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DELHI'S ANNUAL SMOG CRISIS

Dust, Smoke and Real Solutions Beyond
Diwali Firecrackers



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We have no known conflict of
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Executive Summary

Delhi faces a severe annual air-pollution crisis each winter, often ranking among the most polluted cities in the world. While activist attention disproportionately targets Diwali firecrackers, the paper highlights that the real drivers of Delhi's toxic air are continuous, year-round pollution sources:

- **Road Dust** — the **largest contributor** to PM pollution (38–56%). Delhi's roadsides — from central avenues to fringe lanes — are flanked by **open soil**, broken pavements, and stagnant construction dust. Passing vehicles whip this into the air daily, triggering chronic exposure. Road dust discourages walking and public transport, worsens congestion and vehicle emissions, harms street food culture, and turns public spaces into dumping grounds.
- **Vehicular Emissions** — contribute ~15–25% to PM_{2.5}. Despite large vehicle numbers, **other global cities with similar per-capita car counts** maintain clean air via better road clearing, enforcement, and fewer non-vehicular pollutants.
- **Biomass & Garbage Burning** — widespread among low-income communities for heating and waste disposal. Winter night-time smouldering drives **ultrafine particle explosions** across the Indo-Gangetic Plain.
- **Diesel Generator (DG) Sets** — thousands operate during outages or by default in markets and residences, emitting toxic exhaust at ground level. CAQM flags “uncontrolled DG sets” as major deteriorators of air quality.
- **Crop Stubble Burning** — on peak days can cause **40–50%** of Delhi's particulate burden as smoke blows in from Punjab and parts of Haryana & Western UP. Seasonal averages understate the danger of **short-burst smog disasters** that overwhelm hospitals.

The document emphasizes that **Diwali firecracker smoke is sharp but short-lived**: it dissipates within 24 hours with wind changes, unlike the **persistent baseline** from dust, biomass fires, DG sets, and stubble.

Years of bans on fireworks failed to stop severe smog peaks, proving policy mis-prioritization. Firecrackers became a **soft political target** as deeper governance reforms on infrastructure and enforcement were avoided.

The Paper's Core Thesis

Delhi's smog problem is man-made and structurally solvable. A technically feasible, time-bound plan can permanently reduce winter smog if priorities shift from symbolism to execution.

Three-Pillar Solution

1. One-Year "Dust-Free Delhi Mission"

- Fully pave or green every roadside edge (no exposed soil anywhere)
- Deploy mechanical sweeping and enforce construction dust controls
- Result: cut particulate load by **up to one-third**, while improving mobility, business viability, and city aesthetics

2. Two-Year Stubble-Burning Elimination Plan

- Subsidize equipment like Happy Seeder / mulchers
- Crop diversification & residue procurement for biomass industry
- Strong enforcement once alternatives exist
- Transform November air quality **dramatically**

3. Three-Year Action Against Remaining Major Sources

- Phase-out all diesel generators, move to solar + storage
- Total ban on biomass/garbage fires through access to clean energy and waste services
- Expand EVs, public transport, congestion controls; enforce clean fuels in industry



DUST, SMOKE AND REAL SOLUTIONS BEYOND DIWALI FIRECRACKERS

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Introduction

Every year as autumn sets in, Delhi's air turns into a gray haze. The national capital routinely makes headlines for having some of the worst air quality on the planet. Public discourse often scrambles for culprits- and all too frequently, **Diwali firecrackers** become the convenient villain. But while a night of fireworks can indeed foul the air briefly for a day or at maximum two, the true causes of Delhi's persistent pollution are more mundane and year-round. From **dusty roads** to **diesel fumes** and **crop fires**, a constellation of factors chokes Delhi's air each year. Understanding these contributors - and addressing them with real solutions- is key to breaking the deadly cycle.

Road Dust: The Ubiquitous Menace

A typical Delhi roadside with accumulated dust; passing vehicles can easily whip up this dust into the air, worsening particulate pollution. Unlike cities in developed countries where pavements are fully paved or green, many Delhi roadsides are just exposed soil. This pervasive dust not only worsens air quality but also deters people from walking or using public transport due to the grime.

