POLLUTION KA SOLUTION

NEXT STEPS FOR CLEAN AIR IN DELHI

EXPERT RECOMMENDATIONS SUPPORTED BY
CHINTAN ENVIRONMENTAL RESEARCH AND ACTION GROUP

JUNE 2025

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About Chintan Environmental Research and Action Group

Chintan is a non-profit organization that works in the areas of circularity and waste, air pollution and climate change. Using collaborations with diverse stakeholders and evidence-based action, Chintan applies its Lives-Livelihoods-Leadership framework to seek environmental solutions that simultaneously address inequity and poverty, especially for women and children, who are at the centre of its work.

About this Report

This report is grounded in insights from a multi-stakeholder roundtable held on May 21, 2025, convened by Chintan Environmental Research and Action Group in collaboration with the High Commission of Canada in India. The roundtable brought together policymakers, public health experts, scientists, urban planners, and civil society representatives to co-develop actionable strategies for improving Delhi's air quality.

The recommendations herein reflect the collaborative spirit of the dialogue, aiming to support the Government of Delhi in strengthening cross-sectoral coordination, enhancing institutional capacity, and centering people in implementation.

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Executive Summary

DELHI'S AIR POLLUTION remains a pressing public health and environmental crisis. In 2024, the capital city recorded an annual average particulate matter 2.5 (PM2.5) concentration of 105 μg/m³—over twice the permissible Indian standard and more than ten times the World Health Organization (WHO) 2021 air quality guidelines. Despite an expanding portfolio of policy measures and technological interventions, Delhi continues to experience prolonged periods of hazardous air quality. This report identifies a few actions that are likely to have optimal outcomes to change this scenario and meet the relevant standards. It aims to support the Delhi government and its partners in translating these recommendations into on-ground action that delivers cleaner air for all.

Based on both a roundtable discussion on May 21, 2025, co-hosted by the High Commission of Canada in India and Chintan Environmental Research and Action Group, as well as prior work of several attendees and policies, plans and approaches of the Union Government, *Pollution Ka Solution* identifies actionable steps for improved air quality.

The roundtable brought together experts with expertise in public health, environmental policy, air quality science, law, climate communication, and citizen engagement. The goal was to move beyond diagnosis and catalyse targeted, practical interventions, grounded in science, informed by equity, and structured for implementation.

The urgency is underscored by findings in Chintan's 2023 UNfAIR Quality study. This revealed severe health impacts on some of the city's most vulnerable populations. Over 75% of outdoor workers surveyed- waste pickers, safai karamcharis (municipal sweepers) and security guards- were found to have abnormal lung function. The study also showed that women in these occupations experience greater respiratory impairment than men, adding a layer of gendered vulnerability. Women wastepickers were 3.9 times more likely than males to have a respiratory disease, while women safai karamcharis were 6 times more likely to have deteriorated lungs. Another citizen survey in 2024 by Chintan, across low-income settlements in Delhi-NCR, revealed only 10% were familiar with terms like AQI and PM2.5. This disconnect renders citizens' action even more challenging.

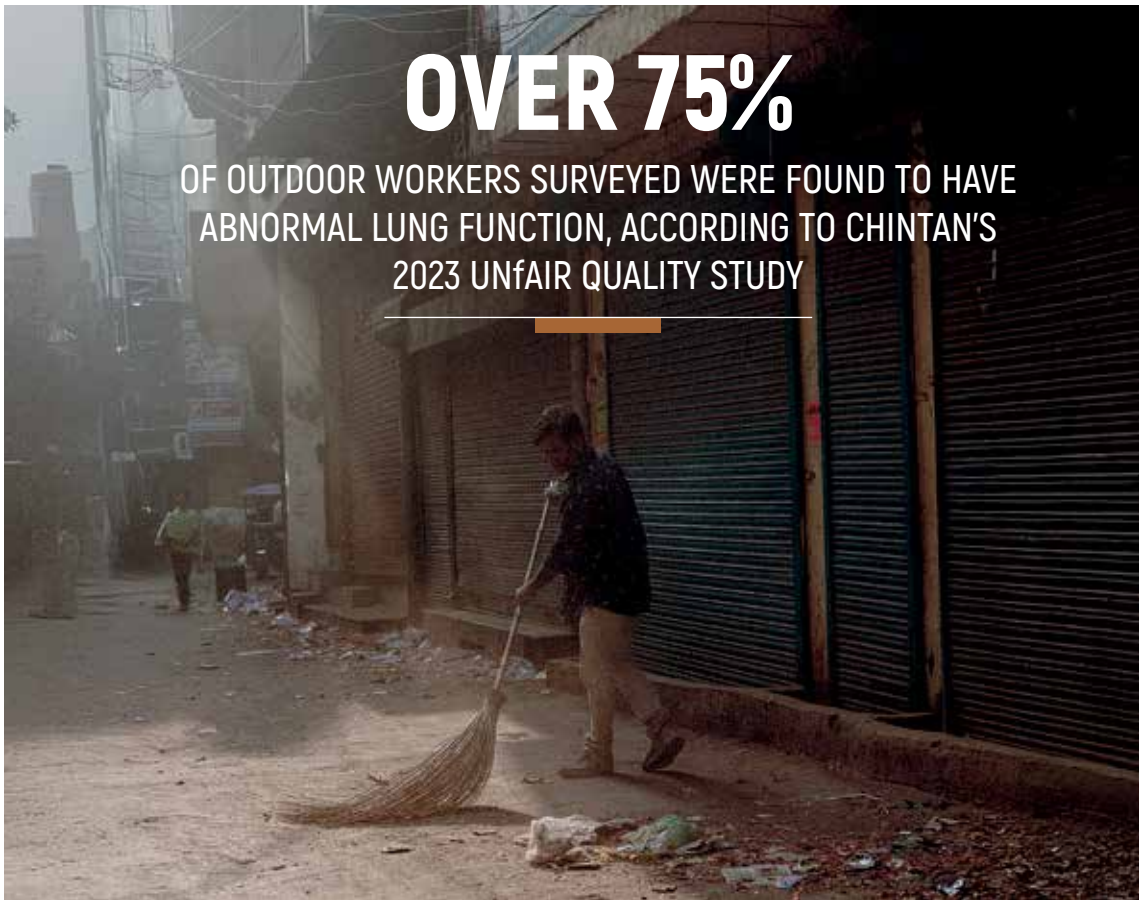
This report makes five interlinked recommendations:

1. ONE AIRSHED-ONE AGENCY: Establishment of a dedicated, inter-agency nodal body empowered to coordinate air quality action across the Delhi-NCR airshed.

