Winter Air pollution in the states of North East

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The growing problem of air pollution challenges the public impression of pristine blue sky in the cities of ecologically sensitive north east region. The current obsession with high pollution concentration in the Indo-Gangetic Plain and overall northern India overshadows and side lines the early signs of the crisis in north eastern states in the national discourse on air pollution and public health. This has emerged from the new analysis of the Centre for Science and Environment (CSE).

Weak and inadequate air quality monitoring and paucity of data do not allow proper assessment of risk. But even the limited evidence shows several cities – especially the state capitals, are already vulnerable to poor air quality and winter smog. Growing pollution from uncontrolled motorisation, use of dirty and solid fuels, industrial sources, open burning of waste and biomass, and continuous urban construction are contributing to the crisis.

Big gaps in data as well as limited air quality monitoring infrastructure makes it difficult to construct reliable air quality trends for the cities to inform action in the region. Signs of worsening of air quality in this region has not drawn adequate public attention. Winter air quality in Guwahati can be almost as bad as what we see in NCR and UP cities. Smaller cities like Agartala and Kohima have begun to experience high pollution days.

The Centre for Science and Environment (CSE) has analyzed urban air quality status in the states of Assam, Meghalaya, Tripura, Nagaland, Mizoram, and Arunachal Pradesh. This is part of the air quality tracker initiative of the Urban Data Analytics Lab of CSE started last winter. The objective of this new analysis is to understand the magnitude and trend in winter pollution in major cities of the region which have recently started realtime air quality monitoring.

This is an assessment of annual and seasonal trends in PM2.5 concentration for the period 1 January 2019 to 7th December 2021. This analysis is based on the real time data available from the currently functioning air quality monitoring stations in North East 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 seven continuous ambient air quality monitoring stations (CAAQMS) spread across six cities in five states: two stations in Guwahati and one station each in Shillong, Agartala, Kohima, Aizwal and Naharlagun.

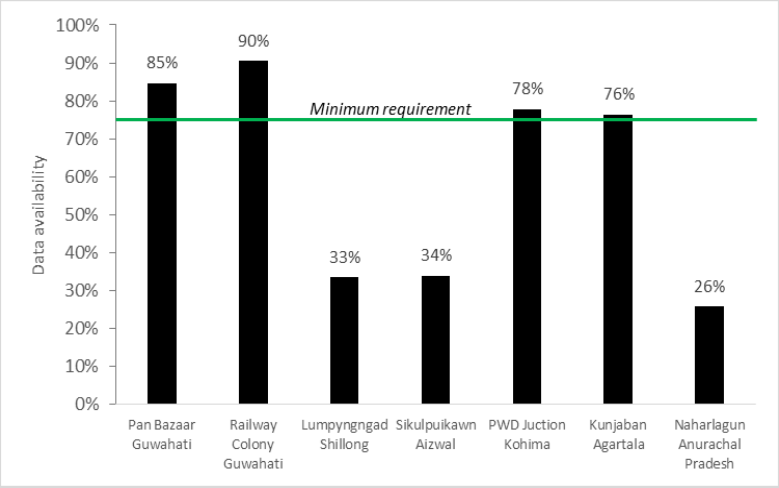
The data is limited. Guwahati in Assam and Shillong in Meghalaya have data available for over two years. Real time monitors in Agartala (Tripura), Kohima (Nagaland) and Aizwal (Mizoram) became operational only near the end of 2020 which limits the possibility of doing long term trend analysis for these cities. Naharlagun in Arunachal Pradesh got its real time monitor in March 2021. Due to excessive amount of missing data from this station any meaningful analysis is not possible.

Seasonal and annual pollution patterns in key cities of North-East India

Data quality remains poor despite setting up of automatic real time air quality monitoring stations: The region has historically been low on monitoring due to hilly terrain and limited infrastructure and resources. With introduction of automated monitoring in the region under CAAQMS program of CPCB, it was expected that air quality data generation would improve. But even this online system is plagued with data gaps. Data availability calculated as number of days with adequate data for commutation of a valid 24hr-average has been low in three of the six cities in the region. In last six month (May to November) data availability at Naharlagun station of Anurachal Pradesh has been just 26 per cent. Stations at Shillong in Meghalaya, and Aizwal in Mizoram fare just marginally better with 33 per cent and 34 per cent data availability (See Graph 1: Data availability at stations May-Nov, 2021).

