

Briefing Note

BREATHING UNEASY: An Assessment of Air Pollution in Bangladesh

Fahmida Khatun
Syed Yusuf Saadat
Kashfia Ashraf

Breathing Uneasy

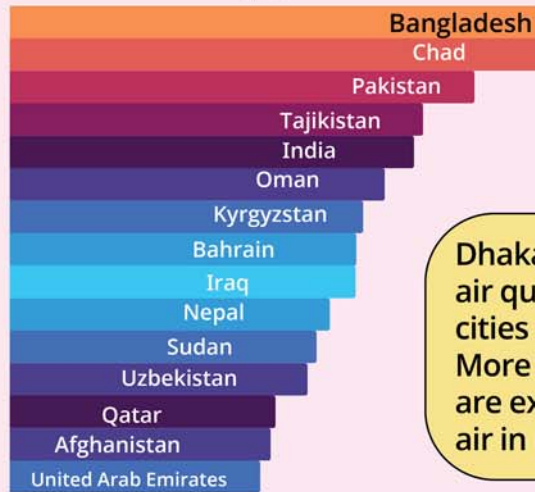
The growing problem of air pollution in Bangladesh

World ranking of highest average PM2.5 concentration (in $\mu\text{g}/\text{m}^3$) in 2021

Bangladesh was No. 1



for having the most polluted air in the world in 2020 and 2021, according to IQAir



How polluted is the air in Dhaka?

Dhaka had the second worst air quality among other cities in the world in 2021. More than 10 million people are exposed to poor quality air in Dhaka.

Major Sources of Air Pollution



Vehicles



Coal-fired power plants



Brick kilns



Construction activities



Biomass burning

Air pollution causes more than 174 deaths per 1,000 people and reduces average life expectancy by 7 years in Bangladesh



Exposure to contaminated air causes health risks and deaths from diseases such as



Heart diseases



Lung diseases



Respiratory diseases

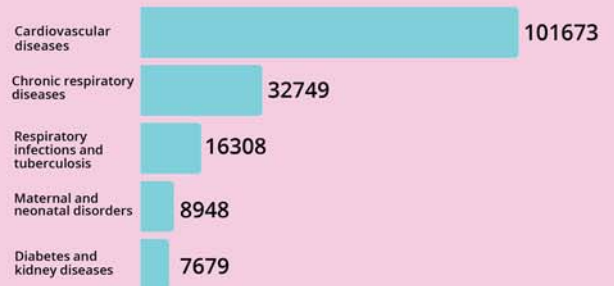


Stroke

This increases the burden of diseases, out-of-pocket expenditure on health, and reduces productivity of people who have been exposed to toxic air for a prolonged period of time

Air pollution contributes to cardiovascular diseases which caused a significant amount of deaths in 2019

Total deaths per 1,000 people in 2019 from diseases associated with air pollution



How can we achieve cleaner air in our cities ?

- ✓ **Promote hybrid or electric cars**
 Encouraging the use of hybrid or electric cars may help reduce vehicular emissions.
- ✓ **Upgrade brick kiln technologies**
 Efficient brick production technologies which emit less pollutants should be established
- ✓ **Regulate construction sites**
 Construction sites should be regulated to ensure proper storage, coverage, and transportation of construction materials
- ✓ **Switch to green energy and technology**
 It is important to shift from coal and move towards renewable energy and increase the use of green technologies
- ✓ **Monitoring and enforcement**
 Strict monitoring and enforcement of controlling the emission level of key pollutants (eg. PM) should be maintained

BREATHING UNEASY: AN ASSESSMENT OF AIR POLLUTION IN BANGLADESH

Highlights

- Bangladeshi cities have extremely poor air quality compared to other cities in Asian and South Asian countries, posing serious health and economic concern for the citizens.
- Air pollution is a major health risk in the world and the death tolls in Bangladesh are rising as diseases are being aggravated by polluted air.
- Effective measures and policies are imperative for achieving cleaner air in major cities of Bangladesh.