One cannot walk on any Delhi street- whether in the heart of the city or the far outskirts- without encountering **dusty, bare earth** flanking the road. Pavements and road shoulders are often simply open soil. In contrast, cities across Europe or North America ensure that next to every road there's **either concrete or a strip of grass**, not loose dirt. The impact of this difference is enormous. **Road dust** is consistently identified as a major contributor to Delhi's particulate pollution - far greater than many realize. Studies by IIT Kanpur and others have found road dust to be the single largest source of particulate matter in Delhi's air, contributing as much as 38-56% of harmful PM emissions. By comparison, exhaust from vehicles accounted for a fraction of that (around 9-20% in these studies). In other words, the dust on Delhi's streets is literally half the pollution problem on its own.

Why is roadside dust such a menace? The city's dry soil, when left uncovered, is easily pulverized by the constant movement of people

and vehicles. Every car that speeds by, **kicks up plumes of fine dust** from the roadside, sending a fresh load of particles into the air for residents to inhale. This process repeats daily on virtually every road. Potholes, broken roads, and unpaved side lanes only add to the dust reservoirs. A few months ago, I went for a night stay near the Mundaka area. Diwali season was long gone, as had the effects of stubble burning. Those who offer keyboard solutions to Delhi's pollution should visit that area once just to get a real-life demonstration of what road dust can do. Even now I shudder to think how people lived there.

The result of this continuous whipping of dust, is a continuous, invisible sandstorm at ground level that **scales up the PM_{2.5} and PM₁₀ levels** across the city.

The consequences of road side dust extend beyond just measured pollution levels. Thick dust coating the sidewalks and bus stops **discourages people from walking or using public transport, including even the metro**- who wants to arrive at work with dust-covered shoes and clothes? Office commuters who might take the metro or bus often hesitate because the "last mile" walk could leave them grimy. This is one of the primary reasons, apart from other factors like weather, that many well-to-do residents opt for cars over public transit partly to avoid this very scenario. In a chain reaction, more car use then means more vehicular emissions and congestion. The ubiquitous dust also impacts local businesses and street life. In most world cities, street vendors and food carts attract all strata of society. But in Delhi, the sight (and smell) of dust and dirt by roadside food stalls limits their clientele largely to those with no other choice. Those who can afford indoor dining or cleaner environs stay away. This means **street food vendors lose out on higher-paying customers**, trapping many of these small businesses in a low-income cycle. A simple environmental issue - unpaved dusty streets - thus ends up affecting public health, transport choices, and even economic opportunities in the city. Pollution in Delhi has, so far, has largely been framed as an elite issue, thereby limiting its political salience and hence no incentive for action. But in reality, ubiquitous pollution, especially from road dust is actually an economic issue - its affects the poor the most. It limits high paying tourism; it keeps away

high paying customers from the entire economic cycle of street food and open air restaurants and the it adversely affects the health of the poor the most.

In a perverse manner, broken sidewalks or open soil also acts as a dumping ground form municipal waste. Right in the middle of a upscale society would be that one place where there is large open space, neither concreted nor green. Invariably it becomes the storage area for local waste which creates it own cycle of pollution and nuisance.

Importantly, road dust is a problem with a clear fix. It's not a mysterious meteorological phenomenon; it is a matter of basic urban infrastructure and maintenance. If every stretch alongside the road were **either concreted or covered with grass/greenery**, there would be no exposed soil to generate dust. Cities with cleaner air have already achieved this- you won't find open dirt lining the streets of Brussels or Rome or indeed Singapore or Brisbane. In fact, **Delhi has almost the same number of vehicles per capita as many Western cities** (about 473 cars per 1000 people in Delhi vs 570 in Brussels), yet those cities enjoy clean air because their roads are well-managed and dust-free. Many countries have been able to eliminate open-soil dust at country level, not just at a city level. In Delhi, forget the outskirts, not even central Delhi is free from side dirt.