Stations at Kohima in Nagaland, Agartala in Tripura and Guwahati in Assam meet the minimum 75 per cent data availability requirement. In contrast the CAAQMS stations in Delhi-NCR have over 95 per cent data availability. It is not clear why these stations have such poor data availability but it probably has to do with poor electricity and internet connectivity in the region.

Graph 1: Data availability at stations May-Nov, 2021

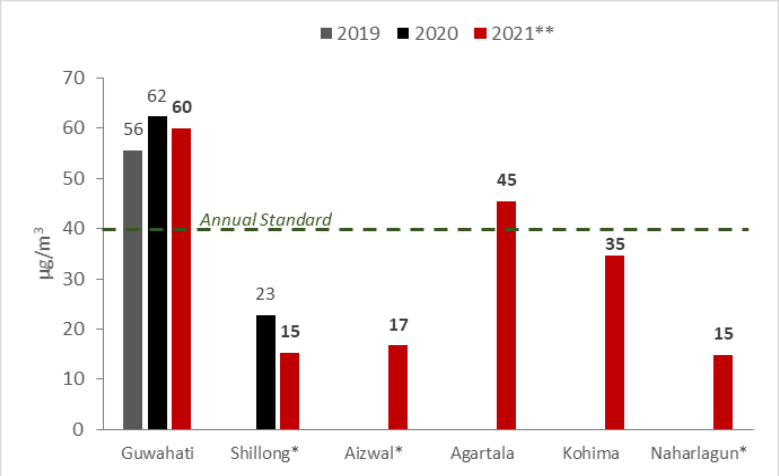


Note: Data availability calculated as number of days with adequate data for commutation of a valid 24hr-average for 1 May-7 Dec 2021.
Source: CSE analysis of real time data from CPCB website

Guwahati has the most polluted air in North Eastern region: Average PM2.5 levels in 2021 (uptill 30th November) has already surpassed the 2019 annual average in Guwahati. The city's 2020 annual average was also higher than its 2019 average which indicates continuous worsening of air in the city. Shillong is the only other city in the region that has a station generating data for over two year but due to poor data availability its annual averages cannot be considered credible. Nevertheless, the city's average is considerably below the annual standard (See Graph 2: PM2.5 trend among cities of North-Eastern states).

In contrast to northern India, the overall pollution level is low and several of them currently meet the national ambient air quality standards. But it is possible to grade them based on their annual trends. Among other cities meeting minimum data availability requirements, Agartala with 2020 average of 45 µg/m3 is second most polluted city in the region. Kohima with 2020 average of 35 µg/m3 is the third most polluted city in the region. Aizwal and Naharlagun do not meet the minimum data availability requirement but the limited data available indicates that these two would most probably be meeting the annual standard.

Graph 2: PM2.5 trend among cities of North Eastern states



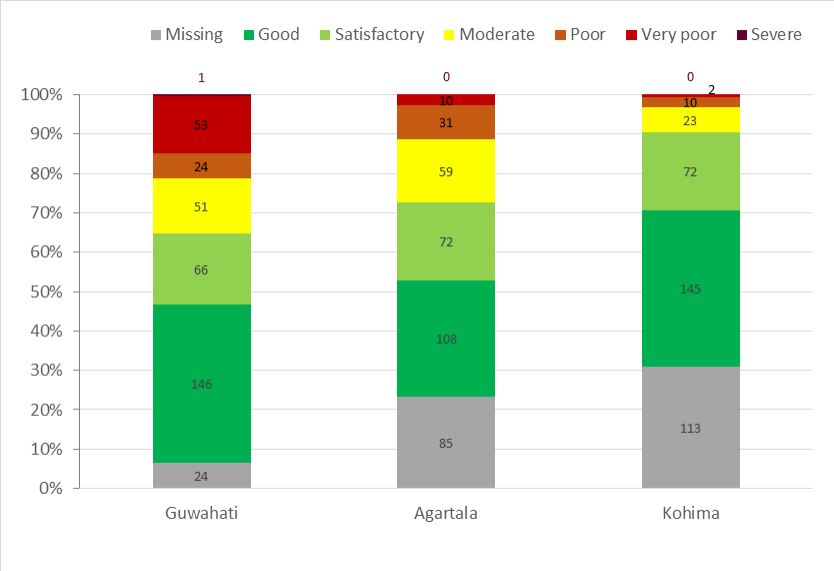
Note: PM2.5 values for sub-regions are based on the average of citywide values of all the cities in that region. PM2.5 values for Guwahati with more than one monitoring stations is based on average of all stations that have continuous and adequate data

