Respirer Living Sciences

DELHI–HARYANA AIRSHED REPORT 2025

Hyperlocal Analysis and Cross-Border Insights

EXECUTIVE SUMMARY

Shared Air, Shared Responsibility

This report consolidates air quality analysis across Delhi and Haryana for October 2025, integrating data from CPCB, Google AirView+, and Respirer Living Sciences to deliver a high-resolution view of the region's shared airshed.

Key Findings

- Delhi exceeded the national $PM_{2.5}$ limit on 23 of 31 days (76.7%); Haryana on 16 days (53.3%).
- Peak pollution occurred 20–21 October, when $PM_{2.5}$ levels rose above 600 µg/m³.
- Hotspots: Jahangirpuri–Bawana–Wazirpur in Delhi; Sakhoti-R (Sonipat) and Sankhol (Jhajjar) in Haryana.
- Cross-border data show pollutants moving freely between the two states, linking Delhi's northwest industrial belt with adjacent Haryana districts.

Takeaway

The Delhi–Haryana corridor operates as a single airshed. Meaningful improvement demands joint monitoring, coordinated enforcement, and shared accountability between both governments.

INTRODUCTION

Air pollution remains one of the most persistent environmental and health challenges across northern India. October marks a critical transition period — the end of monsoon and onset of winter — when stable atmospheric conditions, post-festival emissions, and crop residue burning combine to create a perfect storm for poor air quality.
This study evaluates hourly $PM_{2.5}$ concentrations across Delhi and Haryana between 1–31 October 2025 using data from the Central Pollution Control Board (CPCB), Google AirView+, and Respirer Living Sciences. By integrating regulatory and non-regulatory sensor networks through GIS-based mapping grids (3×3 km for Delhi, 10×10 km for Haryana), the analysis delivers hyperlocal spatial resolution and identifies pollution hotspots often missed by the official network.

Objectives:

- Detect fine-scale $PM_{2.5}$ variations and hotspot clusters.
- Assess monitoring gaps in the current CPCB network.
- Examine cross-border pollution linkages between Delhi and Haryana.
- Generate actionable insights for joint airshed management.

METHODOLOGY

Multi-Source, High-Resolution Monitoring

This study combines hourly air quality data from 1–31 October 2025 for the Union Territory of Delhi and the state of Haryana. To achieve fine spatial detail, the analysis used GIS-based grids at resolutions of 3×3 km for Delhi and 10×10 km for Haryana, covering 187 and 492 locations respectively.

Data Sources:

- Central Pollution Control Board (CPCB): Continuous reference-grade monitors.
- Google AirView+: Street-level mobile sensor data for spatial depth.
- Respirer Living Sciences (Atmos): Fixed and mobile IoT sensors for local precision.

These datasets were integrated and cross-validated to enhance coverage and reliability.

Analytical Approach:

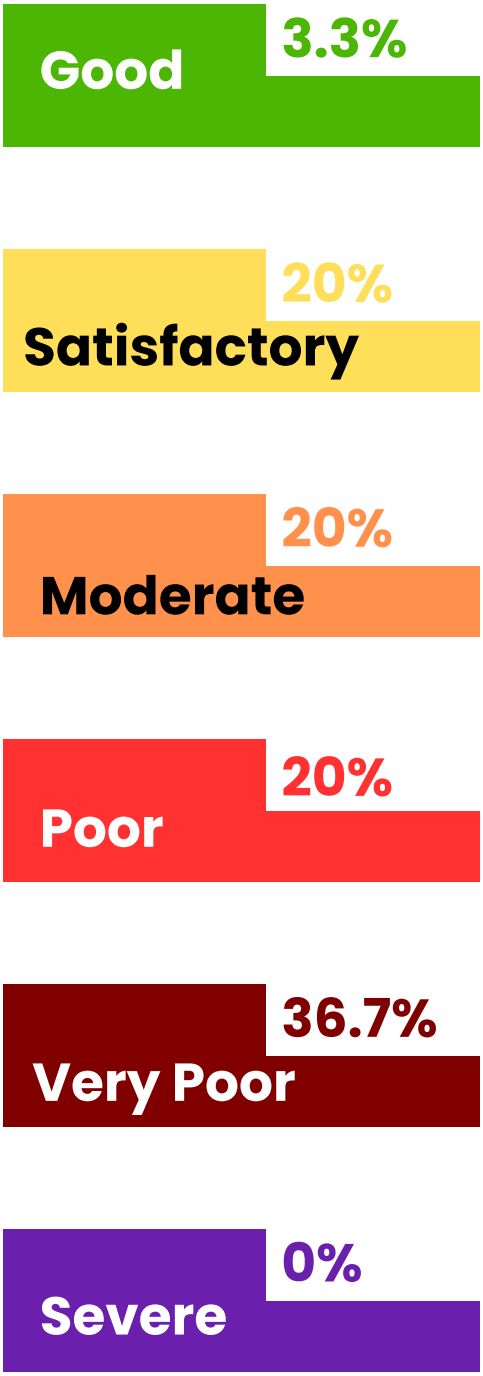
1. Data Integration – Unified datasets for consistent temporal resolution.
2. Spatial Mapping – Mapped $PM_{2.5}$ concentrations onto regional grids.
3. Hotspot Detection – Clustered high-$PM_{2.5}$ zones using density algorithms.
4. Temporal Analysis – Identified pollution spikes and peak-hour events.
5. Validation – Compared hyperlocal outputs with CPCB stations to ensure accuracy.

Outcome:

A high-resolution, multi-source dataset enabling hyperlocal hotspot detection, airshed-level comparisons, and evidence-based policy insight.

Delhi’s Industrial Belt Drives the City’s Pollution Peaks

The analysis shows that Delhi’s air quality during October 2025 remained consistently poor, dominated by emissions from industrial activity, traffic congestion, and festive sources.



- Days exceeding NAAQS (60 µg/m³): 23 of 31 days (76.7%)
- Peak $PM_{2.5}$ levels: 678 µg/m³ on 20–21 October 2025

Rank	Location	Avg $PM_{2.5}$ (µg/m³)
1.	Jahangipuri	144.1
2.	Rohini	142.0
3.	Shahdara	134.8
4.	Mangolpuri	123.8
5.	Madanpur Khadar	120.3