Outcome: Unified and cohesive air quality governance, able to deliver in Mission Mode.

2. CENTRAL FOCUS ON PARTICULATE MATTER (PM) 2.5: Mandate focus of all pollution-control policies, on PM2.5 and other finer pollutants and gases.

Outcome: Integrated approach. Reduction of most lethal pollutants, improvement of human health.



3. STRENGTHENING TECHNICAL CAPACITY: Enable Technical Expert Advisory panels for all pollution-abatement and Urban Local Bodies (ULBs) including budgets, staff, and support structures for these. The role of these must be monitored for optimal results.

Outcome: Strengthened institutions with tools and targets.

4. PUBLIC HEALTH COMMUNICATIONS: Create air quality communications cell with media, science, and health professionals to create de-jargonised, multilingual content. Basic action points should be included including for ULBs, offices, schools and neighbourhoods.

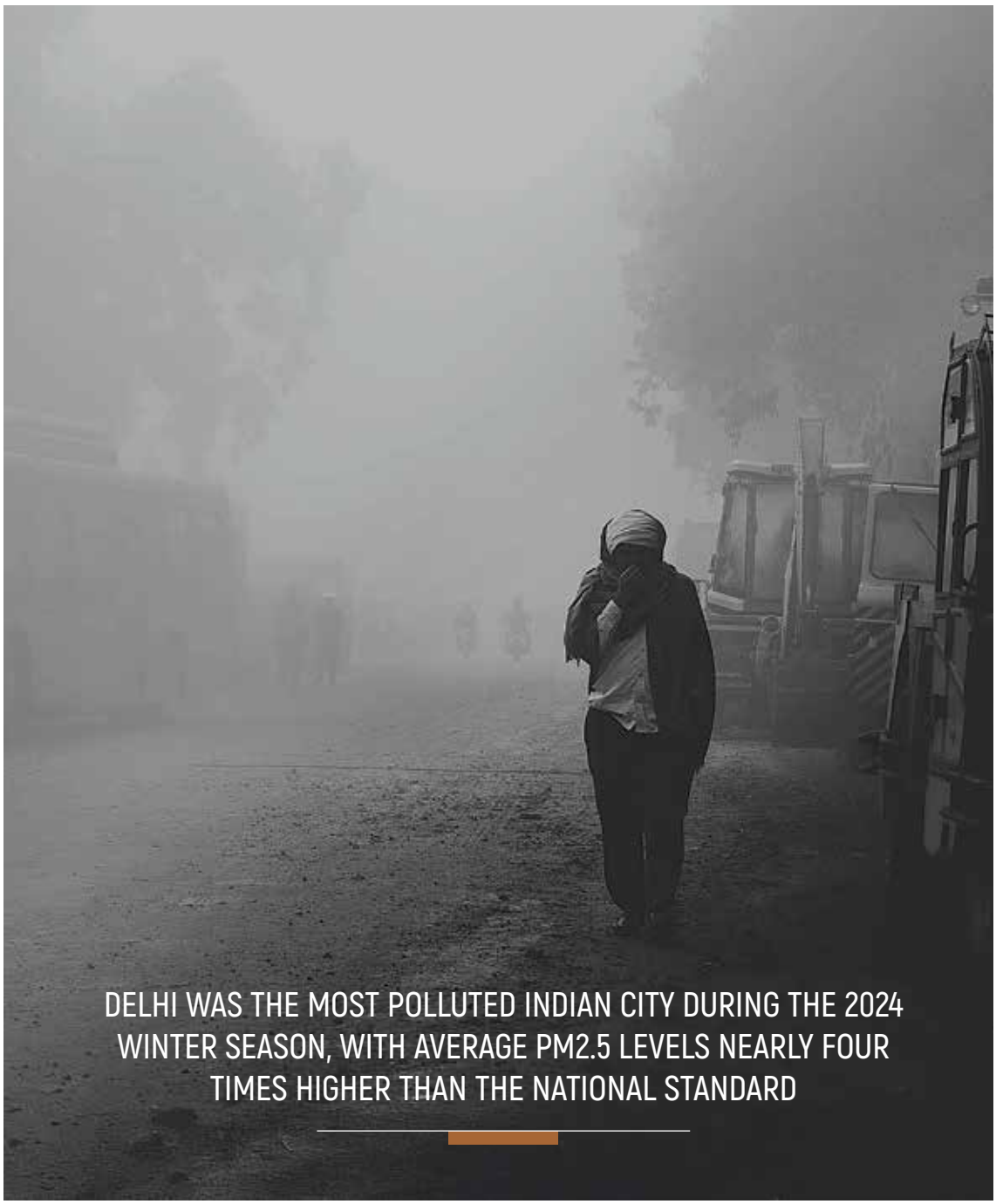
Outcome: Alert the public, especially vulnerable groups, with knowledge creation, and dos and don'ts in the relevant context.

5. NEIGHBOURHOOD MONITORING: Roll out a low-cost monitoring network for real-time hyperlocal action to reduce sources and levels of pollution.

Outcome: Quick local response for targeted and effective action.

Together, these recommendations offer a pragmatic and scalable pathway for Delhi to address air pollution in a way that prioritises public health, institutional accountability, and environmental equity. ◻

1. Introduction and Overview



DELHI WAS THE MOST POLLUTED INDIAN CITY DURING THE 2024 WINTER SEASON, WITH AVERAGE PM2.5 LEVELS NEARLY FOUR TIMES HIGHER THAN THE NATIONAL STANDARD

DELHI CONTINUES TO grapple with a persistent air pollution crisis that endangers public health, weakens economic productivity, and undermines environmental resilience. In 2024, the city recorded an annual average PM2.5 concentration of 105 µg/m³, more than double the Indian National Ambient Air Quality Standard (NAAQS) of 40 µg/m³.[1] During the winter months, the situation worsened, with Delhi experiencing an average PM2.5 concentration of 159 µg/m³, making it the most polluted city in India for the season.[2]

Despite being the national capital, Delhi is one of the 131 cities identified under the National Clean Air Programme (NCAP) as a non-attainment city, i.e., one that did not meet the NAAQS over a 5-year period. The NCAP, launched in 2019, is India's flagship initiative to tackle air pollution and aims to achieve a 40% reduction in the PM10 levels by 2026 in comparison to the baseline levels of 2017. As a non-attainment city under NCAP, Delhi receives central funding and support to implement city-level action plans for air quality improvement.