Think of your carpeted living room. If it is wall to wall carpeted, there would hardly be any dust accumulating in the room. In case it is not, there would not only be dust on the sides but also on the main carpet from where it whips onto the furniture and beyond.

Simple measures like properly paved sidewalks, regular mechanical street sweeping or vacuuming, and planting grass in bare patches could drastically cut Delhi's dust emissions. Imagine a Delhi where stepping outside doesn't mean stepping into a film of dust- where more people feel comfortable walking or taking the metro. The payoff would be cascading: not only cleaner air from less dust, but also fewer vehicle trips, livelier streets, and a better quality of life. Road dust may be everywhere today, but with focused effort it could virtually disappear from Delhi's pollution equation.

Vehicular Emissions: Many Cars, But Not the Only Problem

Vehicular exhaust - the smoke from tailpipes of cars, two-wheelers, trucks and buses - is often the first culprit people think of in air pollution. Indeed, with over 11 million registered vehicles in Delhi, the transport sector is a significant source of year-round emissions. **Traffic congestion, diesel engines, and older vehicles** all contribute to particulate matter (PM) and noxious gases like NO₂ in the air. Studies estimate that vehicles contribute roughly 15-25% of Delhi's PM_{2.5} pollution on average. This is not negligible: in a megacity, that translates to a hefty dose of soot and fumes affecting lungs daily. Vehicle emissions also tend to be worst at street level, meaning exposure is highest for commuters, traffic police, and pedestrians stuck in the smog of idling engines.

However, it's critical to put vehicular pollution in perspective. While Delhi's vehicle count is massive, vehicle exhaust alone does not explain the extreme pollution episodes the city faces. As noted earlier, **road dust actually contributes more particulate pollution than tailpipes do**. Moreover, other cities with comparable car densities have much cleaner air - pointing to the fact that how vehicles are managed (fuel quality, emission standards, traffic flow) and other non-vehicular sources make a big difference. This is not to downplay the need to reduce emissions from transport. Delhi has taken steps like introducing cleaner Bharat Stage VI fuel, expanding the Metro, promoting electric vehicles, and even experimenting with odd-even license plate restrictions. Over the long term, transitioning more of the vehicle fleet to electric or CNG, improving public transport, and phasing out old polluting vehicles will cut a significant chunk of pollution. But even if Delhi somehow magically electrified all its vehicles tomorrow, the city would still have a serious smog problem every winter - because tailpipes are only one piece of a much larger puzzle.

It's also worth noting an intriguing comparison: despite Delhi's vehicle glut, on a per-capita basis the city is not vastly different from some car-heavy Western metros. The stark contrast in air quality stems from

the other factors we discuss- dust, open burning, and external smoke- which aggravate pollution here. Thus, while cleaner transport is important, Delhi cannot road-dust-sweep the problem under the rug by blaming vehicles alone. The city must tackle vehicular pollution and the non-vehicular pollutants simultaneously.

Biomass Burning: Fires in the City

Another underappreciated contributor to Delhi's air pollution is the **burning of biomass and waste within the city** itself. Walk through many neighbourhoods on a chilly winter evening or an early morning, and you might catch the scent of smouldering leaves, wood, or even trash. For a large segment of the population - especially the economically weaker sections - burning biomass is a means to cook food, stay warm, or dispose of garbage. Unfortunately, these countless small fires collectively send up a significant load of pollutants, particularly in the colder months.

Research has shown that **biomass burning is a major cause of Delhi's worst pollution episodes in winter**. In fact, an international study led by IIT Kanpur in 2022 found that during winter haze conditions, uncontrolled biomass burning for residential heating and cooking was the leading cause of the explosive growth of ultra-fine particles at night. They observed "intense and frequent nocturnal particle growth events" driven 70% by vapours from biomass smoke condensing into fine particles. In plain terms, when people burn wood or other organic matter to keep warm, the smoke chemicals linger in the cold night air and form a fog of tiny particles by morning. This phenomenon affects the entire Indo-Gangetic Plain's air and puts nearly 400 million people at risk.