1. INTRODUCTION

Bangladesh is facing an increase in air pollution in recent years, due to an increase in urbanisation, industrialisation, and energy consumption in major cities. If right policy actions and measures are not taken, then the problem of air pollution may deepen, posing a threat to human health, environment, and the economy. Among the key pollutants, fine Particulate Matter (PM) like PM_{2.5} and PM₁₀, which have an aerodynamic diameter less than 2.5 μm and 10 μm respectively, have comparatively higher concentration in the air and are a major sources of mortality from respiratory, cardiovascular, and other types of diseases (Majumder, Nayeem, Patoary, & Carter, 2020). Vehicular emission, coal fired power plants, brick kilns, industrial emissions, road dust, and construction activities are major emission sources of PM in urban cities (Hossain, Majumder, Islam, & Nayeem, 2019; Majumder, Nayeem, Patoary, & Carter, 2020). According to the annual Air Quality Life Index (AQLI) report of 2022, Bangladesh's average concentration of PM_{2.5} increased by 13.1 per cent to 75 $\mu\text{g}/\text{m}^3$ from 2019 to 2020 (Greenstone, Hasenkopf, & Lee, Air Quality Life Index Annual Report 2022, 2022). This is 5 times higher than the annual National Ambient Air Quality Standards (NAAQS) of 15 $\mu\text{g}/\text{m}^3$ and 15 times higher than the World Health Organization's (WHO) guideline of 5 $\mu\text{g}/\text{m}^3$ (DoE, 2005; DoE and The World Bank, 2018). According to the IQAir report of 2021, Bangladesh ranked first in terms of annual average PM_{2.5} concentrations weighted by population (76.9 $\mu\text{g}/\text{m}^3$), followed by Chad (75.9 $\mu\text{g}/\text{m}^3$), Pakistan (66.8 $\mu\text{g}/\text{m}^3$), Tajikistan (59.4 $\mu\text{g}/\text{m}^3$) and India (58.1 $\mu\text{g}/\text{m}^3$) (IQAir, 2021).

2. TRENDS OF AIR POLLUTION IN BANGLADESHI CITIES

The local air quality of Bangladesh from 2015 till 2019, shows that the concentration level of PM₁₀ and PM_{2.5} are the highest, far exceeding the annual Bangladesh National Ambient Air Quality Standard (BNAAQS) which is set for PM₁₀ and PM_{2.5} at 50 $\mu\text{g}/\text{m}^3$ and 15 $\mu\text{g}/\text{m}^3$ respectively (DoE and The World Bank, 2018). Moreover, the concentration level of ozone also increased slightly from 7 $\mu\text{g}/\text{m}^3$ in 2015 to 10.5 $\mu\text{g}/\text{m}^3$ in 2019 respectively (DoE, 2020).

Variation and trend of air pollution is influenced by meteorological and seasonal factors. The concentration of pollutants in the air may vary in different seasons due to the influence of meteorological factors, such as rainfall, wind direction, wind speed, humidity, and temperature (Majumder, Nayeem, Patoary, & Carter, 2020). Dhaka's air quality is also susceptible to large seasonal variation (Islam, Afrin, Ahmed, & Ali, 2015). High AQI was persistent in Dhaka during the winter months of January, February and March, whereas, the value of AQI was the lowest during monsoon on the months of July, August and September (Figure 4). With relatively low temperature and little rainfall in winter, the concentration of pollutants intensifies as large amount of dust particles, aerodynamic particles, and gases from anthropogenic activities and sources such as brick kilns, vehicles, industries and construction sites, are released (Islam, Afrin, Ahmed, & Ali, 2015).

