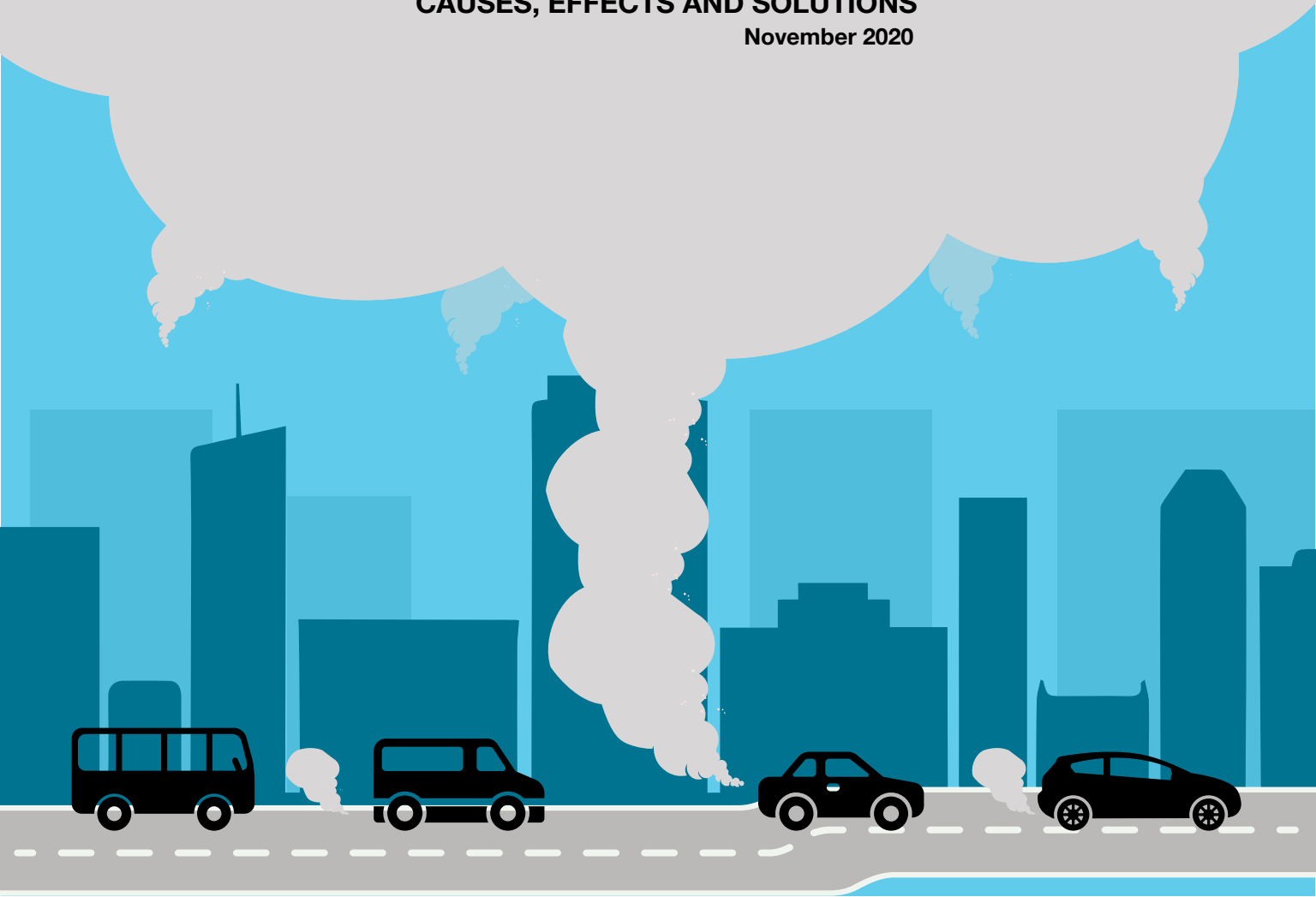




AIR POLLUTION IN GURUGRAM

CAUSES, EFFECTS AND SOLUTIONS

November 2020





Background

Air pollution is the cause for a serious environmental health crisis in India. It was the third leading risk factor for mortality in India in 2017 (after dietary risks & high BP). The exposure to outdoor particulate matter (PM) accounts for a loss of 1.5 years in life expectancy. Air pollution levels in India are among the highest in the world, which is responsible for 10% of the total disease burden in the country¹. It causes about 1.2 million premature deaths annually². Twenty-one of the world's 30 cities with the worst air pollution are in India, with 6 Indian cities being in the top 10 globally. There are currently 122 non-attainment cities in the country where the national ambient air quality standards are exceeded. In recent years, medium and small towns and cities have also witnessed an increase in pollution, thus getting reflected rapidly in the list of non-attainment cities of India.

Furthermore, since air pollution is not a localized phenomenon, the effect is felt in cities and towns far away from the source, thus creating the need for regional-level initiatives through inter-state and inter-city coordination in addition to multi-sectoral synchronization. Besides impacting the health of the citizens, air pollution also has impacts on agriculture, climate, buildings, and aesthetics- in terms of visibility.

In addition to being among the largest cause of mortality, it is also the major risk to cities for economy, work productivity, healthcare costs and tourism, among others. Some of the air pollutants are also climate-forcing agents responsible for near-term warming of the planet, thus forming a strong linkage between air pollution and climate change as well.

