

CLOSING THE GAP

Strengthening Air Pollution
Policy and Enforcement

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1. Key Findings

- Air pollution is an environmental and health threat in majority of urban areas of Nepal

- Major sources of pollutants are vehicular emission, open burning, brick kiln, industries, and infrastructure development

- Exposure to particulate matter has the greatest effect on human health leading to respiratory, cardiovascular, and reproductive systems leading to cancer

- The Government of Nepal (GoN) has targeted to reduce mortality from ambient air pollution to 44.94% by 2030

- Access to near real time air quality data, ban on open burning and revised zig zag kiln are notable efforts for mitigating air pollution by the GoN

- Imposition of fines on vehicles emitting black smoke and annual emission tests of vehicles for green stickers need strict implementation

- Sector specific contribution to air pollution should be emphasized for mitigation and proper enforcement of policies



2. Background & context

Nepal was ranked the 8th highest polluted country in the world in 2023 described as region struggling with regional environmental crisis¹. The urban areas such as Dhankuta, Kathmandu, Pokhara, Siddharthanagar are considered highly polluted due to their topography and emitters². The Constitution of Nepal, 2015 identified clean and healthy environment as a fundamental right of every Nepali citizen with provision of compensatory right for environmental pollution or degradation. While the National Penal Code (2017) criminalizes polluters, including hazardous emissions that adversely affect human health and environment, however it does not specifically address polluting air as a criminal offence. Moreover, weak policy formation and enforcement has resulted in an annual rise in air pollution exceeding WHO guidelines. This rise in air pollution has reduced the average life expectancy by more than 5 years and estimated 95 of 10,000 deaths attributable to airborne particles³. Multiple sources including vehicular emission, open waste burning, brick kiln, industrial processes majorly contribute to particulate matter generation and sector-specific strategies are required to control air quality in Nepal.

This brief aims to analyze the national plan and legislation, efforts by institutions, practice, and major factors contributing to air pollution in the valley. The gap analysis and corresponding recommendation presents an opportunity for Nepal to mitigate air pollution, reduce short lived climate pollutants, and reduction in mortality from ambient air pollution.

3. Approach

The policy brief is based on desk review of existing literature, policies, data analysis, and expert consultations. Literature review was conducted on a systematic approach in which relevant documents were identified based on their relevancy to air pollution. These included project reports, research papers, articles, national and local action plans, and policies, as well as studies related to air pollution with specific focus on open plastic burning and vehicle emissions. These secondary documents were then analyzed to identify gaps in air quality management plans in Nepal. The key documents studied include Nationally Determined Contribution (NDC), Kathmandu Valley Air Quality Management Action Plan, 2076 (KVAQMAP) and reports by Department of Environment (DoE). The review focused on identifying gaps between the action plans and implementation of the policies and legal instruments through thematic approach and categorized into 3 themes: Open waste burning, Vehicular emissions and Brick kiln emissions to provide a comprehensive overview of the status of plastic burning and its contribution to air quality in Nepal. Particular attention and emphasis are directed towards the issue of open burning due to its extensive and detrimental effects. These themes were selected based on their high level of contribution to air pollution as top pollutants in the state. The policy brief relies exclusively on secondary data sources, including desk and literature reviews.

Major Outcome

4.1 Major sources for air pollution

Invisible to the human eye, Particulate Matter (PM) has the greatest effect on human health, a complex mixture of solid particles and liquid droplets derived from diverse sources found in the air. PM₁₀ refers to particulate matter with a diameter of 10 micrometers or less, while PM_{2.5} refers to particulate matter with a diameter of 2.5 micrometers or less. PM_{2.5} is often characterized as fine particles. For comparison, the width of a human hair is about 100 micrometers, so roughly 40 fine particles could fit across its width. This is the major component of air pollution precipitating adverse health issues. The major pollutants of air pollution prompted by humans pertain to open waste burning, vehicular emissions and brick kilns.