3. DRIVERS OF AIR POLLUTION IN BANGLADESHI CITIES.

Vehicular emission: The level of motorisation in Bangladesh has been growing over the years. Emission from vehicles has been disproportionately high in recent years. This is mostly due to the use of poorly maintained vehicles, adulterated fuels, improper traffic and road management and inadequate parking space. The study under the Department of Environment's project titled Clean Air and Sustainable Environment (CASE) revealed that around 10.4 per cent of particulate matter is emitted from vehicles in Dhaka city, whereas 7.7 per cent comes from road dust (DoE and the World Bank, 2019). Diesel-run vehicles are the worst polluters compared to CNG, Octane, or LPG-run vehicles. Nitrogen oxides and black diesel smoke are emitted into the air, plummeting the air quality of the cities. Most of the vehicles that run on diesel fail to comply with the Vehicles Emissions Standard of Bangladesh, thereby releasing higher levels of contaminants into the air.

Brick kilns: Besides vehicles, another significant source of emission is the brick kiln industry. Due to increased development projects taken by the government of Bangladesh, the demand for construction materials has increased significantly in recent years (ESDO, 2020). There were about 8000 brick kilns operating all over Bangladesh in 2018, producing around 15 billion bricks annually (DoE and the World Bank, 2019). Hundreds of brick kiln clusters are located sparsely all over Bangladesh in various districts including Narayanganj, Gazipur, Dhaka, Rajshahi, and Khulna. These urban areas have higher proportion of construction activities and establishment of brick fields, so these districts are highly polluted compared to other districts of the country. In Bangladesh, bricks are manufactured in a primitive system using traditional methods (Darain, Rahman, Ahsan, Islam, & Yusuf, 2013). These outdated models and technologies are imposing serious damage to the environment by emitting large amounts of pollutants (Darain, Rahman, Ahsan, Islam, & Yusuf, 2013).

Construction activities: In Bangladesh, there are several on-going construction activities in urban cities including the construction of road, housing, and flyover (ESDO, 2020). Moreover, the government mega projects such as Metro Rail, Dhaka Elevated Expressway, Rooppur Nuclear Power Plant, Chittagong Cox's Bazar Rail Link, Padma Bridge Rail Link, Dhaka Airport Third Terminal, and Matarbari Coal Power Plant have been in construction for several years now. The construction of these projects contributes heavily to air pollution by emitting high levels of PM_{2.5}

and PM₁₀. The construction sites are often very dusty because there are no specific guidelines or rules on the storage and transportation of construction materials (ESDO, 2020). This gives rise to dust pollution in urban areas. In a study, it was found that everyday 500 metric tons of dust settle on the ground and 2000 metric tons of dust floats in the sky in Dhaka city during winter seasons. The economic boom of Bangladesh contributes to the development of roads, railways and infrastructure of the country, but at the high opportunity cost of worsening the air quality.

Transboundary sources: Besides, transboundary air pollution is also a source of ambient air pollution in Bangladeshi cities. Around 40 per cent of the pollution in Bangladesh comes from the neighbouring countries like India, Nepal, and Bhutan. During dryer months, the air pollution in those countries is the highest, which also adds to the concentration of air pollution levels in Bangladesh. In Dinajpur city, it has been observed that a trail of polluted air comes from India each year during the winter months. Pollutants in South Asia throughout the winter season are transported towards Dhaka city through different routes. Much of the airborne pollutants travel a long distance and cause air quality degradation. Depending upon the heights, air pollutants can travel from 200 km to 500 km in a specified area (Sakib, 2021). The problem of transboundary air pollution may be exacerbated by Dhaka's high population density, low levels of economic development, poor infrastructural condition, and lack of pollution management at the source.