1 India State-Level Disease Burden Initiative Collaborators (Dandona et al., 2017) and ICMR, PHFI, and IHME (2017)

2 The Global Alliance on Health and Pollution (GAHP) 2019 metrics

Air Quality



In March 2019, Gurugram was again named the 7th most polluted city in the world by the IQAir Visual's 2019 World Air Quality Report

Gurugram is among the worst affected cities by air pollution. In 2018, it ranked number 1 as the most polluted city in IQAir AirVisual's 2018 World Air Quality Report³. In March 2019, Gurugram was again named the 7th most polluted city in the world by the IQAir Visual's 2019 World Air Quality Report⁴. Gurugram has four air quality monitoring stations at the following locations: NISE Gwal Pahari, TERI

Gram, Gurugram University in sector 51 and Vikas Sadan. These stations record ambient concentrations of various pollutants which are then used to arrive at an air quality index⁵.

While the data from these stations suggests that the level of both $PM_{2.5}$ and PM_{10} have been well above the prescribed standards, the levels have shown a slight decrease over the years⁶.

Recently, an air lab has been operational since October 2020 that monitors air-pollution data from 24 air-monitors located across the city. The Municipal Corporation of Gurugram (MCG) is working on individual action plans for reducing air-pollution at 14 hotspots across the city⁷.

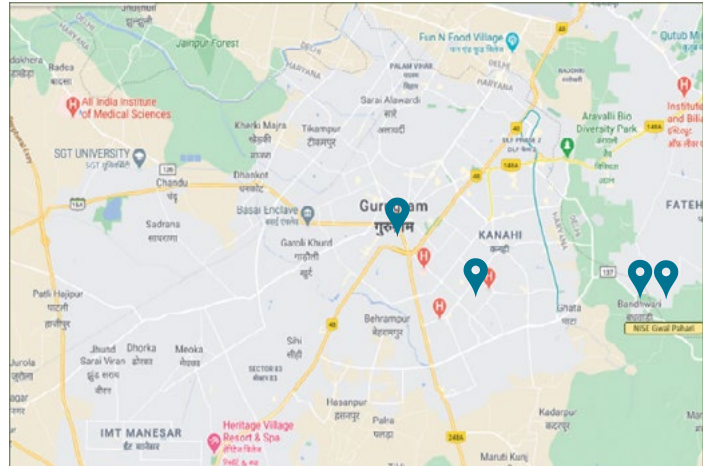


Figure 1 Air Pollution Monitoring Stations in Gurugram

3 <https://www.iqair.com/us/blog/press-releases/IQAir-AirVisual-2018-World-Air-Quality-Report-Reveals-Worlds-Most-Polluted-Cities>