for complete assessment period. Data up till 30 November 2021.
Source: CSE analysis of real time data from CPCB website

Guwahati has almost two months of very poor air quality days: This year so far number of days with air quality in very poor or severe category stands at 54 days in Guwahati city (See Graph 3: PM2.5 AQI categorization of days for major cities in North-East India). This is comparable to cities of North India which is more polluted compared to North-Eastern states.

In other cities good and satisfactory days dominate but poor and very poor days have begun to emerge. Agartala registered 10 very poor days while Kohima two very poor days. There is considerable number of days in these cities for which AQI could not be calculated due to poor data availability. All three cities meet the 24hr standard for about half of the days in 2021 so far. AQI chart for Shillong, Aizwal, and Naharlagun were not made as these cities don't have enough data.

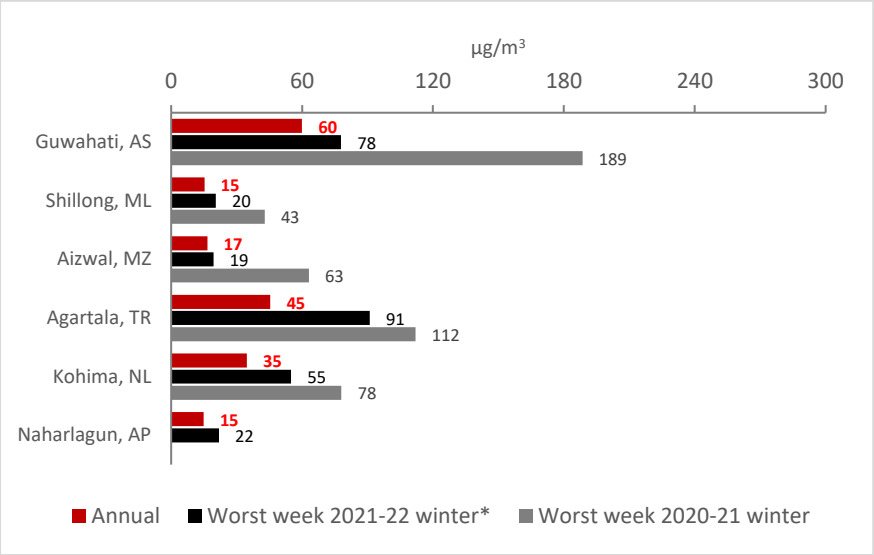
Graph 3: PM2.5 AQI categorization of days for major cities in North East India



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

High pollution episode common during winters despite low annual levels: Except Guwahati, rest of the cities in the states in north east have low annual PM2.5 levels but during winter episodes of high pollution are common. Weekly PM2.5 levels can go as high as 189 µg/m3 in Guwahati (as recorded in week ending on 17 Jan 2021). This winter so far the highest weekly level has been reported from Agartala when it hit 91 µg/m3 (as recorded in week ending on 28 Nov 2021). Last winter it had gone upto112 µg/m3 (as recorded in week ending on 10 Jan 2021). Similarly highly pollutions have been recorded in Aizwal and Kohima (See Graph 4: Weekly PM2.5 levels vs annual level among Cities of North East India).