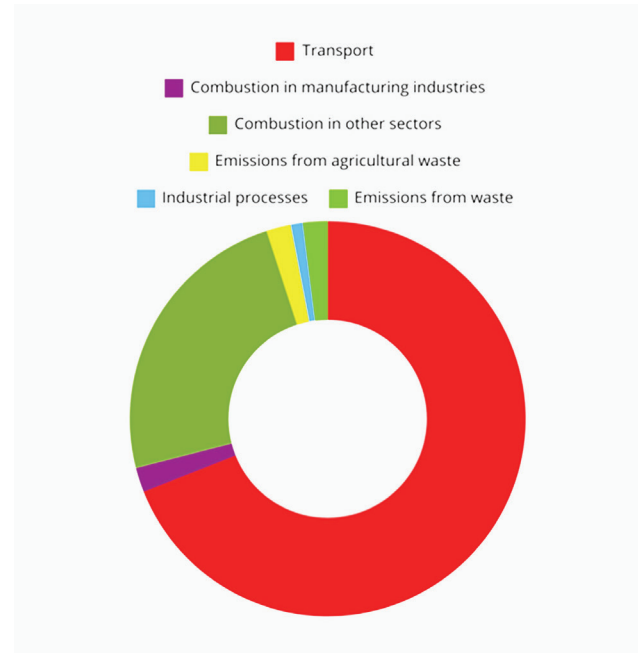


Figure: Sector specific air pollution*

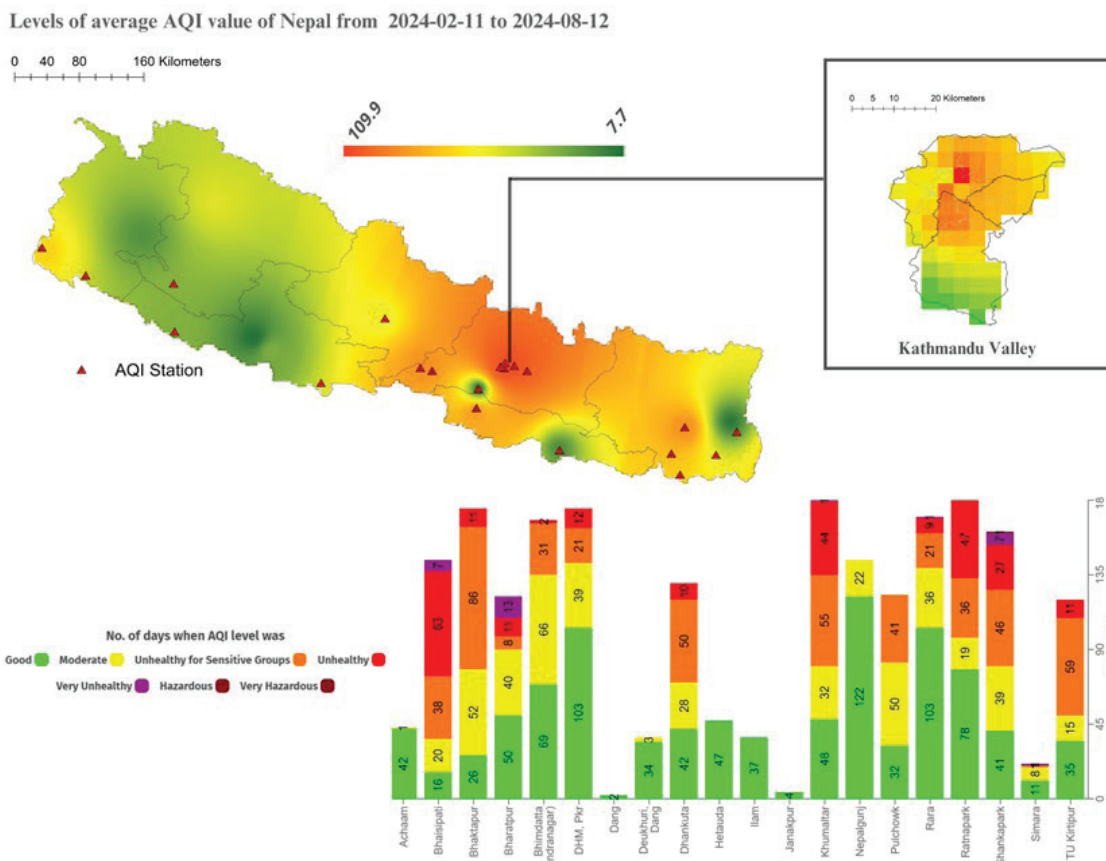


Figure: Image showing Air Quality Index (AQI)*

4.1.1 Emissions from Open Waste Burning

Burning of combustible waste in open areas poses a serious threat to the environment and public health. Waste like paper and plastics and old electronics are commonly burnt in the open causing serious harm to the environment. This practice releases cancer-causing pollutants and contributes to air pollution and climate change. It is crucial to address this issue to protect the well-being of the community and the environment. Open burning has become a measure to dispose unwanted waste from individual households. Similarly, open dumping/disposal and burning of Municipal Solid Waste (MSW) is common in both in rural and urban areas, although Nepal lacks sanitary landfill facilities.

In Nepal, open waste burning is regulated under the Solid Waste Management Act, 2011, and the Solid Waste Management (SWM) Rules, 2013. Moreover, the KVAQMAP outlines strategies to effectively manage industrial, household, agricultural, and medicinal waste in an environmentally friendly manner to avoid open burning practices⁶. However, these regulatory compliances have not been met. In 2018, the Ministry of Federal Affairs and Local Development (MoFALD) and the Supreme Court mandated a ban on open burning, but the local government failed to implement it. The failed ban is indicative of poor waste management policies as 87 municipalities out of 271 municipalities surveyed managed waste by burning⁷. More recently in 2022, Kathmandu Metropolitan city as per its Environment and Natural Resources Protection Act deliberated strict action against any individual found burning waste with a penalty up to NRs 500,000 and legal actions. According to research conducted by Prof. Dr. Sanjay Khanal and Kundan Chaudhary for Kathmandu University (KU) found that