4 <https://www.iqair.com/world-most-polluted-cities/world-air-quality-report-2019-en.pdf>

5 The National Ambient Air Quality Standards (NAAQS) lists 12 pollutants, namely, PM_{10} , $PM_{2.5}$, SO_2 , NO_2 , CO, NH_3 , Ozone, Lead, Benzene, Benzo-a Pyrene, Arsenic and Nickel. The Air Quality Index (AQI) helps put in a single number to 8 of these pollutants (except Benzene, Benzo-a Pyrene, Arsenic and Nickel) to convey the overall daily status of pollution to the citizens.

6 These are based on analysis of the data available at the site: <https://app.cpcbcr.com/ccr/#/caaqm-dashboard-all/caaqm-landing/data> Note: For 2020 the values are lower due to the impact of Covid restrictions and the fact that the data available are till monsoon season only. The values are likely to increase for full year.

7 <https://www.hindustantimes.com/gurugram/mcg-working-on-action-plan-for-14-most-polluted-areas-in-the-city/story-w63bEwEF1qnES4mCxsX9kK.html>

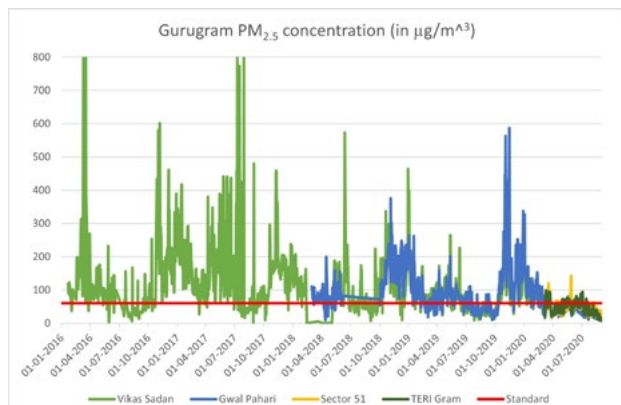


Figure 2 $PM_{2.5}$ Concentration (in $\mu\text{g}/\text{m}^3$) at different monitoring stations in Gurugram

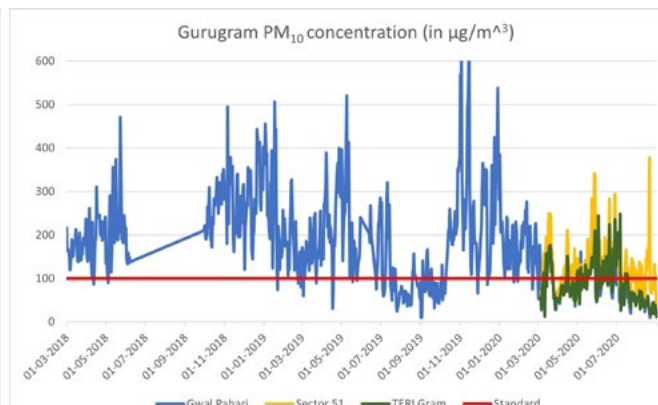


Figure 3 PM_{10} Concentration (in $\mu\text{g}/\text{m}^3$) at different monitoring stations in Gurugram