The health implications of continued exposure to air pollution are severe. According to the National Centre for Disease Control, long-term exposure to pollutants like PM2.5, Nitrogen Oxides (NOx), Sulphur Oxides (SOx), ozone and volatile organic compounds contributes significantly to respiratory illness, cardiovascular disease, stroke, cancers and developmental disorders among children.[3] The Air Quality Life Index (AQLI) 2023 estimates that sustained exposure to Delhi's air pollution reduces average life expectancy by nearly 12 years.

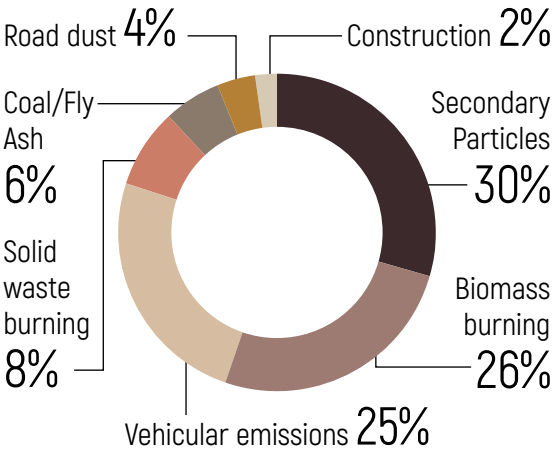
"Air pollution deaths are like multiple Covids every year."

DR. SANJEEV BAGAI,
Sr. Consultant Paediatrician and Neonatologist and Paediatric Nephrologist.

Children, the elderly, outdoor workers, and women are among the most affected. Even low-dose exposures during formative years can lead to long-lasting neurological, respiratory, and reproductive impacts.

Source apportionment studies provide critical insights by quantifying contributions of various sources to Delhi's PM2.5 levels:

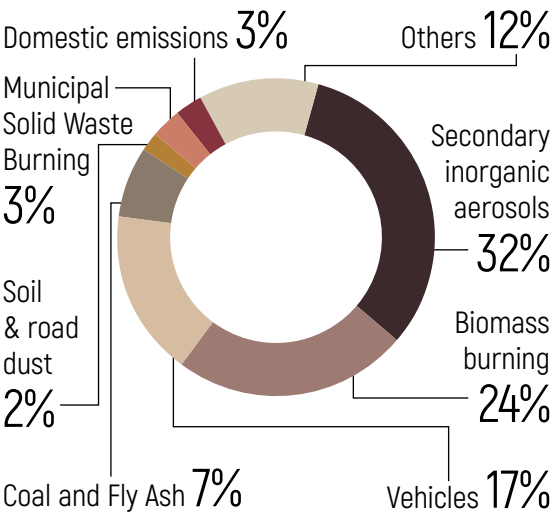
FIGURE 1: SOURCE APPORTIONMENT OF AMBIENT PARTICULATE MATTER DURING WINTER SEASON IN DELHI, 2018. IIT MADRAS AND IIT DELHI



"We need to move beyond health being just the moral case for action, towards using health evidence to prioritise sources that are most toxic."

DR. BHARGAV KRISHNA,
Sustainable Futures Collective

FIGURE 2: REAL-TIME SOURCE APPORTIONMENT AND FORECASTING REPORT FOR DELHI, 2023. IIT KANPUR, IIT DELHI, TERI, AIRSHED PLANNING PROFESSIONALS



Both studies underscore combustion-related emissions—including those from vehicles, biomass, coal, and waste burning—as the most toxic, most consistent, and most policy-addressable contributors to Delhi's PM2.5 burden. These are also the sources with the clearest link to severe health outcomes, especially among vulnerable populations.

Notably, the Real-Time Source Apportionment and Forecasting report found that over 80% of secondary aerosol pollution originates outside Delhi, highlighting the urgent need for regional cooperation with neighbouring states on issues like agricultural burning and industrial emissions.

While a significant share of funds under NCAP- in some cases over 60%[4]- have been allocated towards road and construction dust management measures such as mechanical sweeping and water sprinkling- which fall within the direct mandate of Urban Local Bodies, emissions from combustion sources require increased investment.

Bridging this gap calls for a more integrated, health-based approach to air quality planning- one that combines ongoing dust mitigation with clear strategies to tackle combustion-related sources. Addressing these high-impact emissions must form the cornerstone of any future-ready clean air action plan. ◻

DELHI'S POLICY ARSENAL AGAINST AIR POLLUTION

Delhi has implemented a comprehensive suite of regulatory and policy measures to combat air pollution. The Commission for Air Quality Management (CAQM), established in 2021, has been instrumental in coordinating air quality management efforts across the National Capital Region (NCR). One of the key strategies employed is the Graded Response Action Plan (GRAP), a dynamic framework that prescribes specific actions based on the severity of air pollution levels.

THE REGULATORY AND POLICY LANDSCAPE CURRENTLY INCLUDES:

Comprehensive Action Plan (CAP) 2025: Multi-sectoral strategy including plantation targets, public transport expansion, congestion control, and additional monitoring stations.

CAQM Directive No. 90 dated 9.05.2025- End-of-Life Vehicles and Vehicular Emissions: Reinforces phase-out of 10+ year-old diesel vehicles and other end-of-life vehicles, with implementation by transport departments.

The Motor Vehicles (Registration and Functions of Vehicle Scrapping Facility) Rules 2024: Mandates the de-registration and scrappage of old and polluting vehicles; complements CAQM Directive No. 90.

CAQM Directive No. 76 dated 29.09.2023- Regulation of Diesel Generator (DG) Sets: Regulates DG set usage across sectors; mandates emission control retrofits or dual-fuel modes depending on capacity.

CAQM Directive No. 77 dated 29.09.2023- Prohibition of Waste and Biomass Burning: Prohibits open burning of municipal solid waste and biomass, with mandated enforcement and monitoring by local bodies.