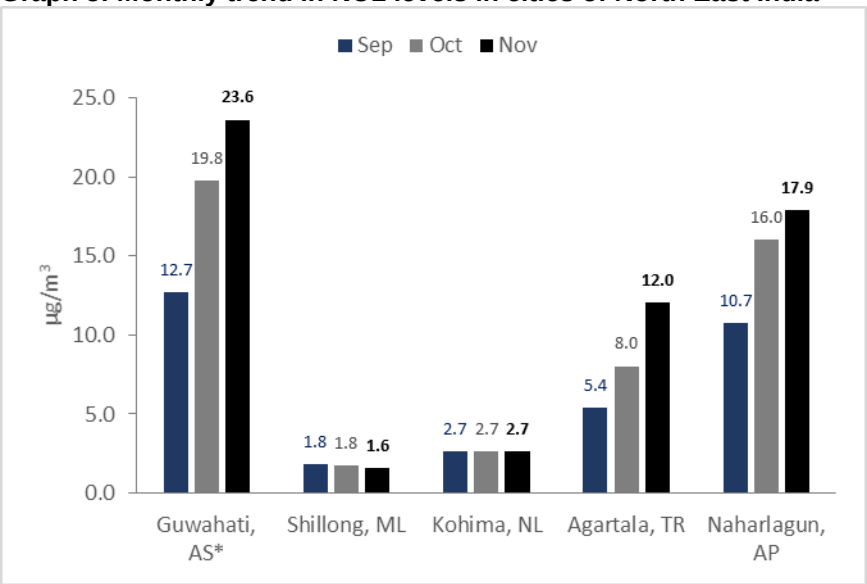
Graph 4: Weekly PM2.5 levels vs annual level among cities of North East India



Note: Worst week for Guwahati were weeks ending on 17 Jan 2021 and 7 Nov 2021; Agartala were weeks ending on 10 Jan 2021 and 28 Nov 2021; Kohima and Aizwal have both their worst weeks ending on 17 Jan 2021 and 5 Feb 2021; Shillong were weeks ending on 17 Jan 2021 and 28 Nov 2021; Naharlagun were weeks ending on 5 Dec 2021.
Source: CSE analysis of real time data from CPCB portal

Guwahati, Agartala and Naharlagun show elevated NO2 levels in winter: There is a significant increase in amount of NO2 in air of Agartala and Naharlagun during November compared to October and September, 2021. Agartala registered 124 per cent jump in monthly NO2 level while Naharlagun registered a 67 per cent increase (See Graph 5: Monthly trend in NO2 levels in cities of North East India). In other cities including Shillong, Kohima, and Guwahati, there seems to be a problem with the monitors as the data points are showing an almost flat line. This implies their NO2 monitors might not be working properly. Guwahati's data for this year is reporting almost flat-line since May 2021. But in 2020 NO2 level in Guwahati had increased as winter progressed -- there was a 85 per cent jump in monthly NO2 levels between September and November. Aizwal has not reported NO2 data since May 2021.

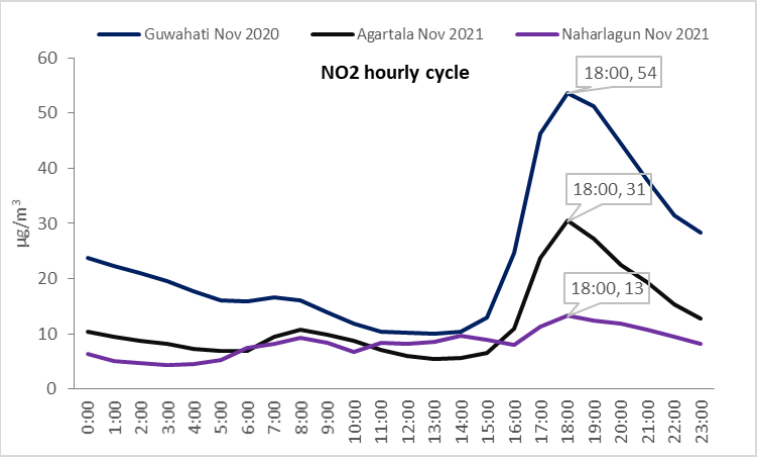
Graph 5: Monthly trend in NO2 levels in cities of North East India



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 website

Daily NO2 peaks with traffic peaks: Only three cities have reliable NO2 data and all of them show peaking of hourly NO2 concentration at 6pm which coincides with evening rush hour in the cities. Hourly NO2 in Guwahati and Agartala increases 5-folds between 1pm and 6pm (See Graph 6: Hourly NO2 cycle for November in Guwahati, Agartala and Naharlagun). NO2 cycle is not as sharp in Naharlagun but still 40 per cent increase in noted at 6pm from 1pm. All three cities have a morning NO2 peak around 7-8am but is relatively smaller to evening peak. In Guwahati, night time NO2 is high indicating impact of night-time truck movement in the city.

