4: PM2.5 AQI heatmap calendar for major cities in Central India). Cities in the east abutting the Indo-Gangetic Plains are dirtier compared to rest of the cities in the region.

Graph 3: PM2.5 AQI categorization of days for major cities in central India



Note: PM2.5 values for cities with more than one monitoring stations is based on average of all stations that have continuous and adequate data for complete assessment period. Data up till 30 November 2021.
Source: CSE analysis of real time data from CPCB website

Graph 4: PM2.5 AQI heatmap calendar for major cities in Central India

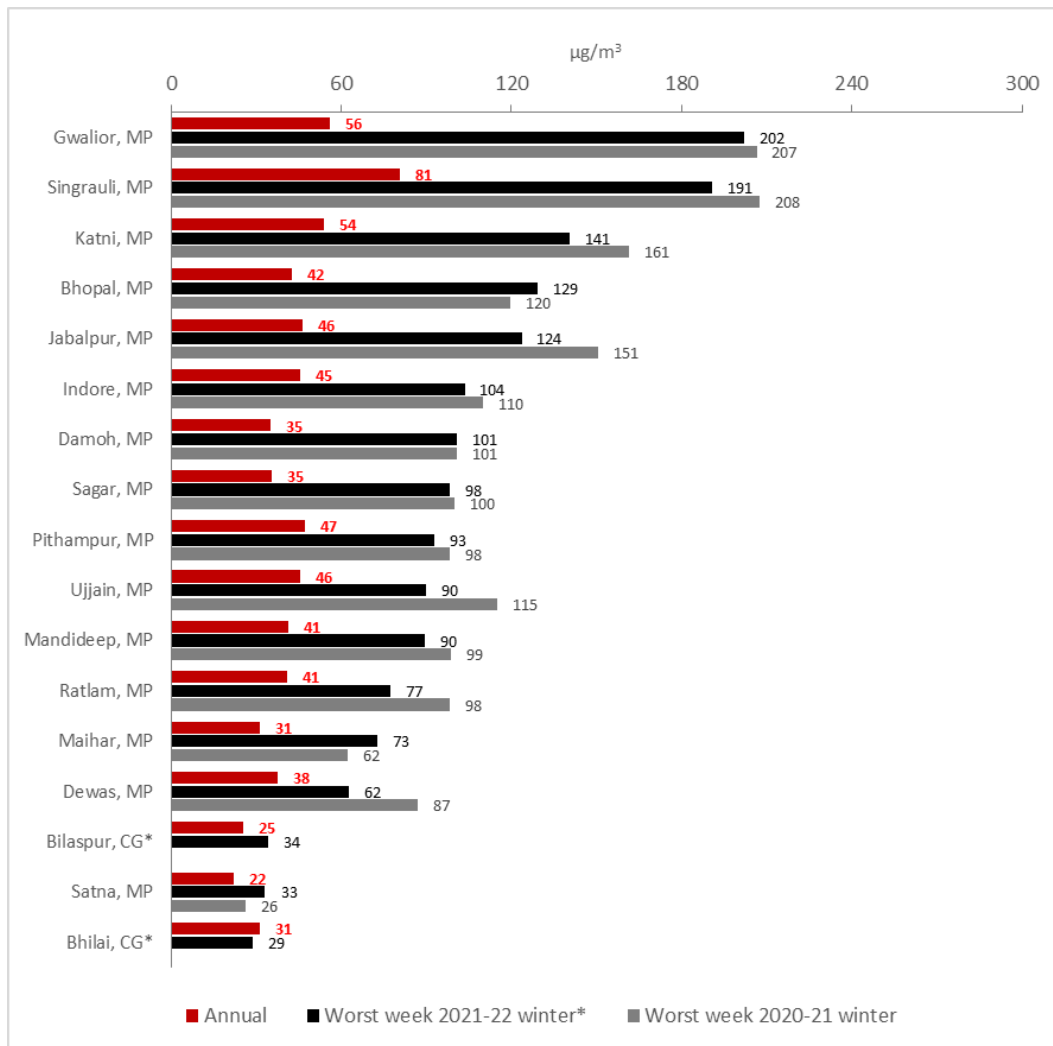


Note: PM2.5 values for cities with more than one monitoring stations is based on average of all stations that have continuous and adequate data for complete assessment period. Cell colours are based on the official AQI category colours. Data up till 12 December 2021.