Delhi is not isolated from this - many low-income households in and around the city still rely on **wood, coal, or cow dung cakes for cooking and heating**. According to a report by the Centre for Science and Environment, around 41% of Indian households use such solid fuels for cooking, which not only adds carbon emissions but also PM2.5 that escapes into the neighbourhood. Even those who have LPG cylinders might burn leaves or discarded materials outdoors in winter for

warmth. On top of that, there's the issue of **open garbage burning** - despite rules against it, one can often find smouldering piles of trash or yard waste in empty plots and street corners, as residents or even municipal workers resort to burning refuse. All these fires might seem small individually, but together they act like a diffuse, unregulated "forest fire" spread across the city.

To address biomass burning, we need to take a two-pronged approach: **enforcement and alternatives**. Enforcement means strictly preventing garbage burning and discouraging any open fires in urban limits - something municipal bodies have attempted with mixed success. It's common in winter to see announcements or even fines for burning, but the practice continues, indicating enforcement is still lax. Equally important is offering alternatives to those who rely on fires for basic needs. For cooking, this means ensuring affordable **clean cooking fuel** (LPG or electricity) reaches all urban poor - a task largely achieved in Delhi but needing constant vigilance so that no one reverts to firewood due to cost or supply issues. For heating in the bitter cold, the government can provide or subsidize **electric heaters or community warming centres**, so that people don't have to burn scrap wood and garbage to keep from freezing. This was even attempted on a pilot basis, but scaling it up would help. Essentially, Delhi must eliminate the scenario where on a cold night thousands of little fires are puffing away in slums and streets. It's a public health imperative: not only do those fires fill the air with particulates, but the people huddled around them inhale the worst of it, leading to respiratory illnesses. Cutting down on biomass burning is a win-win for both air quality and public health, especially for the most vulnerable.

Diesel Generators: Invisible Polluters in Plain Sight

A rumbling diesel generator (DG) set is a common sight (and sound) in many parts of Delhi - whether powering a market during a power outage, or as backup for apartment complexes, hospitals, and offices. These **diesel gensets** are essentially small power plants running on fossil fuel, and they emit a cocktail of pollutants: particulate matter, nitrogen oxides, and sulphur dioxide. While one generator is small,

Delhi has thousands of them. During power cuts or peak load times, many areas echo with their chugging noise and belch of exhaust. Unfortunately, their emissions disperse at ground level right in the breathing zone of residents.

Unregulated use of diesel generators has been identified by authorities as a **significant contributor to Delhi's pollution**, especially in cooler months. The Commission for Air Quality Management (CAQM), a statutory body, explicitly noted that "uncontrolled use of DG sets is a major contributing factor for deterioration of air quality in the region". This is why under the Graded Response Action Plan (GRAP), Delhi and NCR impose bans or restrictions on diesel generator use when air quality reaches certain poor thresholds. However, enforcement remains a challenge - many establishments quietly run their gensets whenever needed, especially if electricity supply is unreliable. Moreover, even when grid power is stable, construction sites and event organizers might use portable generators. Each of these pumps out soot comparable to many trucks' worth of exhaust.

The good news is that tackling DG set pollution is **technically straightforward** - it's about providing cleaner alternatives. The most effective step is improving the reliability and reach of the electric grid so that generators are rarely needed. Delhi's power supply has improved over the years, but backup generators are still used out of precaution or for high-draw events. Incentivizing battery storage and **solar power installations** for commercial complexes can replace the need for diesel backups. Where generators are absolutely necessary (for critical infrastructure like hospitals), they should be mandated to use **cleaner fuels or technologies** - for instance, gas-based generators or retrofitted diesel gens with advanced emission controls. In fact, new regulations in NCR now require larger gensets to be retrofitted or run on dual fuel (gas plus diesel) to cut emissions. Over the next few years, phasing out diesel generators in favour of cleaner backups could eliminate this "invisible" source of pollution. It's a classic case of an unsung problem that operates in the background- you might not notice a generator's emissions as much as a smoky truck or a fire, but it's contributing its share to the smog nonetheless. Removing these stealth polluters would be a significant step toward cleaner air.