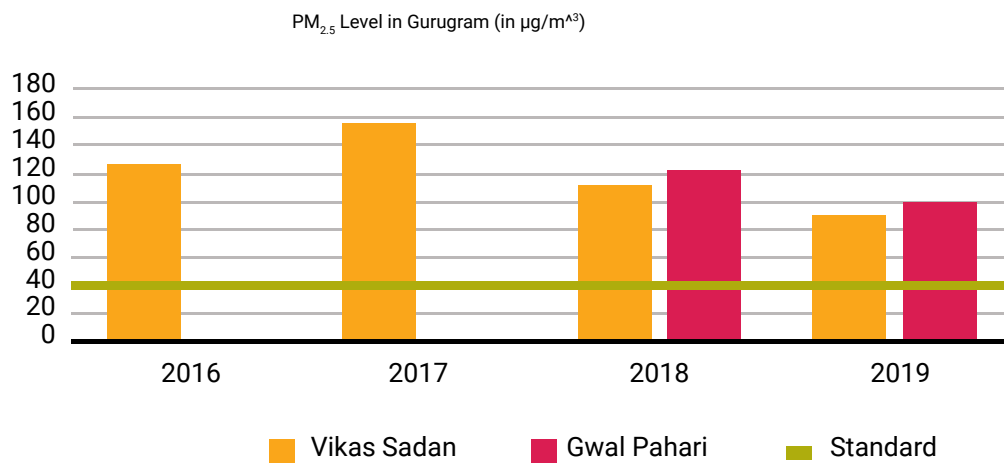


Figure 4 $PM_{2.5}$ Concentration (in $\mu\text{g}/\text{m}^3$) in Gurugram⁸

⁸ Data unavailable for other 2 locations and years



Health Impacts

It increases the risk of stroke, heart disease, chronic obstructive pulmonary disease, lung cancer and acute respiratory infections

Exposure to high levels of air pollution can have adverse impact on the health of the citizens. It increases the risk of stroke, heart disease, chronic obstructive pulmonary disease, lung cancer and acute respiratory infections. The impact varies with nature and concentration of pollutants, exposure, health and age of the receptor.

Air pollution also causes several mental health complications such as impairment of cognitive abilities⁹, increased risk of Dementia and adverse effect on the development of infants' brain¹⁰.

In addition, a recent study by Harvard University found that patterns in Covid-19 death rates generally mimic patterns in both high population density and high PM_{2.5} exposure areas. An increase of 1 µg/ m³ in PM_{2.5} is associated with an 8% increase in the COVID-19 death rate¹¹.

The AQLI report by University of Chicago's Energy Policy Institute in 2020 found that exposure to PM_{2.5} — the most prominent pollutant in the city air — is potentially reducing the lifespan of the average citizen in Gurugram by 8.8 years compared to 5.2 years as national average. Therefore, if PM_{2.5} was brought to a level under 10 µg/ m³ prescribed as WHO Guideline, the citizens could then potentially add 8.8 years to their lives. The report, titled 'Air Quality Life Index' also found that the average annual level of PM_{2.5} in the city increased by 41µg/ m³ between 1998 and 2016, which experts said is alarming compared to the national average rise of 22.1µg/ m³ recorded during the same period.

9 Zhang, Xin & Chen, Xi & Zhang, Xiaobo. (2018). The impact of exposure to air pollution on cognitive performance. Proceedings of the National Academy of Sciences. 115. 201809474. 10.1073/pnas.1809474115.

10 <https://www.unicef.org/press-releases/babies-breathe-toxic-air-south-asia>

11 <https://projects.iq.harvard.edu/covid-pm>

PM _{2.5}	Contains fine particles, secondary aerosols, combustion particles, re-condensed organic metallic vapour, and acid components Can reach all the way down to the alveoli in the lungs	Can be inhaled through respiration by human body; Cross into the arteries, hardening them; Exposure results in coronary heart ailments
PM ₁₀	The dust from roads and industries, as well as particles formed during combustion	Depending on their size, coarse particles can lodge in the trachea (upper throat) or in the bronchi and typically contribute to allergic reactions and respiratory diseases, as well as impact general wellbeing ¹²

Comparison of PM_{2.5} and PM₁₀



Figure 5 Comparison of PM_{2.5} and PM₁₀

¹² Source: Fixing Delhi's Pollution, Indicus Foundation, version: November 15, 2017



Air Pollution Sources

The typical sources of air pollution involve emissions from vehicles, industries, thermal power plants, DG sets, residential sources, among others. In Gurugram, other sources contributing to air pollution are the construction activities, road dust, waste combustion, and seasonal stubble burning. Increasing dust from the Thar desert due to ongoing destruction of Aravalli range is also a concern.

