INDOOR AIR POLLUTION: ENVIRONMENT

NEWS: Indoor air pollution: Can better design in urban infrastructure help combat this growing problem?

WHAT'S IN THE NEWS?

Indoor air pollution in India poses a major public health risk due to poor ventilation, harmful materials, and outdoor infiltration, yet remains under-addressed. Strengthening building regulations, promoting awareness, and ensuring clean indoor environments are essential for safeguarding health and well-being.

Context

- Indoor air pollution in India is emerging as a **critical public health concern**, particularly as urban residents spend between **70% to 90% of their time indoors**.
- Despite growing awareness about outdoor air pollution, **indoor air quality (IAQ)** has not received equal attention in policymaking or public discourse.

What is Indoor Air Pollution?

- Indoor air pollution refers to the **presence of harmful pollutants within indoor environments**, such as homes, offices, schools, and commercial buildings.
- These pollutants may originate from **indoor activities**, **building materials**, **natural processes**, or **outdoor air infiltration**.
- Indoor Air Quality (IAQ) significantly affects the **health, comfort, and productivity** of occupants.

Global and Indian Context

- **2.1 billion people globally** still use open fires or inefficient stoves, contributing heavily to indoor pollution.
- In **2020**, household air pollution led to **3.2 million deaths**, including **237,000 deaths of children under 5 years**.
- The **combined effects** of indoor and ambient air pollution are linked to **6.7 million premature deaths annually**.
- In India, **external pollution sources**, such as poor ambient air and vehicle emissions, **infiltrate indoors**, while **internal sources** like biomass fuel, poor ventilation, and toxic materials worsen the problem.

Major Sources of Indoor Air Pollution

Source Type	Pollutant/Chemical	Impact on Health

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Combustion (Cooking/Heating)	Carbon monoxide, smoke	Headaches, dizziness, heart disease, respiratory illnesses
Building Materials	Asbestos, formaldehyde, lead	Cancer, developmental disorders, chronic respiratory conditions
Biological Contaminants	Mold, dust mites, pollen, pet dander	Allergies, asthma, respiratory infections
Household Products	Pesticides, chemical cleaners, incense smoke	Eye/nose/throat irritation, toxic effects, long-term cancer risks
Outdoor Air Infiltration	PM2.5, PM10, vehicle exhaust	Respiratory and cardiovascular diseases, systemic inflammation
Natural Radiation	Radon gas	Strongly associated with increased risk of lung cancer
Furniture & Furnishings	VOCs from paints, varnishes, adhesives	Headaches, skin irritation, organ damage, potential carcinogenicity

Health Impact of Indoor Air Pollution

Immediate Effects

- Irritation of the eyes, nose, throat
- Headaches, fatigue, dizziness (often confused with viral symptoms)
- Increased asthma attacks in vulnerable individuals

Long-Term Effects

- Chronic respiratory diseases: Asthma, COPD, and bronchitis
- Cardiovascular diseases: Long-term exposure to PM leads to increased heart disease
- Cancer risks: Substances like radon, asbestos, and formaldehyde are known carcinogens
- Cognitive decline: Poor IAQ reduces mental alertness, focus, and decision-making ability

Indoor Air Quality (IAQ) Standards in India

Parameter	Standard Limit	Duration

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PM2.5	40 µg/m³	24-hour average
PM10	60 µg/m³	24-hour average
Carbon Monoxide (CO)	2.0 mg/m³	8-hour average
Formaldehyde (HCHO)	0.05 ppm	30-minute average
Carbon Dioxide (CO_2)	Below 1000 ppm (recommended)	Continuous
Temperature	24°C – 30°C	Comfort Range
Relative Humidity	30% – 60%	Comfort Range

Policy and Regulatory Framework

- **Regulatory Agencies**:
    - *Central Pollution Control Board (CPCB)* – National guidelines and policy monitoring
    - *Bureau of Indian Standards (BIS)* – Standardization of materials and practices
    - *National Building Code (NBC)* – Construction regulations including IAQ norms
    - *State Pollution Control Boards (SPCBs)* – State-level monitoring and enforcement
- **Enforcement Mechanisms**:
    - Periodic building inspections
    - Mandated IAQ monitoring in public buildings
    - Penalties for non-compliance with IAQ standards
    - Awareness programs and advisories

Key Challenges in Addressing Indoor Air Pollution

- **Neglect of Indoor Pollution**: Focus has largely been on outdoor air despite the greater time spent indoors.
- **Poor Building Design**: Older structures often lack proper insulation, cross-ventilation, or use outdated materials.

- **Urban Overcrowding**: High-density housing contributes to insufficient air flow and accumulation of indoor pollutants.
- **Low Public Awareness**: Many are unaware of sources like formaldehyde, VOCs, or radon gas within their living spaces.
- **Economic Barriers**: Healthier construction materials and IAQ systems are still unaffordable for low-income households.

Ways to Mitigate Indoor Air Pollution

Strategy	Details
Improve Ventilation	Use cross-ventilation, exhaust fans, HEPA filters, skylights
HEPA Filters	Remove 99.97% of airborne particles ≥ 0.3 μm (dust, pollen, microbes)
Use Low-VOC Materials	Choose paints, adhesives, varnishes with low chemical emissions
Avoid Hazardous Materials	Eliminate asbestos, lead paints, formaldehyde-containing items
Building Design & Retrofitting	Integrate IAQ in building plans, retrofit older structures for air safety
Natural Air Purification	Use houseplants like aloe vera, peace lily, and snake plant to improve IAQ
Safe AC Usage	Clean filters regularly, use air purifiers, maintain airflow separation
Daily Practices for Households	Open windows daily, allow sunlight in, reduce chemical usage indoors

Conclusion

- Indoor air pollution is a **silent but serious threat**, particularly in India's rapidly urbanizing landscape.
- It impacts **health, cognitive function, productivity**, and **long-term well-being**, especially among **children, elderly, and low-income populations**.
- Tackling indoor pollution requires a **multifaceted approach** involving **public awareness**, **regulatory enforcement**, **scientific building design**, and **affordable air-cleaning technologies**.

Source: https://www.thehindu.com/sci-tech/health/indoor-air-pollution-can-better-design-in-urban-infrastructure-help-combat-this-growing-problem/article69422529.ece