Crop Stubble Burning: Smoke from the Fields

No discussion of Delhi's autumn air pollution is complete without **stubble burning** - the practice of torching crop residues in the neighbouring states of Punjab, Haryana, and Western UP. Each October-November, after the rice harvest, thousands of farmers set fire to their fields to quickly clear them for the next sowing. The resulting smoke plumes rise and travel hundreds of kilometres, often driven by north-westerly winds straight toward Delhi. When this smoke mingles with Delhi's own pollution and the region's cooler air and moisture, it forms the dense smog that blankets the capital and its surrounding NCR towns.

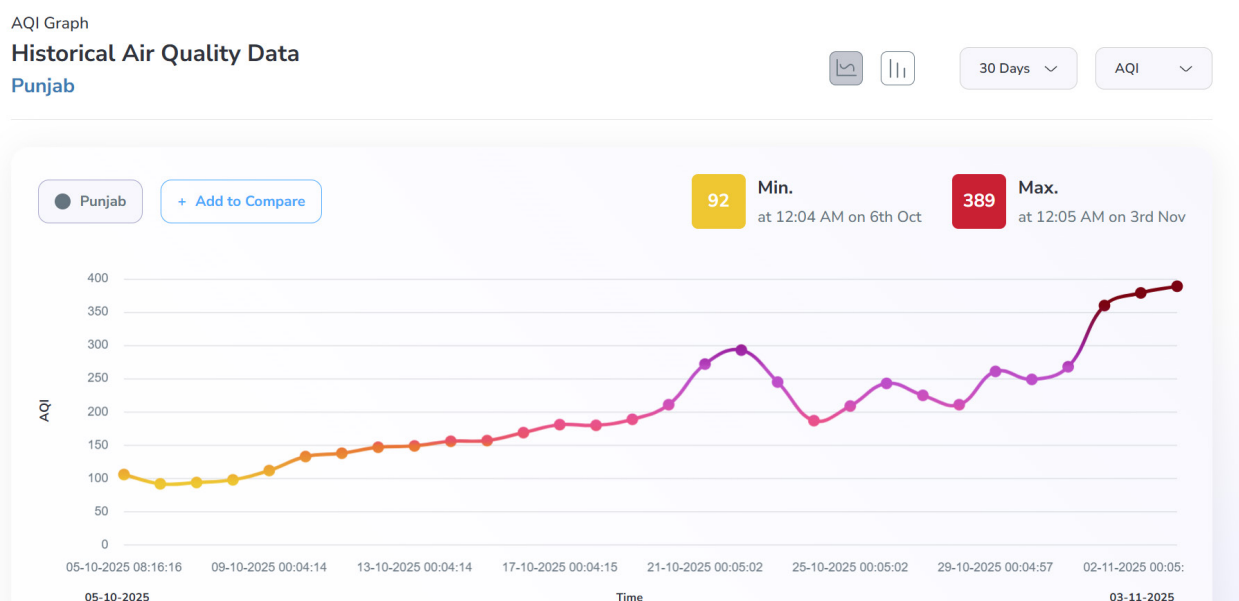
Stubble burning is a highly visible and politically charged issue, and for good reason. On certain days, **farm fire smoke can account for an alarming share of Delhi's pollution**. Data from monitoring agencies show that on the worst smog days, the fraction of PM_{2.5} in Delhi coming from crop fires has spiked to 40-50% or even higher. For instance, in early November 2018, analysts estimated that stubble burning was responsible for about 58% of Delhi's particulate pollution on a particularly bad day. In 2021, the peak contribution was around 48%, and in 2022 about 34% on the worst day. Even in the more moderate 2024 season, when fires were somewhat fewer, one day hit 35% contribution from stubble smoke. In short, when the winds and weather cooperate to transport farm fire smoke, it can turn Delhi's air from merely bad to hazardous in a matter of hours.