Source: CSE analysis of realtime data from CPCB portal

High pollution episode common during winters despite low annual levels: Except Singrauli, rest of the central Indian cities have relatively low annual PM2.5 levels (requiring less than 30 per cent reduction to meet the annual standard) but during winters episodes of high pollution are common place. During these high pollution episodes weekly PM2.5 levels can go as high as 202 ug/m3 as recorded in Gwalior in November 2021 (See Graph 5: Weekly PM2.5 levels vs annual level among Cities of Central India). This winter so far the highest weekly level has crossed 100 ug/m3 in Singrauli (191 ug/m3), Katni (141 ug/m3), Bhopal (129 ug/m3), Jabalpur (124 ug/m3), Indore (104 ug/m3), and Damoh (101 ug/m3). The levels are marginally lower this winter compared to last winter.

Graph 5: Weekly PM2.5 levels vs annual level among Cities of Central India

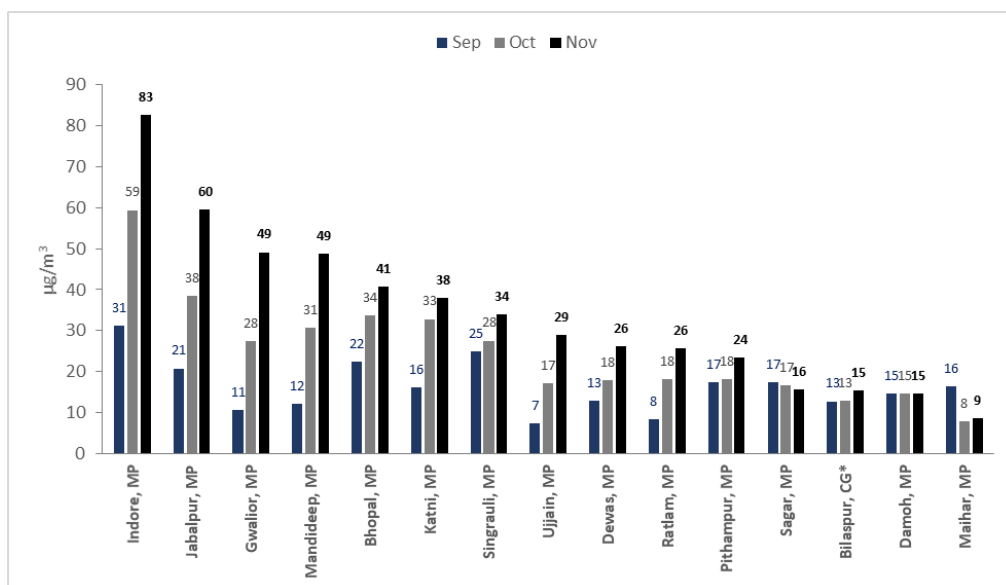


Source: CSE analysis of real time data from CPCB portal

Indore has dangerously high NO2 levels in winter: There is a significant increase in amount of NO2 in air of all cities of Central India during November compared to October and September. Gwalior registered 4.6 times jump in monthly NO2 level while Mandideep registered a 4 times increase (See Graph 6: Monthly trend in NO2 levels in cities of Central India).

In absolute concentration term, Indore registered the highest monthly average of 83 µg/m³ for November. This is higher than 24-hr standard for NO2. It is followed by Jabalpur (60 µg/m³) and Gwalior (49 µg/m³). Such high levels are not recorded even in North Indian cities which are generally more polluted.