Delhi Solid Waste Management Plan (2023): Focuses on 100% segregation at source, decentralised processing, and elimination of open dumping and burning.

CAQM Directive No. 32 dated 16.08.2021- Crop Residue Burning: Establishes a protocol for satellite-based monitoring and response to crop residue burning events in surrounding states.

CAQM Directive No. 16 dated 11.06.2021- Dust Control at Construction & Demolition (C&D) Sites: Requires all projects above 500 sq. m. to register on the Delhi Dust Control Portal and implement prescribed dust mitigation measures.

Delhi EV Policy (2020): Aims for 25% of new vehicle registrations to be electric by 2024; includes incentives for adoption and infrastructure development.

Approved Fuels List (2018; updated by CAQM): Bans use of unapproved fuels across industries; mandates transition to cleaner alternatives such as PNG and electricity.

Despite this wide-ranging policy architecture and ongoing interventions, air pollution in Delhi remains a persistent and complex challenge—one that continues to pose serious risks to public health and demands deeper understanding of its evolving sources.

2. Five Key Recommendations

CLEANER AIR FOR DELHI HINGES ON COORDINATED GOVERNANCE, PEOPLE-CENTRIC COMMUNICATION, EMPOWERED INSTITUTIONS, AND REAL-TIME, SOURCE-SPECIFIC ACTION

"What we need is a clear plan with priorities that the government will focus on and drive, we need dedicated funds for this plan, and a governance structure that is capable enough to implement it."

MOHIT BEOTRA,
Air Pollution Action Group (A-PAG)

2.1 One Airshed- One Agency

Pollutants circulate in clearly demarcated airsheds, which include multiple cities, towns, villages and even forests. Air pollution in Delhi is not only regional in nature but also deeply interlinked across multiple sectors and departments within the city. While emissions from crop residue burning in neighbouring states such as Punjab, Haryana, Uttar Pradesh, and Rajasthan contribute significantly to Delhi's winter pollution load, the city itself faces challenges of fragmented institutional responses and overlapping mandates across its own departments—health, transport, urban development and environment.

Addressing these multifaceted challenges requires an institutional mechanism that is empowered to take action, not only to monitor, across borders and within Delhi's own departmental silos. The complexity of air pollution- persistent and multi-sectoral in nature- suggests the need for a Mission Mode. To that end, this report recommends establishing a dedicated, inter-agency nodal body empowered to coordinate air quality action across the entire airshed of Delhi-NCR. This body should have the mandate and resources to:

- Integrate health, transport, waste, and urban planning within a unified implementation framework.
- Coordinate multi-state actions to mitigate transboundary sources like crop residue burning.
- Align air quality interventions with seasonal forecasts and health advisories.
- Ensure cohesive enforcement of the Graded Response Action Plan (GRAP) across jurisdictions.
- Serve as the nodal agency for reporting progress against public health and air quality targets.

For such a body to be effective, it must be backed by predictable, long-term funding and institutional accountability. In this regard, it is critical to have budgetary provisions that frame clean air as a cross-sectoral investment- one that can generate returns in the form of reduced healthcare costs, improved workforce productivity, and greater urban resilience. A unified institutional framework is critical to sustaining gains and achieving systemic, long-term improvements in air quality and public health.

THE ECONOMIC CASE FOR CLEAN AIR

Cost of inaction: Air pollution leads to losses of up to ₹7 lakh crore ($95 billion) annually in India, equivalent to 3% of the country's GDP and twice its annual public health expenditure (Source: Air Pollution and its Impact on Business- The Silent Pandemic. Confederation of Indian Industries, Clean Air Fund, Dalberg. 2021).

Healthcare burden: A 2023 study in Delhi and Chennai linked long-term PM2.5 exposure to a 30% increase in diabetes incidence, with parallel findings on respiratory, cardiovascular, and cognitive impacts. (Source: PM2.5 exposure, glycemic markers and incidence of type 2 diabetes in two large Indian cities. BMJ Open Diabetes Research & Care).

Economic multiplier: A 2024 systematic review of 104 studies found that nearly 70% of air pollution control interventions delivered greater economic benefits than their implementation costs. These gains were largely driven by reduced disease burden and premature deaths associated with lower levels of particulate matter (PM). (The costs, health and economic impact of air pollution control strategies: a systematic review. Global Health and Research Policy).

Green jobs: Transitioning to clean transport, energy, and waste systems opens up employment opportunities in e-mobility, renewable fuels, pollution control equipment, and decentralized waste management.

"If we are truly serious about tackling air pollution, we need dedicated budgets and full-time professionals focused solely on this issue."

KURINJI SELVARAJ,
Council of Energy, Environment, and Water (CEEW)

2.2 Central Focus on Particulate Matter (PM) 2.5

Over the years, Delhi's air quality interventions have focused extensively on managing road and construction dust—largely because these fall within the direct jurisdiction of Urban Local Bodies (ULBs), who receive the bulk of National Clean Air Programme (NCAP) funding. While these interventions are important-particularly during summer months when PM10 levels peak- they should not dominate budgets or strategic planning, particularly when more toxic sources remain insufficiently addressed.

Combustion-related sources (vehicles, waste burning, residential biomass use, and crop residue burning) release more harmful PM2.5 and black carbon, which pose a greater risk to human health and the climate.[5,6]

There is an urgent need for an integrated strategy that sustains dust control while sharply increasing investment and enforcement in controlling combustion emissions.

A. Road and Construction Dust

Road dust contributes over 30% to Delhi's PM2.5 concentrations during summer[7] which can be partly addressed by targeted

"A coordinated, outcome-driven approach is essential to ensure that resources are directed towards interventions with the greatest impact."

SWAGATA DEY, The Center for Study of Science, Technology and Policy (CSTEP)

interventions such as mechanical sweeping in hotspots.

To make dust control more effective, the following recommendations are proposed:

- Nature-based solutions: Conserve existing trees, shrubs and green buffers that naturally trap dust.
- Scale up mechanized sweeping and targeted dust suppression in high-burden zones.
- All construction sites must include Delhi Pollution Control Board (DPCC) approved monitoring devices linked with the Central Pollution Control Board (CPCB) dashboard. This must be publicly accessible at all times.
- Track fund allocation and evaluate the impact of road dust mitigation efforts across agencies, given the multiplicity of authorities managing roads in Delhi.

