



BREATHING ON THE BRINK: DELHI'S 2024 BATTLE AGAINST AIR POLLUTION

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Delhi, the heart of India, continues to grapple with one of its most critical urban challenges: air pollution. As 2024 unfolds, the issue remains a pressing concern, particularly during the winter months when the city experiences some of its worst air quality levels. Known for its vibrant culture and historical significance, Delhi now finds itself battling a grim environmental crisis, with air pollution posing severe risks to public health and overall quality of life. The Graded Response Action Plan (GRAP), a structured framework implemented in recent years, stands at the forefront of efforts to combat this issue.

The roots of Delhi's air pollution crisis are deep and multifaceted. Rapid urbanization, increasing vehicular emissions, and unchecked construction activities are significant contributors to the city's declining air quality. In 2024, these challenges are compounded by the annual phenomenon of stubble burning in neighboring states like Punjab and Haryana. The practice, driven by socio-economic constraints, releases enormous quantities of pollutants into the air, which, combined with Delhi's local emissions, creates a hazardous mix.

This situation worsens during the winter, when atmospheric inversion traps pollutants near the surface, resulting in a thick, choking smog over the city.

To address these challenges, the GRAP was introduced as a policy intervention in 2017 and continues to evolve. Designed to counter air pollution based on its severity, the GRAP categorizes pollution levels into stages—moderate, poor, very poor, severe, and emergency—and prescribes specific actions for each. In 2024, the plan remains a cornerstone of Delhi's strategy to mitigate air pollution during the critical winter months.

The GRAP's measures include controlling construction dust, restricting diesel generator use, and implementing odd-even vehicular restrictions during periods of high pollution. For severe pollution levels, more drastic steps, such as halting industrial operations and closing schools, are outlined. This tiered response ensures that actions are proportional to the severity of pollution, aiming to protect public health while minimizing economic disruptions.

However, the implementation of GRAP in 2024 continues to face challenges. Ensuring compliance across a sprawling metropolis like Delhi requires substantial resources, coordination, and public cooperation. The enforcement of construction bans, for instance, often reveals gaps in monitoring and accountability. Similarly, the success of vehicular restrictions depends heavily on the availability and efficiency of public transportation, an area where improvements are ongoing but far from adequate.

Another challenge lies in the transboundary nature of pollution. Delhi's air quality is influenced significantly by emissions from surrounding regions. Despite intensified efforts in 2024 to address stubble burning through subsidies and awareness campaigns, the practice remains widespread, driven by economic pressures on farmers. This interdependency highlights the need for collaborative efforts across state boundaries, involving both local governments and central authorities.

In 2024, authorities have taken proactive steps to strengthen GRAP's implementation. The plan was activated earlier than usual this year, reflecting a recognition of the worsening trends in air quality. Enhanced measures such as deploying anti-smog guns, using water sprinklers to control dust, and expanding real-time monitoring of industrial emissions are being prioritized. The establishment of "Green War Rooms" to track pollution levels and coordinate responses in real time has added a layer of efficiency to the system. Additionally, public awareness campaigns encouraging citizens to adopt eco-friendly practices, like carpooling and avoiding waste burning, have been ramped up. Public participation remains pivotal to the success of GRAP. While government policies provide the framework, individual behavioral changes can significantly amplify their impact. In 2024, initiatives encouraging citizens to embrace sustainable lifestyles, such as reducing reliance on private vehicles and supporting afforestation efforts, are gaining momentum.

Schools and colleges are also playing a role by integrating environmental education into their curricula, fostering awareness among the younger generation.

Technological solutions are emerging as another dimension of Delhi's fight against air pollution. Large-scale air purifiers, including smog towers, have been deployed at key locations in the city. However, experts caution that such interventions address symptoms rather than root causes. The real solution lies in reducing emissions at their source, which requires a long-term commitment to clean energy, sustainable urban planning, and stricter industrial regulations.



2024 has also seen increased emphasis on public health as an integral aspect of combating air pollution. The harmful effects of prolonged exposure to polluted air are well-documented, ranging from respiratory illnesses to cardiovascular diseases. The city's healthcare infrastructure is being strengthened to better diagnose and treat pollution-related ailments, particularly for vulnerable groups like children and the elderly.