Vehicles: The limited public transport options in Gurugram result in high vehicle ownership and pollution. The city has one of the highest vehicle ownership rates in the country – i.e. 323 cars per 1,000 people, which is higher than in Delhi (88 cars per 1000 people). In Gurugram, 43 per cent of the households own two-wheelers and 33 per cent own cars. Bus numbers have not increased appreciably in the city and are 50 per cent less than the service level benchmark of 60 buses per lakh population (it was 31 per lakh in 2014-15)¹³.

Diesel generator sets: Haryana government authorities estimate that, at present, more than 14,000 diesel generator sets are running in Gurugram (2019). Besides shopping malls, markets and offices, thousands of residential apartments run on diesel generators as well. A study by Centre for Science and Environment (CSE) in 2018 reported that the use of diesel generator sets increases the level of $PM_{2.5}$ and PM_{10} in Gurugram by 30 percent.

Though Gurugram lacks a dedicated source apportionment study to determine the exact levels of pollution caused by various sources, some studies covering the entire NCR region have estimated the sectoral shares in pollution at various town in NCR, including Gurugram. The ARAI and TERI report (August, 2018) estimated the sectoral shares in $PM_{2.5}$ and PM pollution during summer and winter season based on dispersion and receptor modelling techniques. The major sources considered were vehicles, dust (road, and construction, and soil dust), industries, biomass, and others (DG sets, refuse burning, landfills, etc).

¹³ Anumita Roychowdhury and Shubhra Puri 2017, Gurugram: A framework for sustainable development, Centre for Science and Environment, New Delhi



Figure 6 Sectoral Share estimated by Dispersion Modelling and Receptor Modelling. Source: ARAI and TERI (August 2018) Report No. ARAI/16-17/DHI-SA-NCR/Final Report.

The above study indicates that the contribution of transport sector to PM_{2.5} and PM₁₀ pollution is in the range of 16-27% and 14-23%, respectively; while that of the industry sector is 13-30% and 13-26%, respectively. However, the contribution of dust to PM_{2.5} and PM₁₀ pollution is higher and it is in the range of 20-49% and 23-52%, respectively. The remaining contribution comes from residential and other sources. This clearly indicates the need to have a multi-sectoral approach in order to address air pollution in Gurugram.





Impact of Lockdown on Gurugram Air Quality

A report released by CPCB ¹⁴ studied the impact of lockdown on ambient air quality in Delhi and NCR towns. During the lockdown, based on the Air Quality Index data, the overall air quality had improved in Gurugram, which is proven by the fact that there were no severe, very poor or poor air quality days in the period.

NO₂ and SO₂ levels remained below the National Ambient Air Quality standards (NAAQS) on all days during the lockdown, while PM_{2.5} and PM₁₀ levels were within NAAQS on 38 and 29 days in the 40-day lockdown period. The reduction in PM₁₀ levels are higher as compared to PM_{2.5} levels, when compared against the respective pre-lockdown value. The study also points out that it is likely that road dust resuspension due to vehicle restrictions might have come down resulting in lower particulate emissions with 39% and 41% reduction in 24 hourly PM_{2.5} and PM₁₀ levels during lockdown Phase-I but was only 26% and 34% for 24 hourly PM_{2.5} and PM₁₀ respectively in lockdown phase-II. The reduced impact, in all likelihood, may be due to the onset of dry and windy conditions. 24 hourly NO₂ levels reduced by 45% during both phases of lockdown, as compared to pre-lockdown levels. While SO₂ levels increased in the first phase by 34%, it decreased by 21% during the second phase of lockdown, as compared to pre-lockdown levels.