B. Vehicular Emissions

Vehicular emissions remain one of the largest contributors to Delhi's PM2.5 concentrations in winter, estimated at 17%[8]. Heavy-duty diesel vehicles are an important source of black carbon, a short-lived climate pollutant with significant health and warming impacts.[9,10]

Key recommendations:

- Phase out ageing diesel trucks and public buses *across the airshed* with timelines aligned to black carbon reduction targets. Their phasing out should overlap with incoming electric buses.
- Deploy real-time emissions monitoring technologies, including on-road Remote Sensing Devices (RSDs) to flag super-emitters.
- Enforce stricter norms for freight movement *across the airshed*.
- Improve last-mile public transport and EV charging coverage to reduce private vehicle dependence.

CASE STUDY: IMPACT OF TARGETED ROAD CLEANING ON PM2.5 REDUCTION

In an initiative highlighted by the United Nations Development Programme (UNDP), targeted road cleaning interventions have demonstrated a significant impact on reducing ambient air pollution levels. Using hyper-local sensors, it was observed that cleaning roads in the morning and comparing them to days when cleaning was not conducted resulted in a notable difference in PM2.5 concentrations. The data revealed that such targeted cleaning led to a 40% reduction in PM2.5 levels in the assessed areas.

Note: This case study is based on insights shared by UNDP during the roundtable discussion. We acknowledge UNDP as the source of this illustrative example.

WHY BLACK CARBON MATTERS

Black carbon, or soot, is a major component of fine particulate matter (PM2.5) and a powerful short-lived climate pollutant (SLCP). It is emitted from diesel vehicles, household cooking with solid fuels, open waste burning, brick kilns, and agricultural fires.

Though it remains in the atmosphere only for days to weeks, black carbon has a disproportionately large impact on both climate and health.

It contributes significantly to global warming and is linked to over 8 million premature deaths annually due to air pollution.

Its economic toll is steep–part of the $8 trillion global cost of air pollution each year–often burdening poorer communities and informal workers the most.

Targeted action to reduce black carbon–especially from diesel engines, biomass use, and waste burning–can deliver fast, dual benefits: cleaner air and climate mitigation.

Delhi's air quality measures should prioritise high black carbon sources to maximise gains. Embedding black carbon in air quality management planning will also align with equitable energy transitions and clean mobility goals.

Source: Clean Air Fund (2025). Tackling Black Carbon: How to Unlock Fast Climate and Clean Air Benefits. London: Clean Air Fund.

OPEN WASTE BURNING IN DELHI RELEASES TOXIC POLLUTANTS AND CONTRIBUTES SIGNIFICANTLY TO PM2.5

These measures may be supported by institutional coordination between the Transport, Environment, and Labour departments under the proposed inter-agency governance body.

c. Waste Burning

Solid waste burning releases highly toxic pollutants including black carbon, dioxins, furans, and airborne microplastics. These emissions occur at four key points in the waste management value chain: waste uncollected or dumped outside the formal system, methane-induced fires in landfills exacerbated by fresh dumping, seasonal leaf burning and emissions from waste-to-energy (WTE) plants.[11] In 2024 alone, the Delhi Fire Services recorded 4,933 garbage fire incidents.

Around 50% of Delhi's waste is biodegradable, 35% is non-biodegradable (including

CASE STUDY: E-AUTO SHIFT IN PATNA

Patna has emerged as a pioneering city in clean mobility through its systematic phasing out of diesel-run auto-rickshaws. Between 2020 and 2022, 10,000 diesel autos were converted to CNG, and by 2024 nearly all public autos in the city were electric. The policy went into full effect from April 1, 2022, banning diesel-autos entirely.

The shift has contributed to reduced urban emissions, especially in congested corridors and lower dust re-suspension, a byproduct of cleaner engine operations.

Source: https://www.downtoearth.org.in/pollution/no-diesel-run-buses-and-auto-rickshaws-in-patna-from-april-1-82115

recyclables), and 10% is inert.[12]

Emerging evidence suggests that redirecting waste from open burning to decentralised Material Recovery Facilities (MRFs) and compressed biogas (CBG) plants could reduce PM2.5 by up to 10% in cities like Delhi.[13]

Strategic priorities include:

- Mandatory ward-level composting to divert organic waste from landfills. A comprehensive policy for procurement and creating markets for such compost. Other technologies may be used to divert wet waste from landfills and open dumping.
- Scaling Material Recovery Facilities (MRFs) with wastepicker participation to recover recyclables.
- Online daily emissions tracking of WTE plants to be made publicly available. Given the composition of Delhi's waste, it is likely that no further WTE plants may be required. In this regard, audit the need at all of any future WTE plants.

D. Biomass Use for Cooking and Heating

Indoor pollution from biomass use (firewood, dung cakes, kerosene) remains pervasive in Delhi's low-income settlements, where many residents lack access to affordable, clean cooking solutions. The Lancet Planetary Health Journal links household air pollution to 610,000 premature deaths in India in 2019[14]. Indoor air pollution from biomass smoke is associated with increased incidence of acute respiratory infections in children and chronic obstructive pulmonary disease in adults.

BIOMASS USE IN DELHI'S LOW-INCOME AREAS CAUSES SEVERE HEALTH AND RESPIRATORY PROBLEMS, DEATHS

Key recommendations include:

- Expanding access to Pradhan Mantri Ujjwala Yojana through ASHA worker outreach, especially for migrant workers without Delhi documentation.
- Establishing last-mile Liquified Petroleum Gas (LPG) distribution centres in underserved clusters.
- Providing 2 years of free LPG cylinders for new adopters to build sustained usage habits. Continuing subsidies after that to ensure that LPG remains affordable for low-income communities.
- Incentivising electric cooking where stable electricity is available.

These strategies will reduce toxic indoor exposure and lower ambient air pollution.

e. Crop Residue Burning

Crop residue burning outside Delhi significantly impacts winter air quality in the capital. Solutions must be implemented across state borders through a coordinated airshed governance mechanism.

