



Clearing the Air: Highlighting Actions to Reduce Air Pollution in India

Air pollution is one of the highest-ranking environmental health challenges in the world, especially in developing countries such as India. Air pollution is no longer just a problem in Delhi, but a major threat to other regions across the country. To address the threat of air pollution and associated health risks, national, state and city leaders are taking action. To mitigate the complex and widespread challenges of air pollution, it is important that successful strategies for addressing air pollution are highlighted and scaled effectively. This factsheet highlights actions that key regions in India are taking to improve air quality and protect public health.



School children in Ahmedabad with their flag indicating the day's air quality (Photo: © NRDC)

The air pollution interventions highlighted in this factsheet include Delhi's response to its "air emergency", Ahmedabad's health-based air quality index and risk communication plan, and Chennai's enhanced air quality monitoring and renewable energy initiatives. This factsheet also describes pollution mitigation efforts taken in Bengaluru, Pune, Nagpur, and Raipur.



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RECENT UPDATES

- In January 2019, India launched a National Clean Air Program aimed to reduce particulate matter pollution by 20-30% (from 2017 levels) by 2024
- Delhi officials undertook a number of emergency measures to tackle air pollution: setting up inter-departmental vigilance teams, halting construction, and stopping industrial activities
- In its proposed 2019-20 budget, Ahmedabad announced that it will dedicate funds towards actions for reducing air pollution
- Chennai increased generation of solar energy by utilizing metro rail rooftops
- Raipur registered a reduction in particulate matter pollution levels by effectively implementing industrial regulations

THE AIR POLLUTION PROBLEM

Air pollution is a serious problem in India. Recent reports estimate that one out of every eight deaths in India is caused by air pollution, a rise of almost 50% since 1990.¹ Over half of these 1.24 million deaths in 2017 were in persons younger than 70 years. The average life expectancy in India would be 1.7 years higher if the air quality was improved.¹

Ambient air quality is monitored by the Central Pollution Control Board (CPCB) using manual stations in around 730 sites across 312 cities.² There is also an existing network of 131 continuous ambient air quality monitoring stations (CAAQMS) in the country.³ Many cities in India exceed the World Health Organization's (WHO) standards for particulate matter, a major component of

urban air pollution.⁴ Particulate Matter (PM) describes a complex toxic mixture of solids and liquids. Particles of 10 micrometers in diameter or smaller (PM_{10}) and especially the even finer-sized $PM_{2.5}$ are so small (much smaller than the width of a human hair, for example) that they can penetrate deep into the lungs, where they can cause serious health problems. Major sources of larger PM_{10} include windblown dust and construction, while smaller $PM_{2.5}$ stems from various sources including vehicles, power plants, industry, waste burning, agricultural burning, and cooking with solid fuels.

Beyond the WHO standards, many Indian cities exceed the country's less stringent National Ambient Air Quality Standards. The Central Pollution Control Board has identified 102 such non-attainment cities



Transport emissions are a major source of pollution in Indian cities

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based on monitoring data from 2011-2015. Drawing on measurements and calculations as of 2016 from air monitoring stations in 4,300 cities globally, WHO reported in March 2018 that 11 of the 12 cities with the highest levels of PM_{2.5} pollution were located in India.⁵

Children are particularly vulnerable to the harmful health effects of air pollution because of their still-developing bodies and a higher dose of pollution inhaled per kilogram of body weight, compared to adults.⁶ Studies have shown irreparable harm to lung function in children due to air pollution exposures. Air pollution now contributes to more ill health in India than tobacco use, primarily through lower respiratory infections, chronic obstructive lung disease, heart attacks, stroke, diabetes, and lung cancer.²

DELHI

Delhi is the capital of India with nearly 25 million residents across the larger metropolitan area – Delhi National Capital Region. Severe air pollution episodes continue to plague the region, with major spikes observed during the winter season. Delhi is one of the most polluted cities in the world.

Government officials, health experts, and civil society groups, as well as the judiciary, through the Supreme Court appointed Environment Pollution Control Authority (EPCA), and the National Green Tribunal, have been engaged in devising emergency response plans (like the Graded Response Action Plan, or GRAP) and longer-term strategies to address Delhi's air pollution woes. There have been a host of emergency actions taken during the winter season, when the pollution levels are highest.