According to the report, a 61% reduction in PM₁₀ levels was observed during the first phase of lockdown in Gurugram as compared to 2019 levels due to likely decrease in dust generating activities. Likewise, the second phase of the lockdown too showed an over 60% decrease in PM₁₀ levels compared to 2019 levels. However, the NO₂ levels increased during phase –I of lockdown and decreased only by 20% during the second phase of lockdown compared to levels during same period in 2019. Gurugram also showed an increase in SO₂ levels, which the report attributes to the proximity of thermal power plants. It may also be noted that the monitoring network has increased from 2 stations in 2019 to 4 stations in 2020, leading to better spatial coverage.

¹⁴ A Report on impact of lockdown on ambient air quality, CPCB, September 2020

Air Pollution and Climate Change

The main sources of CO₂ emissions – the extraction and burning of fossil fuels – are not only key drivers of climate change, but also major sources of air pollutants. Furthermore, many air pollutants that are harmful to human health and ecosystems also contribute to climate change by affecting the amount of incoming sunlight that is reflected or absorbed by the atmosphere, with some pollutants warming and others cooling the Earth. These so-called short-lived climate-forcing pollutants (SLCPs) include black carbon, methane, ground-level ozone, and sulfate aerosols. They have significant impacts on the climate; black carbon and methane in particular are among the top contributors to global warming after CO₂.

Climate change is set to increase the amount of ground-level ozone and fine particle pollution we breathe. Less rain and more heat means this pollution will stay in the air for longer, creating more health problems.

Climate change and air pollution tend to be addressed independently; the former focusing on reductions in CO₂ within the international and national arena and the latter focusing on actions to improve air quality locally. Yet, developing integrated strategies that target both of these issues could have benefits for human health, ecosystems and the climate, while reducing associated administrative and implementation costs.

Moreover, it may also be noted that people engage more with issues that affect their local environment and their personal health. Air pollution affects all sections of society, which can generate the political will to address air pollution with the added benefit of mitigating climate change.





Actions to Control Air Pollution

Gurugram, being a part of the NCR region, is covered under various action plans and regulations notified by the Central and State government. These help in the rollout of the broader macro initiatives across various sectors in terms of the technology improvements, cleaner fuel options, as well as banning of certain polluting activities. In addition, the local authorities such as the Municipal Corporation, Traffic Department, Pollution Control Board have a significant role in terms of prevention and control of pollution at the city level.

Some of the action plans/programs that help in addressing air pollution are as follows:

- **NCAP (National Clean Air Program):** Launched by MoEFCC as pan India time bound strategy to tackle pollution with National level target of 20-30% reduction of $PM_{2.5}$ and PM_{10} concentration by 2024, compared to 2017 levels. The objective is to develop comprehensive management plan for prevention, control and abatement of air pollution in addition to augmenting air quality monitoring network. Under NCAP, city specific air pollution abatement action plan for non- attainment cities will be developed, however Gurugram is not part of this list.
- The Graded Response Action Plan (GRAP) has been notified in 2017¹⁵ for emergency action during high pollution periods. It enlists measures such as prohibition on entry of trucks into Delhi, ban on construction activities, introduction of odd and even scheme for private vehicles, shutting of schools, closure of brick kilns, hot mix plants and stone crushers, ban on diesel generator sets, garbage burning in landfills and plying of visibly polluting vehicles etc. The nature, scope and rigour of measures to be taken is linked to levels of pollution viz. severe + or emergency, severe, very poor, moderate to poor and moderate, after due consideration by authorities concerned.
- The Central Government had entrusted the task of implementation of GRAP in the NCR region to the Environment Pollution (Prevention and Control) Authority (EPCA). EPCA was a supreme court mandated body notified in 1998 with the objective of 'protecting and improving' the quality of the environment and 'controlling environmental pollution' in the National Capital Region. EPCA worked on Comprehensive Action Plan (CAP) which lists medium and long-term actions for all pollution sources for Delhi and NCR. Under a recent ordinance released by the Central government, a Commission for Air Quality Management in National Capital Region and Adjoining areas has been set up. The commission has replaced EPCA and other executive panels to streamline