These include:

- Introducing Minimum Support Price (MSP) conditionality linked to verified non-burning, as piloted via orders of the Supreme Court in 2019.
- Enhancing access to Crop Residue Management (CRM) machinery through Custom Hiring Centres (CHCs).
- Strengthening ex-situ uses biomass energy and biofuels to create value for stubble.[15]

CROP RESIDUE BURNING OUTSIDE DELHI WORSENS WINTER AIR QUALITY; CROSS-STATE SOLUTIONS AND COORDINATED AIRSHED GOVERNANCE ARE URGENTLY NEEDED

2.3 Strengthening Technical Capacity

While the proposed inter-agency body (Refer to 2.1: One Airshed- One Agency) can play a crucial role in aligning strategies across jurisdictions and sectors, its effectiveness depends on strong implementation by ground-level institutions within Delhi. Regulatory bodies such as the Delhi Pollution Control Committee (DPCC) and implementing agencies including the urban local bodies form the operational backbone of Delhi's air quality response. Strengthening their institutional capacity is essential for translating high-level strategies into measurable outcomes.

At present, many of these institutions face challenges related to limited staffing, lack of technical expertise, fragmented mandates, and ad-hoc coordination. While the Commission for Air Quality Management (CAQM) provides overarching policy direction and inter-state coordination, consistent and accountable on-ground enforcement rests with city-level bodies.

To address this, the following recommendations are proposed:

- Establishing dedicated Air Quality Cells within key departments with defined roles, responsibilities and budgetary support. These cells can function as technical and operational anchors- supporting data analysis, emissions tracking, public communications, and response coordination.
- Dedicated budget lines to enable recruitment of technical specialists, improve monitoring infrastructure and ensure follow-through on both city-led and regionally mandated actions.
- Institutionalising third-party audits for emissions compliance—particularly in sectors like construction and industrial operations.
- Targeted capacity building air quality science, emerging enforcement tools and public health linkages for field officers and inspectors.
- Setting up standing inter-agency coordination mechanisms- such as nodal officers or working groups- to ensure seamless collaboration across health, urban development, environment and transport departments.
- Creating a Standing Technical Advisory Panel reporting to the Chief Minister with domain experts in public health, atmospheric science, urban planning and environmental engineering to support real-time decision-making and build internal analytical capacity within departments.

A portion of available funds can be earmarked for the above-mentioned recommendations.

"Effective implementation hinges on clearly defined responsibilities and adequate support for on-ground actors. Strengthening accountability mechanisms and enabling institutions to act decisively will help bridge the gap between planning and action."

SUNIL DAHIYA, Founder and Lead Analyst, EnviroCatalysts

"A stronger focus on health outcomes, systemic change and ground-level enforcement can help translate intent into sustained impact."

BHAVREEN KANDHARI,
Warrior Moms

By enhancing institutional capacity through clearer roles, better training and sustained support, Delhi can build a more agile and proactive regulatory ecosystem—well-positioned to achieve sustained air quality gains in line with public health and climate goals.

2.4 Public Health Communications

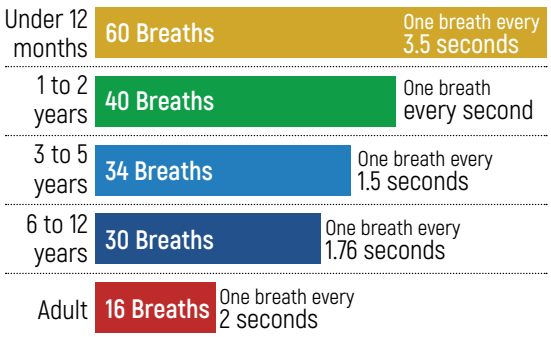
Air pollution in Delhi does not affect all residents equally. Vulnerable groups—including children, elderly persons, outdoor workers, women in low-income households and residents of informal settlements—face disproportionate exposure and health risks due to a combination of proximity to pollution sources, pre-existing health conditions and limited access to protective infrastructure, healthcare, and information.

Children are particularly at risk. The World Health Organization (WHO) notes that children breathe more rapidly and absorb more pollutants per body weight than adults, making them more susceptible to respiratory infections and long-term cognitive impairments. In Delhi, peak pollution months witness a spike in paediatric respiratory complaints in hospitals.[16]

Outdoor workers—including sanitation workers, street vendors, traffic police and waste pickers—are exposed to high levels of ambient air pollution for extended periods due to their work compulsions. A 2023 study by Chintan- UNfAIR Quality- found that over 75% of these workers had abnormal lung function, with severe impairment recorded in up to 27% of safai karamcharis and 17% of waste pickers. The study also revealed a consistent gender disparity, with women wastepickers 3.9 times more likely than males to have a respiratory disease, and women safai karamcharis 6 times more likely to have deteriorated lungs—highlighting the compounded vulnerability of women in exposed occupations.

Women in low-income urban households are often exposed to a double burden of indoor and outdoor air pollution. Indoor use of biomass fuels for cooking—despite the expansion of LPG access—remains common in informal settlements. A 2024 citizen survey by Chintan in Delhi-NCR- Saaf Saans- found that only 10% understood key terms like AQI

FIGURE 3: MAXIMUM RESPIRATORY RATE (BREATHS PER MINUTE)



Source: Vital Strategies, https://www.vitalstrategies.org/wp-content/uploads/A-call-to-action-Air-pollution-in-early-childhood.pdf

AIR POLLUTION IN DELHI DISPROPORTIONATELY HARMS VULNERABLE GROUPS DUE TO HIGHER EXPOSURE AND LIMITED ACCESS TO PROTECTION AND HEALTHCARE

and PM2.5- indicating a gap between data availability and public understanding.

Reducing exposure through warnings, nature-based solutions, reducing particulate matter in vendor zones, shifting waste work from peak pollution hours, avoiding allocating duties to pregnant women in most polluting areas are some of the possible protective measures that can be institutionalised to safeguard the health of outdoor workers, particularly women.

As Delhi advances its clean air agenda, there is a strong opportunity to complement technical and regulatory measures with public health-focused communication and targeted outreach to those most at risk. This would enhance not only awareness but also community-level participation and resilience. To that end, the following strategies are recommended:

- Set up an Air Quality Communication Cell to produce de-jargonised, multilingual, visual content for greater public reach and clarity.
- Share simple, relatable alerts—e.g., "Avoid morning walks today: air quality is very poor."
- Use ward-level data to send alerts via Anganwadis, ASHA workers, schools and local media.

"From a citizen's perspective, the problem is ineffective communication. We need trusted voices like scientists and doctors speaking out in clear, de-jargonized language. When data comes from those we trust, it's far more likely to drive action."

