

Environmental Pollution in New Delhi, India: A Critical Examination of Air Quality and Its Impacts

Executive Summary

New Delhi, India, is suffering from severe air quality issues, with an estimated 10,000 premature deaths per year. The city's air pollution is primarily caused by particulate matter, with an annual average fine particulate matter mass concentration of $121 \mu\text{g}/\text{m}^3$, 24 times higher than the World Health Organization's suggested healthy level. The air pollution in Delhi also affects the surrounding districts, with India having the world's highest death rate from chronic respiratory diseases and asthma. The city's poor air quality has irreversibly damaged the lungs of 2.2 million children. The Indian government has implemented initiatives to reduce air pollution, but their marginal benefits have fallen short over the years. The city's air quality index varies greatly throughout the year, ranging from Satisfactory to Hazardous levels.

Sources and Effects of Particulate Matter Pollution

Particulate matter pollution in New Delhi is a significant environmental concern, with the city's air quality being the most harmful of any major city in the world [S2]. The high pollution level of fine particulate matter (PM₁) in New Delhi has attracted global attention, but the true level of PM₁ pollution could still be underestimated due to hygroscopicity-induced bias associated with particle hygroscopic growth [S1]. A study found that the more severe pollution the larger underestimation, with an average underestimate of up to 20% (or $50 \mu\text{g}/\text{m}^3$) of PM₁ concentration on humid winter morning rush hours [S1]. The study used data from various sources, including the Central Pollution Control Board and SAFAR networks, which have been developed to better understand air pollution and suggest mitigation strategies [S1].

Particulate matter pollution in Delhi is primarily caused by vehicle exhaust, industries, waste burning, and construction activities [S3]. The average concentrations of particulate matter in Delhi and its satellite cities are $123 \pm 87 \mu\text{g}/\text{m}^3$ for PM_{2.5} and $208 \pm 137 \mu\text{g}/\text{m}^3$ for PM₁₀, exceeding national annual ambient standards [S3]. The health impacts of particulate matter pollution in Delhi are significant, with an estimated 7,350–16,200 premature deaths and 6.0 million asthma attacks per year [S3].

The effects of particulate matter pollution on human health are severe, with India having the world's highest death rate from chronic respiratory diseases and asthma [S2]. The city's poor air quality has irreversibly damaged the lungs of 2.2 million children [S2]. The Indian government has implemented initiatives to reduce air pollution, but their marginal benefits have fallen short over the years [S3].

Sectoral Contributions to Ambient Air Pollution

The sectoral contributions to ambient air pollution in Delhi are significant, with vehicle exhaust, industries, waste burning, and construction activities being the primary sources of particulate matter pollution [S3]. The sector contributions to ambient PM_{2.5} in Delhi range from 16–34% for vehicle exhaust, 20–27% for diffused sources, 14–21% for industries, 3–16% for diesel generator sets, and 4–17% for brick kilns [S3]. The Government of Delhi has implemented initiatives such as the compressed natural gas (CNG) switch for public transport, introduction of new CNG buses, metro system, and Bharat-IV stage fuel, but their marginal benefits have fallen short over the years [S3].

Air traffic in Delhi is also a significant contributor to environmental issues, with the Indira Gandhi International Airport being a major source of pollutants, particularly particulate matter [S4]. The increasing number of flights and subsequent exhaust emissions have contributed to the city's poor air quality [S4]. Noise pollution is primarily caused by motorcycle and automobile traffic [S4].

Mitigation Strategies and Policy Initiatives

The Indian government has implemented various mitigation strategies and policy initiatives to reduce air pollution in Delhi [S3]. The Government of Delhi has implemented initiatives such as the compressed natural gas (CNG) switch for public transport, introduction of new CNG buses, metro system, and Bharat-IV stage fuel [S3]. However, their marginal benefits have fallen short over the years due to increasing passenger vehicles, lack of public transport, and growing demand for electricity and construction activities [S3].

The 1997 White Paper proposed measures to reduce traffic-related pollution, including traffic flow smoothing and driving limits [S4]. City authorities claim some success in reducing air pollution, with notable improvements during the COVID-19 pandemic lockdown [S4]. The

Delhi Pollution Control Committee (DPCC) is responsible for controlling pollution in the capital [S4].

Conclusion

In conclusion, the air pollution in New Delhi is a significant environmental concern, with the city's air quality being the most harmful of any major city in the world. The city's poor air quality has severe health impacts, with an estimated 10,000 premature deaths per year. The Indian government has implemented various mitigation strategies and policy initiatives to reduce air pollution, but their marginal benefits have fallen short over the years. Further research is needed to develop effective mitigation strategies to reduce air pollution in Delhi.

References

- [S1] Chen, School Of Geography, Earth, Environmental Sciences, University Of Birmingham, Edgbaston, Birmingham, Ying Chen, Search Author On, Author Information. nature.com. <https://www.nature.com/articles/s44407-024-00001-6>
- [S2] Unknown Author. en.wikipedia.org. https://en.wikipedia.org/wiki/Air_pollution_in_Delhi
- [S3] Unknown Author. sciencedirect.com. <https://www.sciencedirect.com/science/article/abs/pii/S2211464512001492>
- [S4] Unknown Author. en.wikipedia.org. https://en.wikipedia.org/wiki/Environmental_issues_in_Delhi