the waste collection efficiency within the valley is 72 percent, and 9 percent of the valley's waste is burnt. Alluding to the research on emission inventory for crop residue open burning, the findings indicated that substantial reduction in open field burning would dramatically improve air quality in both the Terai region and other parts of Nepal further reducing the negative health impacts associated with premature deaths, respiratory disease, and cardiovascular disease.⁸ This study also concluded inefficient segregation and collection system leading to an enormous proposition of waste disposal in the valley and frequent prevalence of open burning of non-biodegradable waste.



Landfill and Riverside burning

The current waste management in Nepal is linear, as more than 90% is disposed of in landfills and openly disposed, including riverside dumping and open burning⁹. Large quantities of uncollected waste can be found along the banks of urban waterways such as Bagmati and Bishnumati and often spotted around roadsides¹⁰. As per a baseline study conducted in 2020, 27.4% of waste handling practice in most of the municipalities is piled up in the river side¹¹. Such uncollected wastes after a few weeks emit foul odor prompting nearby residents to burn it. Approximately 43% of such areas where waste accumulated is actively burnt¹². Lack of SWM is the key reason for the prominent cause of open burning in urban and peri-urban areas. Despite enforcement of the SWM act 2011 for better SWM practices, the situation is indicative of delayed result. As of 2023, 0.35% of the budget has been allocated to the waste management sector by Kathmandu Metropolitan. However, the municipalities are often expecting funds from federal and provincial governments indicating major resource constraints. The major issue lies in municipality level that includes lack of adequate internal revenue, lack of management plans and high dependency on federal budget.