¹⁵ http://cpcebenvi.nic.in/pdf/final_graded_table.pdf

public participation, inter-state co-operation, expert involvement and persistent research and innovation. It has members from all NCR states, the Central Pollution Control Board; Indian Space Research Organisation, NITI Aayog, and NGOs. The commission has powers to take decisions and act against pollution sources under various environmental laws, like the environment protection act and air act.

- **Ban on Pet-coke and Furnace Oil:** The Supreme Court banned the use of Petroleum Coke (pet coke) and Furnace Oil (FO) for combustion in 2017 in Delhi, Haryana, Rajasthan and Uttar Pradesh.
- **Standards for NO_x and SO_x:** Supreme Court directed the Ministry of Environment, Forest and Climate Change (MoEF&CC) and the Central Pollution Control Board (CPCB) on May 2, 2017 to fix and implement national SO_x and NO_x emission standards for 34 industries by December 31, 2017. However, stringent implementation and enforcement of these standards using continuous emission monitoring systems (CEMS) are lacking.¹⁶
- Gurugram has signed up for Centre's Cycles4Change Challenge. The India Cycles4Change Challenge is an initiative of the Smart Cities Mission, Ministry of Housing and Urban Affairs, Government of India to inspire and support Indian cities to quickly implement cycling-friendly initiatives in response to COVID-19. The Challenge aims to help cities connect with their citizens as well as experts to develop a unified vision and initiatives to promote cycling.
- To deal with the problem of pollution a sum of 1200 crore is provided in budget over two years (2018-2020) by the central government for action on crop residue burning in identified 113 districts in Haryana, Punjab and Uttar Pradesh. The policy promises to minimise the practice of crop burning with an aim to end it permanently. Under the scheme, the government will provide a subsidy on the purchase of different types of farming machines. Two control rooms will be set up by the state government in Gurugram and Faridabad districts for controlling air pollution in winter ¹⁷. The citizens will be able to contact them directly for problems and complaints related to increasing pollution levels.
- Recently in October 2020, the district administration of Gurugram has prepared an action plan to combat air pollution. All the concerned departments and agencies have been directed to keep a tab on violations. Municipal Corporation Gurugram (MCG) and Haryana State Pollution Control Board (HSPCB) offices will form separate teams for checking to implement the action plan, with special attention to waste burning and identified hotspots of air pollution.

16 AIR POLLUTION REPORT CARD 2018, EPCA, CSE

17 <https://swachhindia.ndtv.com/gurugram-faridabad-to-have-pollution-control-rooms-functioning-round-the-clock-51749/>



Combating Air Pollution – Action by Different Stakeholders

Government agencies:

- Implementation of a city specific time bound action plan to control air pollution. Appropriate scientific inputs including source apportionment studies should feed into the plan. Accordingly, commissioning of source apportionment study for better identification of the sources of air pollution and planning of mitigation actions should be undertaken. The roles and responsibilities of different agencies should be clearly delineated and adequate resource allocation provisions made. Further, based on an air shed approach, while the local sources in Gurugram certainly need to be addressed on a priority basis, simultaneously, an action plan to tackle the regional sources needs to be devised in cooperation with the neighbouring states.¹⁸
- **Data monitoring and dissemination:** Increase number of monitoring stations for more reliable data for policymaking. Its timely availability and dissemination to citizens must be ensured
- Introduction of advanced emissions standards in industries, including focus on ensuring monitoring and compliance.
- Ensure improved power reliability in urban areas to eliminate the operation of DG sets. Evolve standards and norms for in-use DG sets. Use of retrofitted emission-control equipment and promoting shift to gas based generators.
- While BS-VI emission norms have been rolled out for new vehicles from April 2020 onwards, stringent inspection and maintenance programs, including PUC checks should be undertaken for the existing fleet of vehicles. Special focus on regulation of light- and heavy-duty diesel vehicles and ensuring strict action against visibly polluting vehicles. Introduction of a scrapping policy and ensuring fleet modernisation would also be helpful.
- Strengthening of public transport network, promotion of shared mobility and boosting last-mile connectivity. Also, introduction of an e-vehicle policy to promote faster adoption of battery operated electric vehicles and strengthening of the charging infrastructure needs to be undertaken.
- Introduction of early alarm system related to traffic congestion on major routes for route diversion for the benefit of commuters.