Graph 6: Hourly NO2 cycle for November in Guwahati, Agartala and Naharlagun

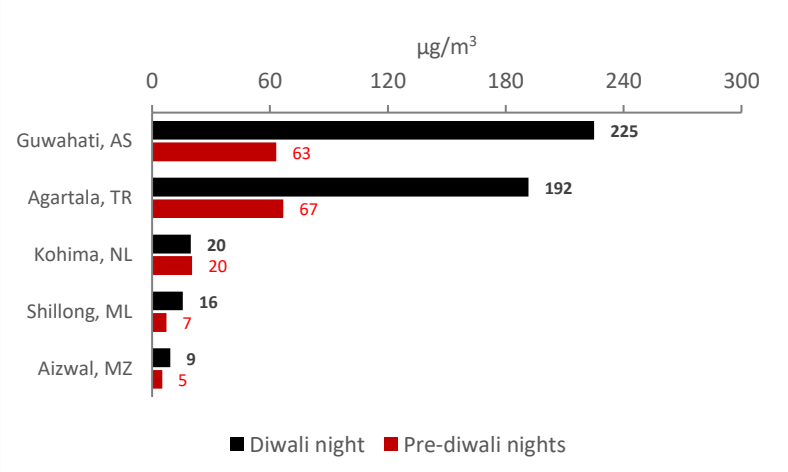


Note: Average NO2 concentration is based on mean of hourly values that have continuous and adequate data for complete assessment period. Data up till 30 November 2021.
Source: CSE analysis of real time data from CPCB website

Diwali is a mega pollution event for Guwahati and Agartala: Pollution level on Diwali night (8pm to 8am) in cities shot up by 1.0 - 3.6 times the average level recorded seven nights preceding Diwali (See Graph 7: Diwali night pollution among cities of North-East India). Guwahati had the greatest pollution build-up on Diwali night, with a 3.6-fold increase in night-time PM2.5, while Kohima had no impact of Diwali on its air quality. Naharlagun had no data for Diwali night while Kohima, Shillong and Aizwal registered very low PM2.5 levels with negligible impact of Diwali.

In absolute concentration terms, Guwahati dominate the list of most polluted Diwali nights with 225 µg/m3 PM2.5 level. Agartala with Diwali night PM2.5 level 192 µg/m3 enters the AQI categorization of very poor level.

Graph 7: Diwali night pollution among cities of North-East India



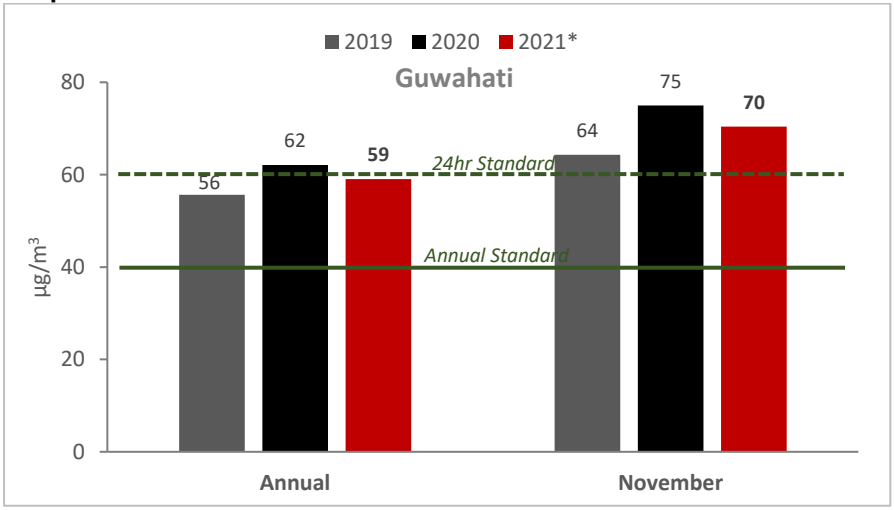
Note: PM2.5 values for cities with more than one monitoring stations is based on average of all stations that have continuous and adequate data for complete assessment period. Diwali night is considered from 8.00PM November 4 to 8.00AM November 5. Pre-Diwali night is average of seven nights (8.00PM-8.00AM) preceding Diwali.
Source: CSE analysis of real time data from CPCB website