It's important to not be sidetracked by average contribution of stubble burning over a season as it might be lower (several studies suggest a seasonal average of, say, 10-20% of Delhi's PM_{2.5} coming from external farm fires). Averages, like statistical data is known to do, obscure the acute peaks that really drive the health emergency. It only takes a few consecutive high-smoke days to send hospital visits soaring and create the "gas chamber" conditions that Delhi is infamous for. Moreover, those peaks often occur in late October and November, setting the stage for a consistently bad winter of pollution as local sources then keep the baseline high. The yearly, relatively lower average means very little when the acute phase occurs between late October and mid-November.

Tackling stubble burning is challenging because the fires are outside Delhi's jurisdiction- it requires coordination and action in neighbouring states. However, it's not an impossible problem. Solutions have been piloted, such as promoting mechanized harvesting equipment that can remove or mulch the straw without burning (like the Happy Seeder and Super Straw Management System) and subsidizing farmers to adopt these methods. There's also the **Pusa bio-decomposer**, a microbial solution developed to spray on fields to decompose the stubble quickly. Governments in Haryana and Western Uttar Pradesh, with support from the central government, have rolled out schemes to provide machinery and even pay farmers an incentive per acre to not burn. Yet, the practice persists among many farmers, specifically in Punjab due to convenience or timing pressures.

Over the years, Western Uttar Pradesh and Haryana have significantly reduced stubble burning. Punjab, caught in the crossfire of Aam Aadmi Party run government since 2022, still has the maximum number of stubble burning fires in sheer numbers. It is not as if the smoke from stubble only chokes Delhi. Punjab suffers equally.

The chart below, from the website www.aqi.in, tells the story of Punjab. After a short upward spike on 21st October post Diwali, the AQI actually dipped to pre-Diwali levels before rising again to alarming levels towards late October as the full effects of stubble burning started kicking in.



What's needed is a stronger push - perhaps a **two-year intensive campaign** to eliminate farm fires entirely. This could involve heavier subsidies or buy-back programs for crop residue (using it as biomass fuel or for making products like compressed natural pellets), combined with stricter enforcement and penalties for deliberate burning. In parallel, helping farmers diversify cropping patterns (reducing the rice area that produces so much residue) and adjusting sowing schedules could alleviate the time crunch that leads to burning. It's a complex socio-economic issue, but the bottom line is clear: Delhi and the nation cannot afford this annual pollution ritual. The technology and policy ideas exist to end stubble burning; they now must be executed on a war footing.

Firecrackers: The Convenient Scapegoat

Amidst the plethora of pollution sources, **Diwali firecrackers** have often been made the culprit in public debates. Every year around the festival of lights, courts and assorted activists scramble to vilify fireworks in Delhi. It's not without reason - anyone who has experienced a Diwali night in Delhi knows that the firecracker smoke can be overwhelming, and by midnight the air becomes acrid and hazy even to the naked eye. Indeed, on Diwali night, pollution readings shoot up dramatically. However, focusing on firecrackers as the prime culprit for Delhi's smog is largely **misguided**. Fireworks produce a sharp spike in pollution that, crucially, is short-lived, at most for twenty four hours, relative to the continuous emissions from other sources.

Consider what happened this year: Diwali 2025 was celebrated on 20th October. By midnight, Delhi's $\text{PM}_{2.5}$ concentrations had surged to extremely high levels - in some places well above $600 \mu\text{g}/\text{m}^3$, which is severe by any standard. But just half a day later, much of that pollution had vanished. By the afternoon of the next day, $\text{PM}_{2.5}$ had dropped to around $80 \mu\text{g}/\text{m}^3$ - still not "clean" air, but a **seven-fold reduction** from the night peak. Monitoring stations across the city showed the same trend: for example, at the RK Puram area, levels that were $\sim 1,400 \mu\text{g}/\text{m}^3$ at midnight plunged to about $117 \mu\text{g}/\text{m}^3$ by the next day. What caused this rapid improvement? Largely, it was a change in weather

and the absence of additional smoke input. Once people stopped bursting crackers and a light wind picked up, the particulate matter could disperse or settle. In other words, the Diwali spike is intense but ephemeral- it does not stick around for weeks on end.