Despite the challenges, 2024 offers glimpses of hope through collective efforts and policy advancements. Delhi is a focal point of the National Clean Air Programme (NCAP), which aims to reduce particulate matter levels across Indian cities. Increased funding, research, and policy innovations under this program complement GRAP's short-term measures, laying the groundwork for a sustainable future.

However, the road ahead requires a comprehensive approach that extends beyond reactive measures like GRAP. Proactive strategies must prioritize green infrastructure, renewable energy, and sustainable transportation. Collaboration between states to address transboundary pollution and promote alternative farming practices is also crucial. Furthermore, public engagement must move beyond compliance to active participation, with citizens becoming stakeholders in Delhi's journey toward clean air.


As 2024 draws attention to the urgent need for climate action globally, Delhi's air pollution crisis serves as a stark reminder of the challenges faced by rapidly urbanizing cities. The city's struggle is emblematic of the broader environmental challenges confronting India and the world. However, it also represents an opportunity—a chance to demonstrate that collective will, innovative policies, and sustainable practices can transform even the most daunting crises into stories of resilience and renewal.

The fight for clean air in Delhi is not just an environmental imperative; it is a moral and societal responsibility. Protecting the health and well-being of millions of residents and ensuring the city's livability for future generations depend on the actions taken today. The challenges of 2024 must be met with urgency, resolve, and a commitment to building a cleaner, healthier Delhi for all.

Ambient PM_{2.5} in Delhi and their Health Effects

LEVELS OF PM_{2.5} IN AMBIENT AIR

Before Lockdown (October 2019)	Human Figure	After Lockdown (September 2020)
PM_{2.5} : 145±46 µg/m³		PM_{2.5} : 88±42 µg/m³
Laxmi Nagar 146±37 µg/m ³		Laxmi Nagar 89±39 µg/m ³
Mayur Vihar III 139±47 µg/m ³		Mayur Vihar III 87±35 µg/m ³
Dilshad Garden 150±53 µg/m ³		Dilshad Garden 87±52 µg/m ³

HEALTH EFFECTS OF PM_{2.5}

Eye Disease

- Dry eye
- Corneal irritation

Respiratory Disorder

- Lung disorder
- Bronchitis
- Lung emphysema

Cancer

- Various organ carcinogenesis

Digestive Disorder

- Bowel blockage

Circulatory Disease

- High blood pressure
- Ischemic arrhythmia
- Heart failure
- Arterial stiffening
- Blocked blood vessel

Allergy

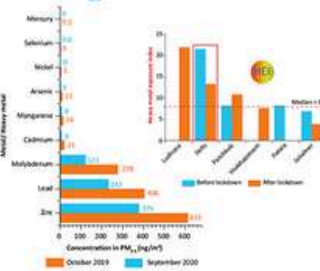
- Various kinds

HEAVY METALS IN PM_{2.5} AND RESPIRATORY SYMPTOMS

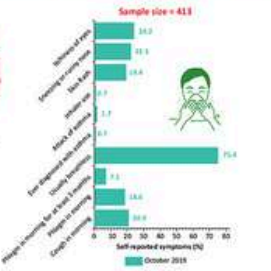
Adverse Health Effects

Cadmium	Lung cancer, kidney and bone damage
Arsenic	Respiratory and vascular diseases, hypertension, diabetes, skin diseases
Nickel	Skin and respiratory diseases, lung and nasal cancers
Lead	Affects nervous, kidney, immune, reproductive, and cardiovascular systems
Chromium	Cancer of respiratory tract
Copper	Affects brain development
Zinc	Fever, nausea, and aching

Metals in PM_{2.5}



Respiratory Symptoms in Children (11 – 17 years)



SOURCES OF PM_{2.5} POLLUTION


Landfill fire


Road dust


Agricultural burning


Automobile exhaust


Solid waste burning


Industries


Household cooking


Old truck

INTERVENTIONS

Road Dust Control  Regular and efficient road sweeping  Road maintenance on annual basis	Vehicular Exhaust Control  Odd-even Scheme  Safe and affordable Public transport  E-vehicles in city area	Solid Waste Management  Integrated approach for solid waste management  Ban on refuse burning	Crop Residues  Waste to energy options: Bio-CNG from paddy straw  Happy seeder for rice residue management	Industrial Pollution  Clean fuel use  Real-time AQ monitoring  Track PM _{2.5} - Heavy metals  Track health effects
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