CHETAN BHATTACHARJI,
Journalist and Consultant, Climate Comms Strategies

"With baseline pollution already high, enforcement is critical–and while the onus lies with the state, every individual must also act."

POOJA DHAR, Advocate

- Engage community figures like doctors, teachers and ASHA workers to relay air quality guidance using accessible formats.
- Complement AQI monitoring with health-based indicators during high pollution periods to guide responses and evaluate impact.
- Embed tested nudges into public programmes-like default LPG enrolment or SMS reminders on high AQI days-to drive safer practices.

A proactive, people-first communication strategy, aligned with health systems and responsive to community needs, will help ensure that clean air benefits are both broad-based and lasting.

2.5 Neighbourhood Monitoring

Delhi's existing network of over 40 Continuous Ambient Air Quality Monitoring Systems (CAAQMS) and one centralised Supersite is a critical asset. These stations have strengthened the city's ability to report daily air quality levels and track long-term trends. However, to move from monitoring to action, Delhi's data ecosystem must evolve to become more granular, real-time, and sector-specific.

Initiatives by state governments are demonstrating the power of hyper-local, low-cost air quality monitoring for targeted interventions. Uttar Pradesh's AMRIT project— supported by IIT Kanpur—aims to install 1,400 sensors across rural areas to capture block-level pollution trends, leveraging AI-enabled analytics for source apportionment and hotspot identification.[17]

The following actions are recommended:

- Expand hyperlocal monitoring: Augment the current network with low-cost sensors across city zones, ideally every 500 meters. This must include informal settlements, high-traffic corridors, and construction hubs, to capture real-time data on PM2.5, nitrogen dioxide (NO_2) and ozone. Such data will help identify localised pollution hotspots and enable responsive interventions.
- Develop sector-specific dashboards: Create analytical tools that disaggregate air quality data by major emission sources—such as transport, waste, industry and biomass—to support evidence-based policy design and sectoral accountability.
- Integrate data into planning and governance: Use hyperlocal and sectoral data to guide decisions in transport, health and

CASE STUDY: USING REAL-TIME DATA FOR RESPONSIVE ACTION IN BIHAR

In Bihar, a network of over 100 low-cost air quality sensors was deployed across several administrative blocks to generate real-time pollution data. The UNDP team compiled this data into daily pollution bulletins, which were shared with the Bihar State Pollution Control Board.

During one such instance, the bulletin flagged an unexpected spike in carbon monoxide levels. A rapid investigation revealed that the source was a 15-hour-long traffic jam in the affected area. Authorities intervened by opening additional movement lanes and restoring the flow of traffic. As a result, emissions dropped significantly within hours, demonstrating the potential of hyperlocal data systems to trigger immediate and effective policy responses.

"To address air pollution, we need whole-of-government and whole-of-society. But we also need to act like an ecosystem—not just take action in isolation, but work with each other and support each other—so that everyone can breathe cleaner air very soon"

BHARATI CHATURVEDI, Chintan Environmental Research and Action Group

urban infrastructure.

- Overlay health and pollution data: Combine air quality and health surveillance to improve early warnings and resource deployment.
- Enable proactive services: Use forecasts to trigger advisories on health, school schedules, and traffic management during high pollution days.
- Expand public access: Share clear, disaggregated air quality data on accessible digital platforms to boost citizen awareness and action.

By strengthening data systems to capture hyperlocal and sector-specific information, Delhi can enhance its capacity to implement precise, effective, and equitable air quality interventions.

These five recommendations are not standalone actions but mutually reinforcing pillars of a healthier, cleaner Delhi. Each demands collaboration across sectors, innovation in public systems, and sustained political will. □

"While the airshed approach is important, we cannot lose sight of the urgent need for hyperlocal, implementable solutions."

SHUBHAM TANDON, United Nations Development Programme (UNDP), India

Conclusion

CLEAN AIR IS an essential pillar for the goal of a Viksit Bharat. Clean air attracts investments, innovators, saves costs of medical care and lost productivity and eliminates reputational risk that comes with air pollution.

The five strategic recommendations are designed to support the Government of Delhi in enhancing the implementation of its clean air agenda. The proposed actions build on existing national efforts while identifying clear areas for reprioritisation and innovation.

Chintan, in collaboration with various agencies and institutions, can undertake Neighbourhood Monitoring along with behaviour shifts, capacity building, public communications and outreach, creating a platform for knowledge and experience sharing and implementing initiatives on the ground and their success. Several other non-state actors are able to support specific initiatives. These existing capacities can be harnessed for quick results.

The next few years are going to be critical for a megacity like Delhi and its neighbouring urban conglomerates to enable all its residents to breathe clean air. Chintan looks forward to building and supporting initiatives to accelerate better air quality. ◻

Glossary

AQI (Air Quality Index): A numerical scale used to describe the current air quality and its potential impact on health, ranging from good to severe.

ASHA (Accredited Social Health Activist): A community health worker under the National Health Mission, who supports health education and awareness, particularly in rural and low-income urban areas.

Air Quality Life Index (AQLI): A research-based index developed by the University of Chicago that translates air pollution concentrations into their impact on life expectancy.

Airborne Microplastics: Tiny plastic particles suspended in the air, originating from degradation of plastic waste, textiles, or industrial emissions, and increasingly detected in air.

Airshed: A geographical region that shares the same air mass and is affected by similar meteorological and pollution conditions, often extending across administrative boundaries.

Ambient: Surrounding. It is used to describe physical properties of air (temperature, humidity, pressure, etc) or air pollution concentration in the open air, as against, at the point of emission or indoors, for example, ambient temperature, ambient air quality.

Black Carbon: A short-lived but highly potent climate pollutant formed by incomplete combustion of fossil fuels or biomass. It contributes to both air pollution and global warming.

CAAQMS (Continuous Ambient Air Quality Monitoring System): Real-time monitoring stations that track pollutants like PM2.5, PM10, SO2, NO2, O3, and CO in ambient air.

CRM Machinery (Crop Residue Management Machinery): Equipment used to manage leftover crop stalks after harvest without burning, such as happy seeders and super straw management systems.

Combustion-related sources: Sources of air pollution that release emissions through burning of fuels or waste, such as vehicles, biomass, coal, and municipal solid waste. These are among the most toxic contributors to PM2.5.