Other key sources: Other drivers of air pollution include construction activities, biomass burning, and waste burning. With rising economic growth, the energy consumption also rises in all sectors of the economy. The use of biomass, coal, oil and natural gases reflect economic growth and development of a country. However, the use of these natural resources without complying with the energy emission standards, results in discharge of high levels of pollutants into the air. This imposes various health and environmental costs to the economy. Open landfill incineration and plastic waste burning is also a contributing source to air pollution. Burning of municipal solid waste, which contains about 12 per cent plastic, which releases toxic gases into the atmosphere such as dioxins, furans, mercury, methane, and polychlorinated biphenyls (ESDO, 2020). Airborne particulate emission (soot) and solid residue ash are byproducts of plastic combustion in Dhaka city. The contemporary waste disposal methods into landfills in Dhaka city insinuates an unrecoverable loss of essential raw materials and energy. Different sectors account for different levels of pollutant emission into the atmosphere. Among the four sectors, manufacturing and power industry has the highest emission contribution and has released increasingly large volumes of pollutants over the years, from 2014 till 2018 (EDGAR, 2022).

4. IMPACTS OF AIR POLLUTION IN BANGLADESHI CITIES

Impact on health: Exposure to poor and contaminated air triggers adverse health risks, creating various symptoms and diseases. Both long-term and short-term exposure to poor air have detrimental health risks which may contribute to diseases such as type 2 diabetes, lower respiratory infection, pulmonary diseases, ischemic, cardiovascular diseases, and chronic obstructive pulmonary diseases (Boogaard, Walker, & Cohen, 2019). On top of that, the toxicity of the air pollutants may gradually reduce the functionality of our lungs, and may even develop lung cancer and chronic heart diseases (Hossain, et al., 2021). Children between the age 1 year

to 4 years, and the elderly between the age of 60 years to more than 95 years, are the most vulnerable groups, as their mortality increases when exposed to ozone, particulate matter, and dust pollution (HEI, 2020). Deaths from numerous diseases associated with air pollution in Bangladesh have risen by 9 per cent over the last 20 years (IHME & GBD, 2019). The highest causes of death are cardiovascular diseases, followed by chronic respiratory diseases. According to the Air Quality Life Index (AQLI) study, it is estimated that the citizens of Dhaka city are losing more than 8 years of life expectancy on average due to air pollution (AQLI, 2022).

Impact on the environment: During January, the meteorological condition is the worst in Bangladesh. Some heavy metals like lead and mercury are commonly found with road dust and other pollutant samples. When this dust falls into flowers, it disturbs their pollinating process. Air pollution also effects the photosynthesis, growth and reproduction of plants (Gurjat, Molina, & Ojha, 2010). Besides, ground-level ozone is a highly reactive pollutant that hinders the growth of agricultural crops and reduces the yield of many crop species such as wheat, rice, soyabean, and cotton. During the months of January to March, the ground-level ozone concentration increases, and therefore the production of crops and winter vegetables are adversely affected in Bangladesh (Gurjat, Molina, & Ojha, 2010). In addition to that, acid rain becomes increasingly prevalent in areas with extremely high air pollution (Gurjat, Molina, & Ojha, 2010).

Impact on economy: Urban air pollution imposes high economic costs on society. In a study by the World Bank, it was found that loss of welfare due to air pollution accounted for about 6.14 per cent of the total GDP of Bangladesh in 2013 (IHME and World Bank, 2016). The economic cost of air pollution is often attributed to the cost of healthcare. Bangladesh's average annual out-of-pocket expenditure has drastically risen over the years. Each person in Bangladesh had to spend BDT 8,334 per year on healthcare from their own pocket in 2019 (The World Bank, 2022). Healthcare expenses have become a huge burden on the poor and marginalised people of the country. Moreover, if people suffer from health problems due to air pollution, their cost and health expenditure would most likely rise, which in turns puts a strain on their work productivity. Due to pollution and environmental degradation in urban areas, the annual loss of productivity was estimated to be USD 1.44 billion for Dhaka city, and approximately USD 6.52 billion, or 3.4 per cent of GDP for Bangladesh in 2015 (The World Bank, 2018).