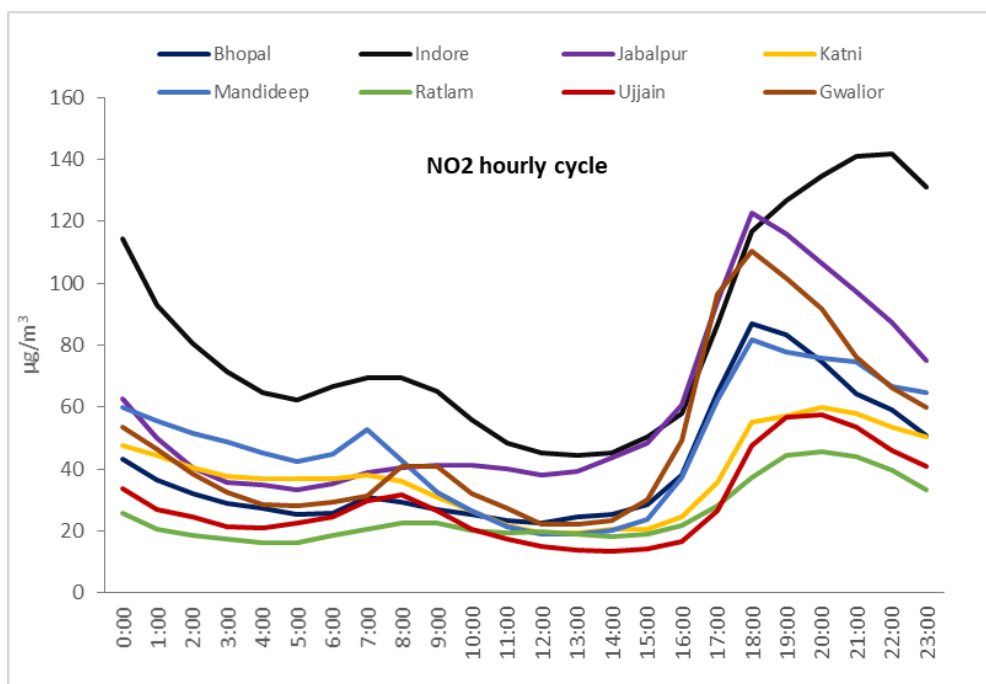
Graph 6: Monthly trend in NO2 levels in cities of Central India



Note: NO₂ values for cities with more than one monitoring stations is based on average of all stations that have continuous and adequate data for complete assessment period. Data up till 30 November 2021
Source: CSE analysis of real time data from CPCB portal

Traffic is a major contributor to pollution in the cities: All cities show peaking of hourly NO₂ concentration between 6pm and 8pm which coincides with evening rush hour in the cities. Hourly NO₂ in Gwalior increases 5-folds between noon and 6pm (See Graph 7: Hourly NO₂ cycle for November in Central India cities). NO₂ cycle is equally as sharp among other cities with 2.5-4.3 times increase in noted at evening from afternoon. All cities have a morning NO₂ peak around 7-8am but is relatively smaller to evening peak. In Indore high NO₂ levels persist uptill midnight indicating presence of pollution from night-time truck movement in the city.