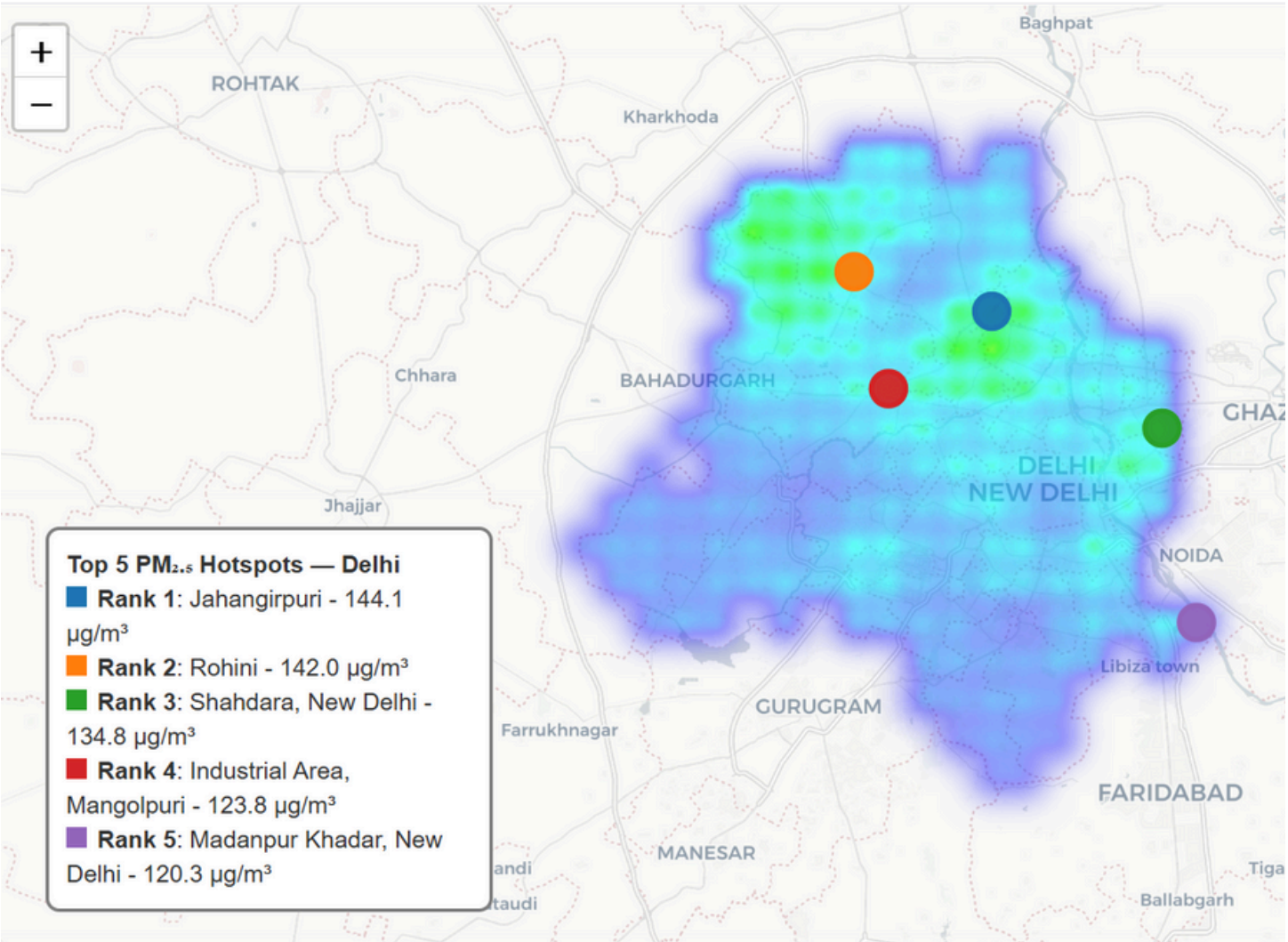
Insights

- The Jahangirpuri–Bawana–Wazirpur industrial corridor forms Delhi’s most critical pollution cluster.
- Secondary peaks appear in east Delhi (Anand Vihar–Shahdara) and west Delhi (Mangolpuri–Mundka).
- Cleanest zones: Dwarka, Lodhi Road, and Sri Aurobindo Marg — areas with higher green cover and fewer industrial emissions.