Amending the act and incorporating the most effective MSW open burning control strategy is highly important as waste generation is expected to increase in years to come. Priority in increasing waste collection services and policies to practice waste segregation at the source can be the foremost steps undertaken to reduce the air pollution from open waste burning along riverside and landfills.

Hospital waste and incinerators

As per Health Care Waste Management Guidelines, 2014 hospitals must comply by standards set for incinerators. Nepal is also a signatory to Stockholm Convention since 2007 to eliminate emission of carcinogenic chemicals released from such incinerators. However, 41% of hazardous waste generated from hospitals is either incinerated or burnt illegally. A Stack monitoring test conducted in 2017 revealed that among 3 hospitals that were assessed, none of the incinerators complied with the prescribed standards. More than 100 incinerators used across Nepal are violating the convention by its operation and thus hospital wastes are openly burnt¹³. These findings highlight domestic and hospital waste burning as significant source of emissions despite strict regulations against illegal burning. This significant gap between policies and its implications shows that more regulatory and economic instruments are required to effectively manage solid waste that ultimately results in open waste burning.

To address these challenges, effective waste handling procedures and strengthening institutional mechanisms are crucial. Till date no comprehensive data collection mechanism of the incinerators used across hospitals in Nepal have been implemented. Medical waste data handling and management is crucial to identify the status of waste management in hospitals. Regular assessment of hospital waste incinerators combined with strict enforcement of a ban on open waste burning, high penalties for violation of standards are necessary steps to ensure compliance and reduce environmental impact for hospital waste open burning.

Backyard burning

Household remains a major source of waste generation with about 50% of the waste from municipalities of Kathmandu valley is generated by households¹⁴. The frequency of waste collection was found to be directly related to waste burning in household¹⁵. In addition, this study reflected that out of 10 residents residing inside the valley, one resident burnt the waste, therefore this issue of open waste burning persists-at homes, roadside, and even in collection centers. This relation has also backed the finding which states that household open burning is more prevalent in the sub-urban area than in the core municipalities. This problem also stems from individuals' habit of burning plastics and other inorganic waste given the practice of open burning prior to the government mandated regulatory and ban. Unawareness and resistance to change has persisted the problem of open burning.

There is a direct connection between unmanaged waste and open burning as the issue of unmanaged waste catalyzes open waste burning to reduce the waste at the site. Furthermore, source segregation by providing incentives to household levels by employing regulatory instruments can mandate separation of wastes from source of generation. This helps to manage solid waste ultimately leading to reduced open burning¹⁶.

4.1.2 Vehicular emissions

The predicament of vehicular emissions has immensely affected the visibility and poor air quality in the atmosphere. The collective annual emission of all pollutants per vehicle was estimated at 5.46 tons. Specifically, the estimates were 23.63 tons for heavy duty vehicles (HDVs), 10.35 tons for light duty vehicles (LDVs), 1.83 tons for 2-wheelers, and 5.58 tons for 3-wheelers respectively¹⁷.

Multi-sectoral policies such as National Climate Change Policy and Low Carbon Economic Development Strategy plans to promote the use of clean energy, support adoption of energy efficient technologies to reduce GHG emissions with emphasis on gradually phasing out the high carbon emitting transport vehicles¹⁸. The environment-friendly Vehicle and Transport Policy (2014) targets to reduce emission from transport sector and increase share of Electric Vehicle (EV) up to 20% of total market share by 2020 but Nepal has only achieved an estimate of 1% market share in EV of 2023¹⁹. This delay in achieving the target is indicative of policy instability due to political instability. The taxation policy on EVs has changed 4 times within 2 years leaving individuals confused about energy policies ultimately demoralizing the public to use EVs²⁰.

Efforts to control vehicular emissions include the Vehicle Inspection and Maintenance (I/M) Program which sets emission standards and promotes cleaner fuels. Despite the measures, a randomized test conducted between 2017 and 2018 found that 635 vehicles out of 1374 were emitting smoke and particles higher than the government standards²¹. With only 3 Vehicular Emission Testing Stations in Kathmandu valley and inadequate budget allocation further hinders effective policy implementation. Addressing these issues includes broader stakeholder engagements and assessment of present policies²².