PM_{2.5} concentrations in Delhi spiked on Diwali night but dropped dramatically by the next afternoon. Favorable weather allowed the firework smoke to disperse by 21 October afternoon, unlike the persistent smog driven by crop-burning and other sources. This data underscores that firecrackers' impact, though acute, is short-lived compared to Delhi's chronic pollution factors.

This is not to say firecrackers are harmless. The short-term exposure to very high pollution can itself be dangerous, especially for sensitive individuals. However, the core issue is that **beyond the 24-48 hours of Diwali, fireworks are simply not a source of pollution.** Yet, they receive disproportionate attention, often at the expense of sustained action on the true year-round causes. It's politically conveniently and administratively easier to target a one-day cultural event with bans- it shows quick action and generates headlines - whereas tackling road dust or enforcing against generators is hard, grind-it-out work with less immediacy. This was the exact template that Delhi followed between from 2015 Diwali season till 2024 Diwali. The 'secular' politics that animates the chatterati and the activists found a common cause in Diwali firecrackers. The courts were more than happy to oblige and be seen on the 'right' side of narrative building elites. Ultimately when the government changed in Delhi in 2025, it petitioned the Supreme Court to take a different view. The Supreme Court obliged and the results are conclusive. Firecrackers do cause a spike – which clears in a day or so. The root causes for sustained high pollution are different which received no attention in the last decade from the local Delhi government run by AAP.

It is telling that Delhi's modern smog crises became extreme over the last decade (roughly the same period in which firecracker bans were ramped up). The worst haze episodes- post-2015- coincided with years when **Diwali was already under restrictions**, indicating that something

else was driving the new levels of severity. The data and expert analyses all point to those other factors: stagnant dust and construction debris, continuous vehicle and industrial emissions, and then a huge slug of *external smoke from stubble fires*. We should treat firecrackers as a small part of the pollution pie (a Central Pollution Board estimate once suggested the spike from Diwali adds on the order of 30-40 $\mu\text{g}/\text{m}^3$ to seasonal $\text{PM}_{2.5}$ levels, which is not negligible but modest compared to the hundreds of μg from other sources). In fireworks have become a soft target- a visible problem that's relatively easier to clamp down on- whereas dust control, waste management, and agricultural policy require sustained, year-round effort. Then of course there is the politics of targeting Hindu festivals which made Diwali a soft target.

A Roadmap for Clean Air: Real Solutions, Real Work

If Delhi is to **truly escape** its annual pollution nightmare, a comprehensive attack on the root causes is necessary. The time for half-measures and symbolic gestures is over- what's needed is a bold, focused plan with clear timelines. Here is a proposed roadmap that zeroes in on the biggest contributors and outlines how to eliminate them:

1. **One-Year Blitz to Eliminate Road Dust:** Launch an intensive campaign to **pave or green every roadside and dirt surface** in Delhi within the next year. This means no open soil anywhere abutting a road - if a sidewalk or curb is broken or unpaved, fix it; if there's a bare earth shoulder, cover it with grass or shrubs or at least gravel. The city should deploy resources to identify every dusty stretch and address it. Alongside, ramp up **mechanized street cleaning** - vacuum sweepers that regularly remove dust, instead of merely brooming it back into the air. Ensuring that "dust does not arise in the first place," as experts have noted, should be the mantra. A dust-free Delhi would not only cut particulate pollution by up to a third or more (given road dust's ~30-40% contribution), but also make the city visibly cleaner and more walkable. The benefits - cleaner air, easier breathing, and even nicer aesthetics - will be immediately felt by all.