The national and Delhi government formed 52 cross-government vigilance teams to ensure implementation of the GRAP. The teams were empowered to take punitive action against violators responsible for air pollution emissions. Based on recommendations made by the CPCB, the Supreme Court-appointed EPCA halted all construction from November 1-10, 2018.⁷ It also ordered closure of all stone crushers and hot mix plants for the same period. Moreover, EPCA ordered closure of the polluting Badarpur Thermal Power Plant and banned use of diesel generator sets in Delhi. EPCA instructed all industries using coal and biomass as fuel (excluding thermal and waste to energy plants) to remain shut from during the peak pollution season.⁸

The Supreme Court also put restrictions on burning fireworks on Diwali (allowed only for hours between 8:00-10:00 pm). To reduce exposure to high pollution levels in Delhi, both the CPCB and the Indian Institute of

Tropical Meteorology's System of Air Quality and Weather Forecasting and Research (SAFAR) issued health advisories that asked people with heart or lung disease, elderly and children to avoid prolonged or heavy outdoor exertion when the air was bad.⁹

Furthermore, some longer-term actions were envisioned to respond to air pollution in Delhi, including a comprehensive electric vehicles (EV) policy. Delhi's draft EV policy sets a target for 25% of all vehicles to be EVs by 2023 and suggests putting in place financial disincentives for buyers of petrol and diesel vehicles. The draft policy proposed that petrol and diesel vehicle users will pay a "Pollution Cess" beginning April 2019. As part of this policy, an air quality parking surcharge would be levied on the base parking fees on all non-electric vehicles, and additional road taxes would be levied on diesel and petrol vehicles. A congestion fee of up to 2.5% on fares is planned to be levied on all cab aggregator and taxi trips -- this tax will be waived for rides taken in an e-two-wheeler, electric auto, or electric cab.¹⁰

AHMEDABAD

Ahmedabad is one of India's largest and fastest growing cities with a population surpassing 7 million. The WHO urban air quality database and several international and Indian studies have identified Ahmedabad as one of the most polluted cities in India and it is one of the non-attainment cities recently identified by the CPCB in the National Clean Air Plan.

In 2017, the Ahmedabad Municipal Corporation (AMC), in partnership with the Indian Institute of Tropical Meteorology's System of Air Quality and Weather Forecasting and Research (SAFAR), the Indian Institute of Public Health-Gandhinagar, and the Natural Resources Defense Council, launched a city-wide Air Quality Index (AQI) and Air Information and Response (AIR) Plan that provides publicly-accessible daily air quality reports and establishes an early warning pollution forecasting system to alert residents about dangerously poor air quality.¹¹ The AQI and AIR Plan also support an air quality awareness program that reaches 140,000 children in over 90 schools. In addition to enhancing health risk communication, the AIR Plan also facilitates city-level policy action on mitigation of air pollution. Supported by the AIR Plan, a voluntary expert working group comprising of experts from premier academic institutions has been formed in Ahmedabad to develop recommendations to improve air quality in the city.¹²

Recently, in the proposed budget for FY 19-20 the AMC earmarked funds to address air quality by improving roads

and traffic conditions, reducing fires at the Pirana dumpsite, and deploying 1000 electric buses (over three years) in the city.¹³

CHENNAI

Chennai, the capital of Tamil Nadu, is the fourth largest city in India. Tamil Nadu is a major contributor to India's gross domestic product and is one of the country's most urbanized states. Air pollution is an increasing concern in this city, with emissions from vehicles, industry, and thermal plants, among other sources. Focusing on improved air quality monitoring, groups in the Chennai region are stepping up local efforts.

The Tamil Nadu Pollution Control Board operates 11 air quality monitoring stations in the Chennai region under the National Air Quality Monitoring Program, with three continuous ambient air quality monitoring stations that generate a summary AQI throughout the day.

Launching a local air quality monitoring network, hospitals and other groups installed low-cost, real-time air quality monitoring systems at five locations in Chennai in 2018 that display results online as part of a joint project by Huma Lung Foundation, The Other Media's Healthy Energy Initiative, and UrbanSciences.¹⁴

To reduce the city's dependence on polluting thermal coal-fired power, the Greater Chennai Corporation has planned to install solar panels on 662 of its buildings under the Smart City initiative. These buildings will include government offices, schools, and hospitals and these

together are expected to generate 3.06 MW of electricity.¹⁵ The Chennai Metro Rail Limited (CMRL) is also playing its part in reducing fossil fuel use and has already installed 3.76 MW worth of solar rooftop capacity. Another 4.2 MW rooftop solar power installation is under progress which is expected to be completed by February 2019.¹⁶ The CMRL has also launched an electric feeder auto service, with the aim to deploy 100 such electric autos on the road.¹⁷

BENGALURU

A major technology hub and the capital of Karnataka, Bengaluru is increasingly in focus because of local air pollution that regularly exceeds national health-based standards. A reputation for endless snarls of traffic congestion and pollution motivated state and local administrations to take action on air pollution. According to information on the CPCB website, the city currently has a network of 10 CAAQMS.¹⁸

The Bangalore Electricity Supply Company (BESCOM), the local power utility, has introduced the city's second electric vehicle charging infrastructure at the premises of Karnataka Electricity Regulatory Commission (KERC) on Millers Road. The first such facility was installed at the headquarters of BESCOM in February 2018.¹⁹