The ambitious targets and plans formulated show the government's urgency to reduce vehicular emissions, but policy instability and lack of proper implementation plans are further hindering the process. Transport sector contributes to 69% of emission in Kathmandu, further compounded by emissions from open burning emissions, together significantly causing public health problems further placing an economic burden on the country due to loss of productivity and over-utilization of health system resources. Thus, urgent attention to this implementation gap is required by keeping attainable targets and proactively ensuring stability in the formulated plans and goals.

4.1.3 Emissions from brick kilns

The Government of Nepal has made ample of attempts to address industrial pollution and promote sustainable environmental practices through policies. Such include, Industrial policy, 2010 that promotes environmentally friendly industrial production processes and includes provisions to provide technical and financial assistance to improve the technologies used to make industries more environmentally sustainable. Furthermore, the Industrial Enterprises Act of 2019 and the Environmental Protection Act of 2019 mandate that brick kilns with a production capacity of up to 30 million bricks per year undergo an Initial Environmental Examination (IEE), while larger kilns must undergo an Environmental Impact Assessment (EIA) before establishment.

Given the grim situation, National Emission Standards for Suspended Particulate Matter (SPM) were set by the government directed towards brick kilns in 2008 and further revised in 2018. After the promulgation of the standards in 2008, a research conducted on brick stack emission to compare the trend of SPM revealed that while the average SPM values of operating kilns were within the old standards, they exceeded the revised standards and were significantly higher than those in India and China^{23,24}.

Emphasis on regular stack monitoring by KVAQMP also emphasizes the need to reduce industrial emissions through regular stack monitoring to ensure compliance with the emission standards. However, stack monitoring is conducted sporadically. Additionally, among 78 of 110 total brick kilns studied in 2019, it was appalling to discover that none of the kilns had pollution control devices²⁵. Reflecting from above findings, it is evident that in addition to the implementation gap, monitoring of emissions is another key problem surrounding all major air pollution sources such as open burning, vehicular emission as well as brick kilns. Implementing regular monitoring and assessment remains a significant challenge, highlighting a gap in policy execution requiring an urgent need for regulation through legal instruments.

4.2 Best practices on mitigating air pollution/ Evidence based learning

The Department of Environment established 27 air quality monitoring stations all over Nepal for monitoring air pollution. The government has targeted to reduce the mortality rate from ambient air pollution to 44.94 per 100,000 population through national and local level strategies by 2030²⁶. In Nepal, several successful initiatives have been implemented such as Climate and Clean Air Coalition Brick Production to mitigate black carbon from brick kiln, green stickers in vehicles to mitigate vehicular pollution, promotion of broomer machine deployed in the valley to reduce roadside particulate matter, strict enforcement of ban on open burning at the local level, and ban on 20-year-old vehicles to reduce vehicular emission. Awareness through Nepali media's non-stop reporting on air quality, availability of air quality data on, advocacy at different levels, smart solar dustbin has helped keep the issue alive in the public discourse.

India and China, Nepal's neighboring countries are among the top 10 most polluted countries; however, both the countries have taken significant steps in mitigating air pollution. India launched National Clean Air Programme (NCAP) to reduce particulate matters of 10 microns by 40%²⁷ by designing specific clean air action plans targeting specific air pollutants and source including open waste burning, vehicular emission, road dust, construction dust in 131 City Action Plans (CAPs)²⁸. Transboundary air pollution is a concern for Nepal as stubble burning from Punjab is one of the major reasons for air pollution during the winter. To control the stubble burning, under the Indian Penal Code, section 188 makes stubble burning a crime. The National Green Tribunal (NGT) also banned crop residue stubble burning in Uttar Pradesh, Punjab, Haryana, and Rajasthan. China, on the other hand has made remarkable progress in reducing pollution through National Air Quality Action Plan, which laid out specific targets in heavily polluted areas to improve air quality by the end of 2017. The government allocated USD 390 billion to implement the action plan and reduce ambient air pollution. This resulted in declination of exposure to particulate pollution by 42.3 percent across China²⁹. Evidence based policy found that even most institutional and financial clear policies reflect positive changes in long-term at least a decade³⁰.