Graph 7: Hourly NO₂ cycle for November in Central Indian cities

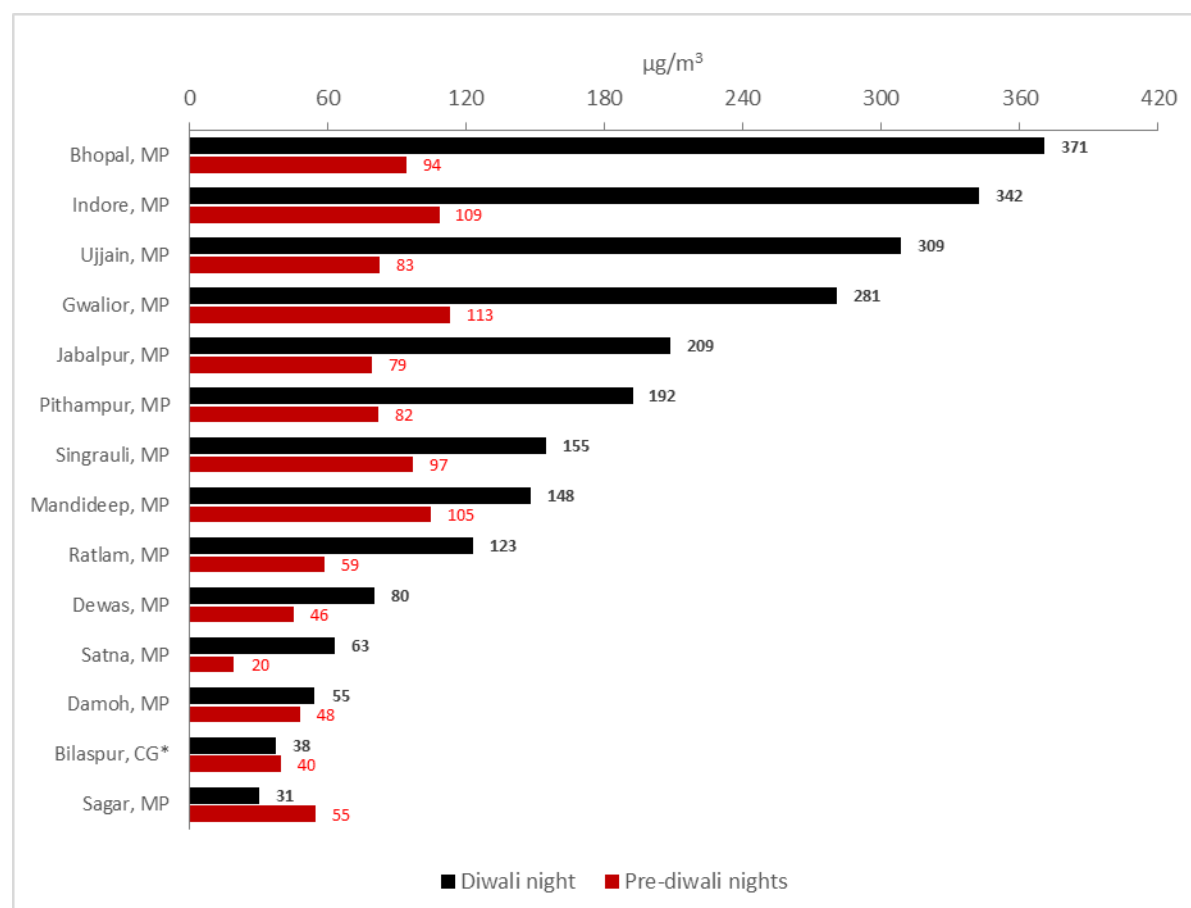


Note: Average NO₂ concentration is based on mean of hourly values that have continuous and adequate data for complete assessment period. Data up till 30 November 2021.
Source: CSE analysis of real time data from CPCB website

Diwali is a mega pollution event: Pollution level on Diwali night (8pm to 8am) in cities shot up by 1.4 - 3.9 times the average level recorded seven nights preceding Diwali (See Graph 8: Diwali night pollution among cities of Central India). Bhopal had the greatest pollution build-up on Diwali night, with a 3.9-fold increase in night-time PM_{2.5}, followed by Ujjain that saw 3.7 fold increase. Sagar, Bilaspur and Damoh registered very low PM_{2.5} levels with no impact of Diwali.

In absolute concentration terms, Bhopal dominate the list of most polluted Diwali nights with 371 µg/m³ PM_{2.5} level. Pollution was very high among all other major cities as well on Diwali night with Indore (342 ug/m³), and Ujjain (309 ug/m³), Gwalior (281 ug/m³), Jabalpur (209 ug/m³) crossing 200 ug/m³ mark.

Graph 8: Diwali night pollution among cities of Central India



Note: PM_{2.5} values for cities with more than one monitoring stations is based on average of all stations that have continuous and adequate data for complete assessment period. Diwali night is considered from 8.00PM November 4 to 8.00AM November 5. Pre-Diwali night is average of seven nights (8.00PM-8.00AM) preceding Diwali.
Source: CSE analysis of real time data from CPCB website

The next steps

This region that includes critically polluted industrial areas requires urgent attention under the National Clean Air Programme. While strengthening air quality monitoring network for proper risk assessment, tighten action in critically polluted areas and scale up implementation of multi-sector clean air action plan to meet time bound clean air target. This is needed to prevent worsening of the public health crisis in this region.