Mapping Delhi’s October 2025 Pollution Intensity

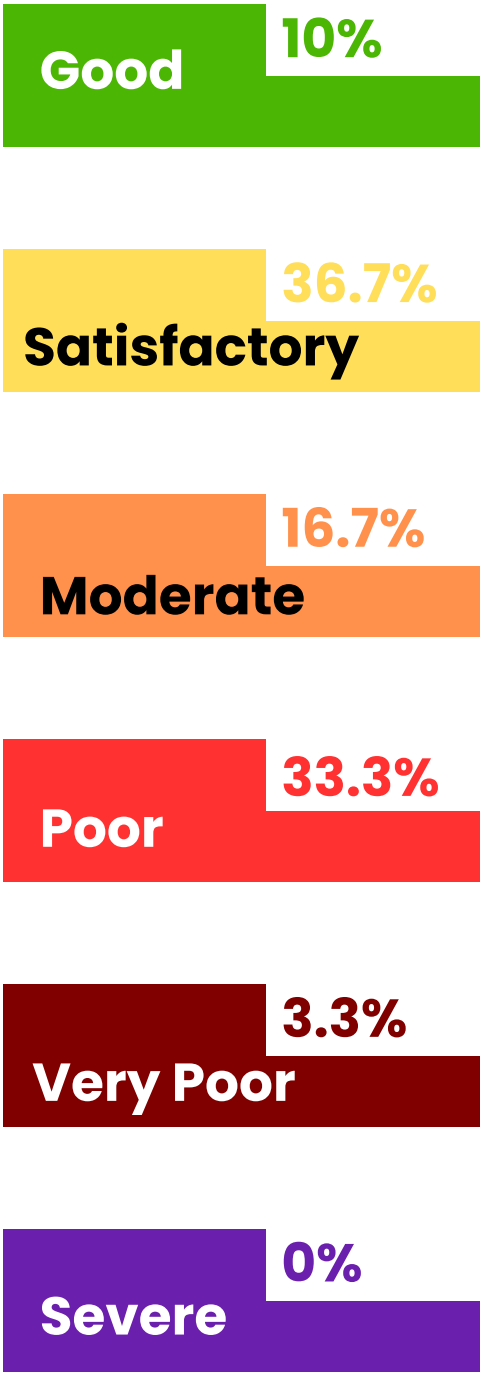
Mapping Delhi’s October 2025 Pollution Intensity

Spatial mapping of $PM_{2.5}$ concentrations across Delhi at a 3×3 km resolution reveals distinct pollution clusters concentrated in the city’s northwestern and eastern industrial belts. These zones consistently recorded the highest particulate matter levels throughout October, reflecting localized emissions, heavy traffic, and stagnant meteorological conditions.



Haryana's Border Districts Reflect Delhi's Pollution Pulse

The air quality analysis for October 2025 shows that Haryana, though generally cleaner than Delhi, experienced significant particulate pollution in districts adjoining the National Capital. These regions, particularly Sonipat and Jhajjar, registered strong correlations with Delhi's industrial and transport emissions.



- Days exceeding NAAQS (60 µg/m³): 16 of 31 days (53.3%)
- Peak $PM_{2.5}$ levels: 287 µg/m³ on 20–21 October 2025

Rank	Location	Avg $PM_{2.5}$ (µg/m³)
1.	Sakhoti-R	122.5
2.	Sankhol	108.8
3.	Sasroli	106.0
4.	Jhanj Khurd	83.1
5.	Karnal	74.3