The BESCOM has planned to set up a network of charging stations at 11 identified BESCOM-owned locations. In addition, the city Transport department will also tie up with BESCOM to develop 120 charging stations in the city including in business parks, shopping malls, metro stations, and the airport. BESCOM has also proposed that the Urban Development Department make it mandatory for high rise structures to reserve parking for all EVs.²⁰

Supported by Azim Premji Philanthropic Initiatives, a Bengaluru Clean Air Platform (BCAP) has been launched to catalyse collective action against air pollution. The BCAP aims to showcase how stakeholder engagement and joint action can improve the air quality in a city. The BCAP's approach involves three key elements: improving open data availability, increasing citizen engagement, and supporting state-led actions.²¹

PUNE

Pune is the second largest city in the state of Maharashtra (after the capital, Mumbai) and is the ninth largest city in India. Traditionally known for its educational institutes that contribute to a highly skilled labour force, Pune has emerged as a strong industrial belt. Today, it is a booming automotive manufacturing and IT service hub.



Information, education and communication materials in English and Gujarati supporting the Ahmedabad AIR Plan



Open burning of waste contributes to air pollution in India cities

Photo: © IIPH-G

In partnership with the Indian Institute of Tropical Meteorology's SAFAR Program, Pune has a network 10 CAAQMS and public electronic display boards that aim to generate awareness about local air quality and its connection to health.²² The air quality data collected by the city is published for the public in an annual Environment Status Report.

The Pune Municipal Corporation (PMC) has carried out a succession of studies on air quality sources. Transport is clearly a major polluting sector – with the city having more vehicles (3.62 million) than people (3.5 million) in 2018.²³ The city is making efforts to reduce traffic congestion and near-roadway air pollution by promoting non-motorised transport.

Recently, the city floated a tender for 500 electric buses, procured 8000 bicycles, with the goal of eventually making 20,000 such cycles available. It is also improving the design of its streets by building cycle-only tracks and developing a pedestrian movement policy. To curb burning of waste, the city has completely banned open dumping practices. Pune has also adopted 20 bio-methanation plants that help reduce trash burning and polluting emissions from landfills, while also generating clean energy. To reduce dust particles generated during construction activities, the PMC is providing ready-mix concrete.²⁴

NAGPUR

Located at the heart of India, Nagpur presents another example of how Indian cities are trying to improve air quality. With a population of 2.5 million, Nagpur is the third largest city in the state of Maharashtra and faces severe air pollution problems from vehicular traffic and clusters of neighbouring industrial operations and thermal power plants.

The Nagpur Municipal Corporation (NMC), in partnership with the Maharashtra Pollution Control Board (MPCB) and National Environmental Engineering Research Institute (NEERI) has developed a comprehensive action plan to reduce air pollution in the city. The plan identifies responsibilities for different city and state agencies including the NMC, MPCB, city Traffic department, National Highway Authorities of India, Nagpur Smart Cities department, Road Transport Office Nagpur, Maharashtra State Government Commissioner of Transport, and NEERI.²⁵ The actions suggested in the plan target reduction of pollution from vehicular emissions, suspended road dust, industrial operations, construction, solid waste management (trash, biomass, landfill burning), domestic fuel burning, diesel generator sets, and bakeries.

In 2017, Nagpur emerged as an EV innovation hub with ride-sharing firm Ola partnering with the city to launch a fleet of electric taxis. Though Ola's EV fleet in Nagpur was not a success, it provided the company valuable data insights on the challenges of promoting electric vehicles in the Indian market.²⁶ Building on this experience, Ola has tweaked its EV strategy to focus more on three-wheelers.

The Maharashtra State Electricity Distribution Co. Ltd (MSEDCL) is leading efforts to set up ten electric vehicles charging stations in the city. Each MSEDCL electric vehicle charging station will be set up at a cost of around 250,000 (~\$3,520). A vehicle would be charged completely in about 45-60 minutes at these stations.²⁷

RAIPUR

Raipur is the capital and largest city of Indian state Chhattisgarh, with a population of 1 million. Raipur is home to one of the biggest and largest steel markets in India and also one of the biggest industrial centres. Raipur has more than 200 steel mills and six steel plants. Apart from these industrial operations, the city also has aluminium, power generation, and coal industries.

Raipur ranked high on the list of cities with a high degree of air pollution in 2014 but has since dramatically reduced its particulate matter pollution over two consecutive years. The CPCB notes that in 2014, the average particulate matter level was 325 $\mu\text{g}/\text{m}^3$, compared to 190 $\mu\text{g}/\text{m}^3$ in 2015 and 150 $\mu\text{g}/\text{m}^3$ in 2016.²⁸

To improve the city's air quality, local authorities prepared an air pollution master plan. As part of this plan, ambient air quality monitoring stations were established at strategic locations that considered the location of industrial operations in the city and adjoining areas.