Nepal lies in a difficult geographical terrain which heightens the ambient air pollution from transboundary air pollution, but other sources such as vehicular emission, open waste burning, brick kiln, industries also play a pivot role in fueling air pollution specifically particulate matter. The inhabitants are exposed to particulate matter fifty times higher than the recommended WHO standard, leading to a decrease in life expectancy by 5 years. The GoN has taken significant steps in mitigating air pollution through intervention of policies, action plans, and availability of air quality data. However, there is a need for proper technology, funding availability, awareness at the ground level along with disaggregated action plan focusing on sector and pollutants specific pollution reduction for a tangible and achievable target. In conclusion, the GoN should strongly enforce associated policies and emphasize accountability to achieve clean air.

Actionable Recommendations

5.1. Strengthen Awareness and Enforcement of Open Waste Burning Regulations

Open burning of domestic and hospital waste is still prevalent in most local bodies, despite existing regulations. The gap between policy and practice highlights an urgent need for more effective strategies to manage waste sustainably and mitigate its negative impacts.

Enhance Public Awareness:

Open burning is mostly practiced in backyard, riverside and roadside is difficult to track and monitor. Thus, greater resources and assistance should be invested to inform people of the impact of open waste burning to air pollution and its associated health risks to change the practice.

Improve waste management services:

Policies should emphasize the importance of well-planned waste management systems. This includes improving systems for collecting, sorting, and disposing of waste at municipality. Hence, rejecting the linear disposal approach and adopting the circularity model. Promoting source segregation and recycling at the individual level by providing incentives can help reduce the need for open burning and encourage better waste management practices.

5.2. Improve Vehicular Emission Controls and Infrastructure

Vehicular emission is a persistent issue despite substantial political will to reduce vehicular emissions. Inadequate enforcement and monitoring of emission standards underscore the challenges in turning these policies into effective action. Thus, it is crucial to strengthen the existing policies with action-oriented plans.

Expand vehicle inspection, monitoring stations and databases:

Regular and instant emission tests for vehicles should be actively enforced and stricter penalties should be imposed for non-compliance to the standards to encourage proper maintenance of in-use vehicles. Air Quality Monitoring Stations should be well distributed so better visualization of air quality can be conducted.

Strengthen existing policies:

Restructuring the public transport system to facilitate successful transition to mass transit system by implementing policies that support expansion and efficiency of public transportation while simultaneously incentivizing the adoption of EV. This helps support the existing plans directed to clean energy and vehicular emission reduction.

5.3. Enhance Compliance with Brick Kiln Emission Standards

With over 1000 operational brick kilns, it is one of the significant contributors to ambient air pollution and greenhouse gases³¹. Brick kilns emit particulate matter, including heavy metals like chromium and lead, which affects human health and degrades soil quality. Furthermore, these emissions can elevate the overall levels of particulate matter in the atmosphere.

Support Technological Upgrades:

Policies and financial support by the government to promote energy-efficient technology and use innovative techniques such as construction of zig zag fixed chimney kilns as demonstrated by Clean Brick Initiative implemented by ICIMOD, Federation of Nepal Brick Industries and MinErgy could be a way forward to make brick kilns more environmentally sustainable. Also, pollution control measures are recommended by the operating brick kilns.

Implement Regular Monitoring:

Establish and strengthen a regular and rigorous emission monitoring system for brick kiln emissions to ensure compliance with revised industrial emission standards.

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