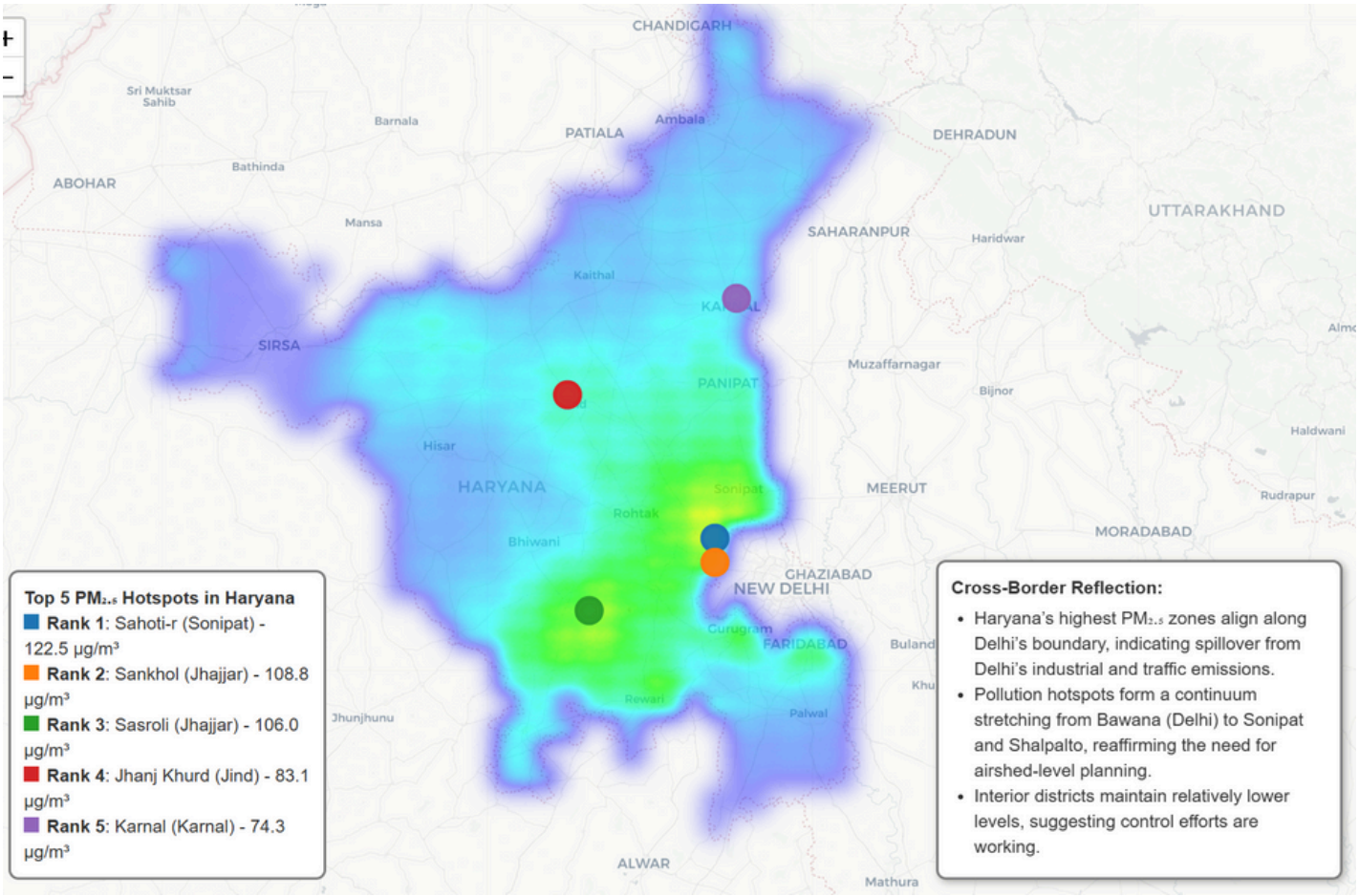
Insights

- The Sonipat–Jhajjar corridor mirrors Delhi's northwest cluster, confirming cross-border pollutant flow.
- Sakhoti-R, just 13 km from Delhi's Bawana industrial zone, recorded Haryana's highest $PM_{2.5}$ levels.
- Central Haryana (Jind, Karnal) showed moderate but rising pollution, possibly due to transport and agricultural emissions.
- Cleanest regions: Panchgaon (Gurugram), Sirsa, and Faridabad, benefitting from lower industrial density and open terrain.

Mapping Haryana’s October 2025 Pollution Zones

Mapping Haryana’s October 2025 Pollution Intensity

Hyperlocal mapping across Haryana at a 10×10 km grid resolution reveals distinct pollution clusters concentrated in the Sonipat–Jhajjar belt, directly adjoining Delhi’s northwest industrial zones. While western and southern Haryana maintained relatively cleaner air, peri-urban regions near the National Capital experienced recurring particulate spikes throughout October 2025.



DELHI AND HARYANA: ONE AIR, ONE CHALLENGE

The hyperlocal datasets reveal that Delhi's pollution hotspots and Haryana's border districts operate as a single, interlinked airshed. Industrial clusters in northwest Delhi correspond almost perfectly with high $PM_{2.5}$ readings in Sonipat and Jhajjar, while evening wind patterns carry pollutants across the boundary and trap them under calm atmospheric conditions.
This relationship underscores that administrative boundaries do not constrain air movement — shared emissions demand shared solutions.