Continuous stack emission monitoring systems were installed in over 145 industries that fall under the 17 highly

polluting categories (identified by the CPCB) and 118 rolling mills while enforcing a legal restriction on particulate matter emission to less than 50 $\mu\text{g}/\text{m}^3$.

Furthermore, notices for closure were issued to ten industries and 40 rolling mill units in 2017 for violating environmental standards. Power was disconnected for several violators and notices were served to 163 others in non-compliance with Chhattisgarh Environment Conservation Board regulations.²⁹ These efforts are complemented by interventions taken to reduce emissions from vehicular sources, construction activities, burning of crop residue and biomass, and household waste burning.

NATIONAL CLEAN AIR PROGRAM (NCAP)³⁰

India launched a National Clean Air Program (NCAP) in January 2019. The NCAP lays out a roadmap to prevent, control, and reduce unhealthy air pollution. Specifically, the NCAP will expand the national air quality monitoring network, build capacity for air pollution management, and strengthen public awareness about the dangers of air pollution. The NCAP is a comprehensive strategy to bring down levels of deadly particle air pollution ($\text{PM}_{2.5}$ and PM_{10}) by 20-30% by 2024 (compared to 2017 levels). Initially launched as a five-year action plan, the NCAP may be further extended after a mid-term progress review.

The approach for NCAP includes collaborative, cross-sectoral coordination amongst the relevant central ministries, state governments, and cities. It aims to leverage existing policies and programs including the National Action Plan on Climate Change and other central government efforts to mitigate climate change.

The NCAP brings increased focus on local actions to reduce air pollution by requiring action plans from 102 non-

attainment cities that currently exceed national air standards. The Smart Cities Program will be leveraged to launch the NCAP in the 43 smart cities that are amongst the overall 102 non-attainment cities.

Similar to India's climate change mitigation efforts, the NCAP will be institutionalized by respective ministries. Inter-sectoral groups will be organized comprised of relevant ministries and experts from the industry, academia, and civil society. The plan provides an institutional framework at centre and state levels (comprised of an Apex Committee at the Ministry of Environment, Forest and Climate Change in the Centre and at the Chief Secretary Level in the states) to drive implementation of the NCAP.

The program will further partner with multilateral and bilateral international organizations, philanthropic foundations, and leading technical institutions to achieve its goals.



Resuspended dust contributes to air pollution in Indian cities

Photo: © IIPH-G

SOLUTIONS FOR CITIES

There are a host of actions cities can take to address rising air pollution levels in India, and the National Clean Air Plan highlights a number of solutions that local authorities can implement. The United Nations Environment Programme (UNEP) has also endorsed a list of such actions that cities can take in its report. The list provided below is excerpted from Table A of UNEP's 2019 report, *Air Pollution in Asia and the Pacific: Science-based Solutions*.³¹ These solutions include:

1. Post-combustion controls: Introduce state-of-the-art end-of-pipe measures to reduce sulphur dioxide, nitrogen oxides and particulate emissions at power stations and in large-scale industry
2. Vehicle inspection and maintenance: Enforce mandatory checks and repairs for vehicles
3. Dust control: Suppress construction and road dust; increase green areas
4. Agricultural crop residue: Manage agricultural residues, including strict enforcement of bans on open burning
5. Residential waste burning: Strictly enforce bans on open burning of household waste
6. Clean cooking and heating: Use clean fuels – electricity, natural gas, liquefied petroleum gas (LPG) in cities, and LPG and advanced biomass cooking and heating stoves in rural areas; substitution of coal by briquettes
7. Renewables for power generation: Use incentives to foster extended use of wind, solar and hydro power for electricity generation and phase out the least efficient plants
8. Energy efficiency for households: Use incentives to improve the energy efficiency of household appliances, buildings, lighting, heating and cooling; encourage roof-top solar installations
9. Electric vehicles: Promote the use of electric vehicles
10. Improved public transport: Encourage a shift from private passenger vehicles to public transport
11. Solid waste management: Encourage centralized waste collection with source separation and treatment, including gas utilization
12. Wastewater treatment: Introduce well-managed two-stage treatment with biogas recovery

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Highlighted Resources:



Protecting Health from Increasing Air Pollution in Ahmedabad

www.nrdc.org/sites/default/files/ahmedabad_aqi_-_final.pdf



Ahmedabad Air Information and Response (AIR) Plan

www.nrdc.org/sites/default/files/ahmedabad_air_plan_feb_2017_final_pdf.pdf



Getting the Word Out: Health Risk Communication Strategies for Ahmedabad's AIR Plan

www.nrdc.org/sites/default/files/iec_issue_brief_2018_dec3.pdf



Development of Ahmedabad's Air Information and Response (AIR Plan) to Protect Public Health

www.mdpi.com/1660-4601/15/7/1460



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