5. EXISTING POLICIES IN BANGLADESH

Over the years, the Government of Bangladesh has taken several measures to improve the air quality of Bangladeshi cities. In July 1999, the government removed lead from gasoline to reduce harmful emission of pollutants into the air. At the beginning of 2003, the government helped improve the air quality by eliminating 41 per cent of PM_{2.5} pollution, by banning and completely phasing out 2-stroke engine driven auto-rickshaws from Dhaka city (DoE and the World Bank, 2019). The government also promoted the use of cleaner Compressed Natural Gas (CNG) as a fuel for vehicles so that emission from burning of fossil fuels could be greatly reduced, as well as lower greenhouse gas emissions can be observed. Moreover, the government banned the use of buses and trucks older than 20 years and 25 years respectively. The vehicle emission standard

of Bangladesh was revised in 2005 and the new standards incorporated EURO-II for new and light vehicles and EURO-I for on-road and heavy vehicles (Hossain, et al., 2021).

In addition, the government also issued a High Court order to shut down existing illegal brick kilns and prohibit the establishment of brick kilns in commercial, residential, and environmentally sensitive areas around Dhaka city in 2019. This intervention by the government reduced the level of pollution around Dhaka city substantially and improved the air quality. Additionally, the government decided to use concrete blocks instead of bricks in all future government projects by 2025, so that brick production can be minimised and air pollution from brick kilns could be reduced. In recent years, more environmentally friendly technologies for brick production are being considered so that the emission from brickfields can be decreased (Hossain, et al., 2021). Furthermore, in 2009 the Department of Environment (DoE) undertook an extensive project titled “Clean Air and Sustainable Environment” to address the problems of air pollution from vehicular emission and brick kilns. Under this program, the air quality index (AQI) was calculated for different cities of Bangladesh to get a clear idea about the daily air quality (Hossain, et al., 2021). Additionally, the government released the draft of the Clean Air Act in 2019 to manage the national ambient air quality of Bangladesh. Although the draft was submitted, the act has not yet been implemented.

6. CONCLUSION

Air pollution in the cities of Bangladesh is becoming worse with each passing minute. Achieving a greener environment with cleaner air has become a necessity for the citizens of the country. The rising health, economic and environmental concerns regarding air quality should be addressed, and effective policies should be taken by the government to fight against the air pollution.

Bangladesh should have a broader policy space and identify practical, implementable policies to achieve cleaner cities and eventually minimise the adverse impacts of air pollution. Ensuring strong commitment among politicians, researchers, scientists, and physicians is paramount for an effective approach towards emission reduction. Coordination between ministries needs to be more efficient to have proper enforcement of laws and regulations to reduce air pollution. Strong enforcement by the Department of Environment and other public and private stakeholders can help Bangladeshi cities achieve cleaner air and a greener environment. Environmental experts and policy makers should work closely to merge economic and environmental policy to get health and economic benefits. Under this context, some possible key issues that need to be addressed include the following:

1. Hybrid cars should be made more affordable by lowering their import duty.
2. Fitness testing on vehicles should be done on a regularly basis using scientific methods. The government should enforce the use of computerised emission testing in cars, buses and trucks to meet the vehicular emission standards.
3. The government may consider imposing a carbon tax to help reduce the carbon footprint of cities.

4. The technology used to manufacture bricks in the brick kilns are quite primitive. As brick kilns are a major source of air pollution, efficient brick production technologies which emit less pollutants should be used.
5. Construction sites should also be regulated to ensure proper storage, covering and transportation of construction materials.
6. The government should ensure strong political commitments among politicians, researchers, scientists, and physicians to reduce the negative impacts of air pollution.
7. An emissions database should be created and updated regularly.
8. Lastly, there needs to be a shift away from coal and a move towards renewable energy. Investment in renewable energies and green technology will lead to a reduction in air pollution, mitigate climate change issues and promote economic growth.

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Centre for Policy Dialogue (CPD)

House 40/C, Road 11 (new), Dhanmondi, Dhaka-1209, Bangladesh

Telephone: (+88 02) 48118090, 55001185, 58156979

E-mail: info@cpd.org.bd Website: www.cpd.org.bd