Delhi Hotspot	Avg $PM_{2.5}$ (µg/m³)	Nearest Haryana	Avg $PM_{2.5}$ (µg/m³)	Approx. Distance
Jahangirpuri	144.1	Sakhoti-R (Sonipat)	122.5	13 km
Mnagolpuri	123.8	Sasroli (Jhajjar)	106.0	15km
Shahdara	134.8	Karnal	74.3	80km

Regional Interpretation

- Delhi's northwest industrial belt forms a continuous pollution corridor with Sonipat–Jhajjar, extending the $PM_{2.5}$ plume beyond the city boundary.
- Hourly pollution patterns across border sensors show synchronized spikes, indicating regional meteorological coupling.
- While Haryana's interior regions exhibit recovery, the border zone remains the most reactive to Delhi's emission load.

FROM DATA TO ACTION: MANAGING THE DELHI–HARYANA AIRSHED

The findings highlight the urgent need for coordinated, real-time, and cross-border action. Below are key strategies to strengthen air quality management and address overlapping emissions across Delhi and Haryana.

This SDG Progress Report is a continuous work in progress - a way for your organization to track its impact and improvements over time. This section is just a summary of your strategy for continuing the excellent work done so far.

1

Expand Continuous Monitoring

Establish new sensor-based and reference-grade stations in peri-urban and border areas such as Sonipat, Jhajjar, and Bahadurgarh to capture transboundary pollution movement in real time.

2

Integrate Multi-Source Data

Merge CPCB, Google AirView+, and Respirer sensor data into a single AtlasAQ-based platform to ensure spatial completeness and transparent public access.

3

Enforce Industrial and Construction Controls

Mandate on-site dust suppression, stack emission monitoring, and compliance audits in industrial clusters — particularly Jahangirpuri–Bawana–Wazirpur and Sonipat–Jhajjar.

4

Coordinate at the Airshed Level

Establish a Delhi–Haryana Joint Task Force for synchronized implementation of seasonal measures such as the Graded Response Action Plan (GRAP) and crop-residue management initiatives.

INTEGRATING TECHNOLOGY, GOVERNANCE, AND ACTION

Effective management of the Delhi–Haryana airshed requires an integrated system that connects real-time data, policy enforcement, and stakeholder collaboration. The proposed AtlasAQ framework brings these components together to enable continuous, transparent, and actionable air quality monitoring.

Data Ingestion

- Real-time streams from CPCB monitors, Google AirView+ mobile sensors, and Respirer Living Sciences IoT nodes feed into the AtlasAQ data pipeline.

Data Processing

- Automated validation removes outliers and harmonizes temporal resolutions. Spatial interpolation fills monitoring gaps, ensuring consistent coverage.

Visualization & Alerts

- Hyperlocal dashboards display pollution intensity, hotspot emergence, and trend analysis — accessible to regulators, researchers, and the public.

Action & Feedback

- Alerts trigger field inspections, dust mitigation, and community advisories. Post-intervention data are re-evaluated to measure impact, creating a closed feedback loop.

Governance Integration

- Regulatory Agencies: CPCB, DPCC, and HSPCB coordinate data sharing and enforcement.
- Technology Partners: Respirer and Google provide hardware, calibration, and analytics support.
- State Governments: Delhi & Haryana jointly execute seasonal action plans and cross-border protocols.

A SHARED FUTURE FOR A SHARED AIRSHED

The Delhi–Haryana corridor stands as one of India's most interconnected and pollution-prone regions. The October 2025 analysis demonstrates that air pollution does not recognize borders — industrial emissions, vehicular exhaust, and regional crop burning create a unified atmospheric system.

To achieve sustained improvement, both governments must adopt a joint airshed management framework built on real-time data, shared accountability, and transparent public reporting. Integrating technology with governance through platforms like AtlasAQ will enable faster responses, measurable outcomes, and community participation.

Cleaner air for Delhi and Haryana is achievable — but only through collaboration, consistency, and commitment.

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