2. Two-Year Plan to End Stubble Burning: In collaboration with neighbouring states and the central government, Delhi must spearhead a mission to **completely stop crop-residue burning within two years.** This involves funding and facilitating alternatives for farmers: massively expand the distribution of farm machines like Happy Seeders that allow sowing without burning, provide monetary incentives for farmers who refrain from burning, and enforce penalties for violations once alternatives are in place. The science shows that when stubble burning is eliminated or reduced, Delhi's autumn air sees a dramatic improvement. For example, the relatively cleaner Diwali of 2025 was partly thanks to a 79% drop in farm fires, in neighbouring areas of Haryana and Western Uttar Pradesh, compared to the previous year. We know the solution - now it's time to implement it at scale. A two-year deadline would concentrate efforts primarily in Punjab as well as eliminate the relatively small number of fire incidents still taking place in Haryana and UP, to deploy required technology and training by the 2027 crop cycles. It's an ambitious target, but treating it like an emergency (which it is) can make it attainable. Imagine a November in Delhi where the sky stays blue because no smoke is blowing in - that alone could save thousands of lives and illnesses.

3. Three-Year Drive to Curb All Other Major Sources: Within a three-year horizon, target the remaining key pollution sources systematically:

- **Upgrade or Replace Diesel Generators:** Mandate that all diesel gensets in Delhi/NCR be either converted to cleaner technology (CNG/LPG based or fitted with advanced filters) or phased out in favor of battery backup and solar power by 2028. In the interim, strictly enforce existing bans on DG use on bad-air days, and create a citywide database to monitor compliance.
- **Promote Clean Cooking and Heating:** Ensure 100% LPG or electricity access for cooking in all urban households to eliminate charcoal/wood usage. Simultaneously, roll out programs for distributing electric or solar heaters and blankets in winter to remove the need for burning biomass for warmth. Couple this with

a zero-tolerance approach to open burning of garbage - provide better waste collection so people aren't tempted to burn trash, and have quick response teams to douse and penalize any garbage fires.

- **Sustainably Reduce Vehicular Emissions:** Expand public transportation and last-mile connectivity so that more people leave their cars at home. Expedite the adoption of electric buses and taxis, and enforce the retirement of old polluting vehicles. While vehicles aren't the sole culprit, cutting their emissions by, say, half in the next few years will complement the gains made from dust and smoke control.
- **Industrial and Construction Pollution:** Tighten monitoring of industries in and around Delhi- even if most big polluting industries have been relocated, ensure the remaining units use clean fuels (no coal or heavy oil). Strictly enforce dust control at construction sites (covering materials, using water sprays) as per norms, with heavy fines for violations. Every construction project should factor in pollution mitigation as a non-negotiable cost.

Each of these measures requires diligent execution, not just paper directives. But if pursued earnestly, within three years Delhi could drastically shrink the pollution from these local sources.

In conclusion, Delhi's air pollution crisis has been allowed to fester through piecemeal measures and misplaced priorities. The evidence is clear that **road dust, biomass burning, diesel generators, vehicular emissions, and seasonal farm fires** are the true giants that must be slain to reclaim blue skies. It is easier to ban a festive indulgence like firecrackers and declare victory, but that is a pyrrhic victory- doing so treats a symptom for a day and ignores the disease that rages all year. The technology, knowledge, and strategies to combat the real causes exist. The capital's notorious smog is not an inevitability of geography; it is a man-made problem with man-made solutions. **The path forward is demanding, but the reward - the sight of a clear Delhi sky and the sound of 30 million people breathing easier - is well worth the effort.**

Finally, what is needed is that at least on this issue political one-upmanship is set aside. BJP governments in Haryana and Uttar Pradesh have demonstrated that they are willing to walk the talk as regards stubble fires. The politics of Punjab, on at least this issue, needs to be insulated from regular bickering.

Sources: The analysis draws on studies and reports by IIT Kanpur, CSE and others identifying road dust as the largest contributor to Delhi's particulate pollution. Data from air quality monitoring (e.g., CPCB, SAFAR) underscores the episodic impact of stubble burning- with peak contributions reaching ~40-50% on worst days- and the transient spike from Diwali fireworks. Policy perspectives from the CAQM and expert opinions have been incorporated regarding the role of diesel generators and biomass burning. These sources and empirical evidence all point toward a comprehensive mitigation approach, rather than singular fixes, to resolve Delhi's air pollution crisis.