¹⁸ Breathe India: An action plan for combating air pollution, NITI Aayog, 2018



- Encouraging flexi/staggered timings to minimize peak movement of vehicles on the road. Introduction of low and zero emission zones with congestion charges.
- Urban planning and design to be centered around public transport and non-motorised transport (footpaths/cycle tracks)
- Stringent implementation of Construction and Demolition (C&D) Rules, 2016, and Dust Mitigation Notification, 2018, of the Government of India.
- Proper maintenance of roads and greening of roadside areas and open spaces, while mandating wall-to-wall paving of roads. Emphasis on mechanised sweeping machines for regular cleaning of roads to reduce dust and, creation of green buffers along the traffic corridors.
- Stringent control of dust from construction activities using enclosures, dust screens, fogging machines, water spraying, etc.
- Management of agricultural residues, including strict enforcement of bans on open burning.

Industry/ Corporates:

- Introduction of state-of-the-art air pollution control measures and promoting switch to cleaner technology and clean fuels such as CNG, where possible.¹⁹
- Reduce emissions by making changes to manufacturing processes and heating/cooling equipments. Reducing vehicle miles travelled, purchasing environmental friendly supplies, and improving energy efficiency can also prove to be effective in emission reduction.
- Promotion of car-pooling options to reduce the use of individual vehicles. Adoption of electric-car fleets for transportation.
- Encourage behavioural change in employees by educating them regarding air pollution and mitigation actions that they can undertake to address the challenges.
- Enhanced adoption of renewable energy (rooftop solar, biogas, etc) and energy efficiency measures. Also, procurement of renewable energy should be encouraged.
- Adopting cleaner construction practices.
- Support the scaling up of new and innovative technologies for addressing air pollution and climate change.

19 UNEP (2018). Air Pollution in Asia and the Pacific: Science-based Solutions



- Help in the monitoring and sharing of air quality data with the citizens in their respective areas, besides being an important stakeholder in the implementation of the city specific AQM plan.
- Build coalitions and partnerships between corporates to take joint action in addition to individual measures.

Citizens/RWAs:

- Shift from private passenger vehicles to public transport. Explore options for shared mobility (car pooling) and non-motorised transport such as walking and cycling.
- Ensure proper vehicle maintenance and timely PUC checks. Avoid prolong idling and turning off engines at red traffic signals. In addition to above, minimise travel during severe or very poor AQI.
- Adopt renewable energy such as rooftop solar, use energy efficient appliances and avoid wastage of energy.
- Adopt electric vehicles.
- Segregate waste for proper management to reduce burning.
- Promote tree plantation and greening of open areas.
- Build public pressure on authorities to implement a time bound action plan for control of pollution.

The Way Forward

Moving forward, a multi-pronged strategy along with a time bound action plan is required, covering a range of interventions – both short and long term. Multiple aspects - related to policy/regulations/ technological interventions/capacity building /and awareness raising – have to be covered. The success would depend on the timely implementation of the action plan – that encompasses contributions from multiple stakeholders; everyone has to chip in with their contributions. Finally, the air quality management plan for the city has to be dynamic and account for the changing profile of the city over the years.





Why we are here

To stop the degradation of the planet's natural environment and to build a future in which humans live in harmony with nature.

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