



Open Waste Burning in Indian Cities Intensifies During Winter, Exposing Gaps in Municipal Waste Management and Air-Quality Governance

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Recent Developments:

- A recent **World Resources Institute India** working paper based on field surveys across **11 Indian cities** found that open waste burning rises sharply during winter, with the incidence, quantity of waste burned and associated emissions becoming **up to three times higher** than in summer.
- The winter increase is associated with colder conditions, stagnant atmospheric conditions, greater demand for warmth and persistent weaknesses in municipal waste collection and processing systems.
- The findings indicate that **open waste burning is not merely an air-pollution issue but also a municipal-service delivery and environmental-governance problem.**
- Paper, plastics and other combustible materials form important components of the waste being burned, while burning of plastics is particularly concerning because incomplete combustion can release hazardous pollutants.
- The problem becomes especially important during winter because lower temperatures, shallow atmospheric mixing and weaker dispersion can increase the persistence of locally emitted pollutants.

What is Open Waste Burning?

Meaning and Nature:

- **Open waste burning** refers to the uncontrolled combustion of municipal solid waste in streets, vacant plots, community spaces, roadside locations, collection points and dumpsites without appropriate emission-control systems.
- It commonly involves mixed waste containing plastics, paper, textiles, organic matter and other combustible materials, making the resulting emissions difficult to predict and control.
- Unlike scientifically designed waste-treatment facilities, open burning generally occurs at low and uncontrolled temperatures, increasing the possibility of incomplete combustion and toxic emissions.

Why Winter Intensifies the Problem:

- Winter increases open burning because accumulated waste is sometimes burned for disposal and, in vulnerable communities, combustible waste may also be used as an easily available source of warmth.
- **Temperature inversions and a lower atmospheric boundary layer** during winter can restrict pollutant dispersion, increasing local exposure even when the absolute quantity burned is relatively small.
- Therefore, the winter problem reflects an interaction between **waste-management failure, human vulnerability and unfavourable meteorology.**

Major Causes of Open Waste Burning:

Weak Municipal Waste Collection:

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- Irregular or incomplete **door-to-door collection** allows household and commercial waste to accumulate, encouraging residents and businesses to dispose of it through burning.
- The Central Pollution Control Board has identified door-to-door collection, regular sweeping, waste removal and covered transportation as critical elements of an effective solid-waste-management system.

Insufficient Waste-Processing Capacity:

- Inadequate **segregation, recycling, composting, biomethanation and material-recovery facilities** can cause collected waste to accumulate at intermediate points and dumpsites.
- Lack of adequate processing infrastructure can also weaken the effectiveness of source segregation because recyclable and organic fractions may ultimately be mixed and disposed of together.

Cost and Convenience:

- Open burning is often perceived as a quick and inexpensive method of disposing of accumulated waste, particularly where formal collection systems are unreliable.
- Small commercial establishments and households may therefore resort to burning when alternative disposal arrangements are inconvenient or costly.

Winter Heating and Socio-economic Vulnerability:

- Some economically vulnerable groups use combustible waste as a readily available source of warmth during cold weather.
- Burning of paper and plastics for heating creates a **double burden**, because vulnerable populations may simultaneously become the source and immediate victims of toxic exposure.

Weak Enforcement:

- Repeated burning at vulnerable locations indicates gaps in **monitoring, enforcement and accountability**.
- CAQM has specifically directed NCR authorities to strengthen surveillance, particularly during winter and at locations vulnerable to garbage burning, while adopting zero tolerance towards open burning of municipal solid waste.

Environmental and Health Impacts:

Air Pollution:

- Open burning releases **PM2.5, PM10, black carbon, carbon monoxide, volatile organic compounds and other hazardous pollutants**, depending on the composition of the waste and combustion conditions.
- Plastic-containing waste can generate highly toxic combustion products, including **dioxins, furans and other persistent organic pollutants** under uncontrolled conditions.
- Open waste burning can also contribute to ozone formation through emissions of reactive gases and volatile organic compounds.

Soil, Water and Ecosystem Contamination:

- Ash and partially burned residues can contain heavy metals and persistent contaminants that may enter **soil and groundwater**.
- Runoff from contaminated residues can transport pollutants into nearby drains and water bodies.
- Plastic residues can fragment into smaller particles and contribute to long-term environmental contamination and ecological damage.

Climate Implications:

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- Open burning releases **carbon dioxide, black carbon and other climate-forcing pollutants**.
- Black carbon has a strong short-lived climate effect and can also influence snow and ice albedo when deposited on high-altitude surfaces.
- Preventing open burning therefore supports both **air-quality improvement and climate mitigation**.

Public Health:

- Exposure to smoke can cause **coughing, eye irritation, breathing difficulties and aggravation of respiratory conditions**.
- Fine particulate matter can penetrate deep into the lungs and enter the bloodstream, increasing risks associated with **cardiovascular and respiratory diseases**.
- Long-term exposure to carcinogenic compounds such as certain polycyclic aromatic hydrocarbons can increase health risks.
- Waste-management workers and people living near burning sites face disproportionate exposure, creating an **environmental-justice dimension** to the problem.