Spotlight on Guwahati

Guwahati has comparatively better data set that allows more insights into the pollution behaviour in the city. This city has a stable annual average of PM2.5 since last three year but it does not meet the annual standard for PM2.5 (See Graph 8: PM2.5 annual and winter trend in Guwahati). It needs to cut pollution level by 33 per cent to meet the standard.

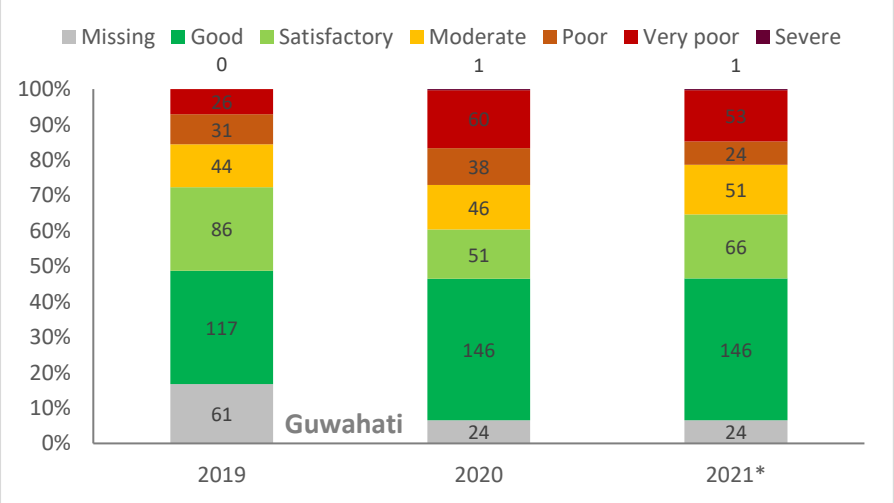
Further, November pollution this year is lesser compared to last two Novembers. But most polluted months for the city are December and January. Analysis of days as per the categorisation of the national air quality index shows that the city is experiencing increasingly higher number of days with poor or worse air quality, and most of these days are concentrated during winter months. Number of days with good air quality has remained same in last two years (See Graph 9: PM2.5 AQI trend in Guwahati).

Graph 8: PM2.5 annual and winter trend in Guwahati



Note: PM2.5 values is based on 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

Graph 9: PM2.5 AQI trend in Guwahati



Note: PM2.5 value is based on stations that have continuous and adequate data for complete assessment period. AQI is based on PM2.5 sub-category only. Data up till 30 November 2021.
Source: CSE analysis of real time data from CPCB portal

Way forward

Sparse and limited air quality data underrates the magnitude of the problem in cities. Though overall pollution in the region is low, air pollution is increasing in several cities. Cities like Guwahati needs to cut annual average PM2.5 levels by 33 per cent to meet the standard. High pollution episode is becoming common during winter despite low annual levels. Guwahati in Assam, Agartala in Tripura, Kohima in Nagaland, and Aizwal in Mizoram experience high pollution days. These are the early signs of growing public health crisis in the hilly terrains and valleys.

Cities of north eastern states need urgent support under the National Clean Air Programme to implement locally appropriate clean air action and robust air quality monitoring network for proper risk assessment. This is urgently needed to cut pollution from growing motorisation and congestion, use of solid fuels and open burning, and dispersed industrial sources at the early stages to prevent worsening of the public health crisis in this ecologically vulnerable region.