Custom Hiring Centres: Facilities that rent agricultural machinery like CRM tools to small and marginal farmers at affordable rates.

Dioxins: Toxic chemical compounds produced during combustion processes like waste burning, known to cause cancer and other health issues.

Furans: Toxic byproducts of industrial and waste combustion processes, often found alongside dioxins and known for their serious health impacts.

Hotspots: Areas with consistently higher levels of air pollution than surrounding regions, often due to dense traffic, industry, or waste burning.

Low-cost Sensors: Affordable, portable devices used to measure air quality indicators at hyperlocal levels, enabling community-based monitoring.

MRF (Material Recovery Facility): A specialized facility where non-compostable waste is sorted and stored temporarily so that recyclable materials can be separated and recovered.

MSP (Minimum Support Price): The minimum price at which the government procures crops from farmers.

Mission Mode: A results-oriented, time-bound implementation strategy used by governments to address key issues with dedicated resources, clear outcomes, and coordinated inter-agency action.

NAAQS (National Ambient Air Quality Standard): Standards set by the Central Pollution Control Board (CPCB) under the Air (Prevention and Control of Pollution) Act, 1981, to safeguard public health from the adverse effects of air pollution.

NO2 (Nitrogen Dioxide): A toxic gas produced primarily by vehicles and power plants, known to cause respiratory issues and contribute to secondary PM formation.

Non-attainment City: A city that has consistently failed to meet the National Ambient Air Quality Standards (NAAQS) for five consecutive years. These cities receive additional attention and resources under national programs like the NCAP.

Remote Sensing Devices (RSDs): Portable systems used to measure real-time vehicle emissions on roads, identifying high-polluting vehicles (super emitters) without stopping them.

PM2.5: Fine particulate matter with a diameter of 2.5 micrometres or smaller. These particles can penetrate deep into the respiratory system and bloodstream, posing serious health risks including heart and lung diseases.

PM10: Particulate matter 10 micrometers or less in diameter (also known as Respirable Suspended Particulate Matter). Comparative to larger particles which get trapped in the nose, mouth and throat. PM10 can be drawn into the lungs and isn't visible to the naked eye, impacting our upper respiratory tract.

PMUY (Pradhan Mantri Ujjwala Yojana): A government scheme providing subsidised LPG connections to women from low-income households to reduce dependence on biomass fuels.

Secondary Aerosols: Tiny particles formed in the atmosphere through chemical reactions between gases like sulphur dioxide (SO_2), nitrogen oxides (NOx), and ammonia (NH_3). These gases react to produce sulphates, nitrates, and ammonium compounds, which are major components of PM2.5 pollution.

Potential sources include power plants, refineries, brick kilns, vehicles, industries, agriculture, organic waste decomposition, and open drains.

Sulphur Oxides (SOx): Gases primarily composed of sulphur dioxide (SO_2), produced from the burning of fossil fuels. SOx exposure is linked to respiratory illness and environmental effects like acid rain.

Super Emitters: Vehicles or facilities that emit far higher levels of pollutants than average for their category, often due to poor maintenance or outdated technology.

ULBs (Urban Local Bodies): Statutory civic agencies responsible for governance and delivery of municipal services such as waste management, sanitation, and pollution control in urban areas.

VOCs (Volatile Organic Compounds): A group of carbon-based chemicals that easily evaporate at room temperature and can contribute to ground-level ozone formation and smog. Sources include vehicle exhaust, industrial processes, and household products.

WHO (World Health Organization): A specialized agency of the United Nations responsible for international public health, which sets global air quality guidelines and monitors environmental health risks.

µg/m³ (Micrograms per cubic metre): A unit of measurement used to express the concentration of pollutants in the air. One microgram per cubic metre represents one-millionth of a gram of pollutant in a cubic metre of air.

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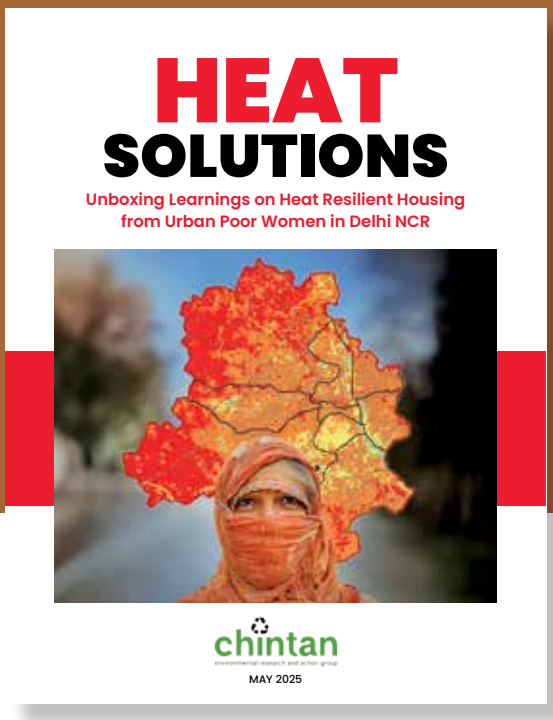

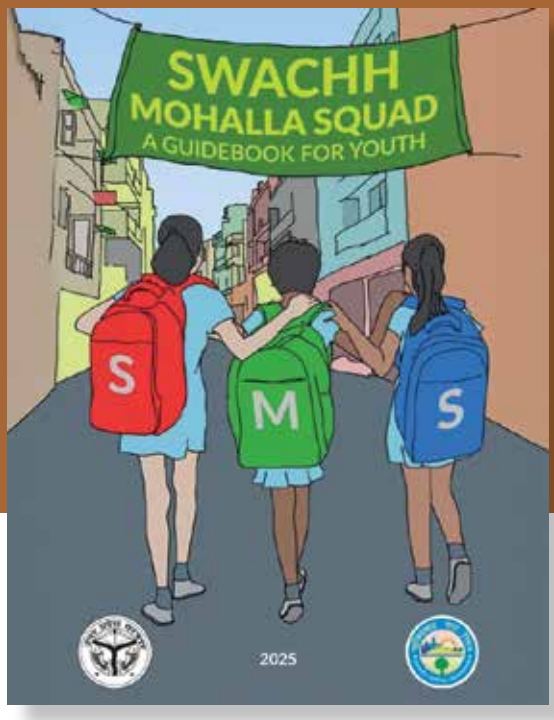

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