Government Initiatives and Policy Framework:

Solid Waste Management Rules, 2016:

- The **Solid Waste Management Rules, 2016** provide the principal regulatory framework for municipal solid waste management, including responsibilities relating to collection, segregation, transportation, processing and disposal.
- The rules emphasise scientific waste management and assign important responsibilities to **urban local bodies and local authorities**.
- CPCB guidance also promotes the waste hierarchy, under which **prevention, reduction, reuse, recycling and recovery** are preferred over final disposal.

CAQM Measures:

- The **Commission for Air Quality Management** has treated open municipal-waste burning and fires at dumpsites as important air-quality concerns in the NCR.
- CAQM's directions require effective collection, segregation, transportation and processing of municipal solid waste, strengthened surveillance at vulnerable locations and **zero tolerance towards open burning**.
- Under **Operation Clean Air**, CAQM has continued inspection and enforcement activities across NCR cities, demonstrating the shift towards source-specific and location-specific pollution control.

Waste-to-Energy:

- The **Ministry of New and Renewable Energy** supports Waste-to-Energy projects that can convert suitable urban, industrial and agricultural wastes or residues into **biogas, Bio-CNG, electricity and producer or syngas**.
- Such projects can provide an alternative to uncontrolled disposal, provided that waste segregation, appropriate technology, emission standards and financial viability are ensured.

Pradhan Mantri JI-VAN Yojana:

- The **Pradhan Mantri JI-VAN Yojana** supports integrated bio-ethanol projects that utilise suitable biomass and agricultural residues, thereby promoting resource recovery and reducing dependence on uncontrolled residue disposal.
- The scheme links waste-residue management with **renewable energy and circular-economy objectives**.

Extended Producer Responsibility:

- **Extended Producer Responsibility (EPR)** places responsibility on producers for managing specified post-consumer waste streams, including plastic packaging, e-waste and batteries.
- Effective EPR can increase collection and recycling, reduce landfill pressure and limit the quantity of combustible waste entering informal disposal channels.

Single-Use Plastic Regulation:

- Restrictions on specified **single-use plastic items** seek to reduce littering and the environmental burden created by low-utility plastic products.
- However, restrictions must be accompanied by affordable alternatives, effective enforcement and improved collection systems to prevent waste displacement into informal burning.

Key Challenges in Tackling Open Waste Burning:

Governance and Institutional Coordination:

- Waste management involves **urban local bodies, State Pollution Control Boards, CPCB, CAQM, private operators and citizens**, making coordination essential for effective implementation.
- Fragmented responsibilities can weaken accountability when waste is generated, collected, transported and finally disposed of by different agencies.

Infrastructure and Financial Constraints:

- Smaller cities and economically weaker urban areas may lack adequate **material-recovery facilities, composting units, biomethanation plants and scientific disposal facilities**.
- Municipal finances and technical capacity therefore remain critical determinants of waste-management performance.

Behavioural and Social Factors:

- Open burning cannot be eliminated through penalties alone when residents lack reliable collection services or affordable disposal alternatives.
- Public participation, source segregation and community-level monitoring are therefore essential components of sustainable waste governance.

Way Ahead:

Shift from Reactive Enforcement to Source-Level Prevention:

- Cities should move from responding to visible burning incidents towards **universal door-to-door collection, source segregation, decentralised processing and systematic monitoring** of waste-sensitive locations.
- Waste-management systems should prioritise prevention, reuse, recycling and recovery before considering disposal.

Integrate Winter Waste and Air-Quality Planning:

- Urban authorities should prepare **winter-specific waste-management plans** alongside air-pollution action plans, with enhanced night-time surveillance and rapid response at vulnerable locations.
- Local pollution-control strategies should account for seasonal meteorology, population vulnerability and the spatial distribution of waste-burning hotspots.

Protect Vulnerable Communities:

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- Providing **safe and affordable heating alternatives** to sanitation and waste-management workers can reduce the incentive to burn waste for warmth.
- Worker protection should include appropriate personal protective equipment, training and safeguards against exposure to toxic smoke.

Strengthen Circular Economy:

- Greater investment in **recycling, composting, biomethanation, material recovery and resource recovery** can convert waste from an environmental liability into an economic resource.
- EPR should be strengthened through traceable collection systems, recycling targets, digital monitoring and accountability across the value chain.

Improve Urban Governance:

- Urban local bodies should establish measurable indicators for collection efficiency, segregation, processing capacity, open-burning incidents and grievance resolution.
- Data-driven identification of **waste-sensitive locations** can enable targeted enforcement and better allocation of municipal resources.

Value Addition for UPSC:

Important Concepts:

- **Waste Hierarchy:** Prevention ? Reduction ? Reuse ? Recycling ? Recovery ? Disposal.
- **Circular Economy:** Treating waste as a resource through recovery, reuse and recycling rather than linear disposal.
- **Environmental Justice:** Disproportionate exposure of economically vulnerable communities and waste workers to environmental hazards.
- **Source-Level Prevention:** Preventing waste accumulation and burning through reliable collection, segregation and decentralised processing.
- **Seasonal Air Pollution:** Interaction between emission sources and meteorological conditions such as temperature inversion and reduced atmospheric mixing.

Mains Analytical Takeaway:

- Open waste burning demonstrates that **air pollution cannot be addressed only through pollution-control measures**; it requires simultaneous improvement in municipal services, waste-processing infrastructure, social protection, enforcement and citizen participation.
- The sustainable solution lies in transforming waste management from a **disposal-oriented system into an integrated circular-economy model**, while making winter air-quality governance more targeted and locally responsive.