Policy Brief on Air Pollution & Health in Kathmandu Valley

Brick Kilns and Other Industries

Introduction

Air pollution is a major public health risk in Kathmandu Valley where the annual average concentration of PM2.5 is about five times higher than World Health Organization (WHO) guidelines (WHO, 2018). Realizing this, the Ministry of Health and Population together with the WHO is implementing the Urban Health Initiative (UHI) in Kathmandu Valley to build evidence on the health impacts of air pollution, enhance the capacity of the health sector and raise awareness on this issue. This policy brief on air pollution from industries, mainly brick kilns in Kathmandu Valley, is part of a series on different sources of air pollution in Kathmandu Valley and its linkage to health.

Although Kathmandu is not a major industrial city, industries do contribute to air pollution. But the brick kilns in the Valley are a significant source of air pollution. This is followed by industries such as wool dyeing, dairy and beverages which operate boilers that use fuels such as diesel, rice husk and saw dust. It is estimated that there are 90 industries with boilers in Kathmandu Valley (DoE, 2017b).

Brick is the most commonly used building material and brick making is a traditional industry in Kathmandu Valley. In 2017, there were 110 brick kilns operating in the Kathmandu Valley – 63 in Bhaktapur, 32 in Lalitpur and 15 in Kathmandu district (DoE, 2017b). Among these, 107 were Fixed Chimney Bull’s Trench Kiln (FCBTK), two were Hoffmann and one was Vertical shaft Brick Kiln (VSBK). These kilns normally operate from November to May producing around 660 million bricks per year.

Emission from Brick Kilns

The main source of energy in the brick kilns is coal, which is mainly imported from India. Besides coal, some kilns also use fire wood, saw dust and rice husk. Brick kilns are a major source of pollution in Kathmandu Valley as they emit SO_2, NOx, Particulate Matter, CO_2 and CO from their chimneys as well as fugitive dust during handling and transportation of the bricks. Department of Environment estimates that brick kilns in Kathmandu emit almost 4000 tons of particulate matter per year (DoE, 2017b). In addition to emitting air pollution, the brick industry also consumes a large amount of top soil and water.

Table 1: Emission from Kathmandu’s Brick Kilns

Kiln	Annual Production (million)	Stack Emission (PM in Tons)	Fugitive Dust (TSP in tons)
VSBK	8	2.64	12
FCBTK	612	1060.8	2501
Hoffman	40	65.2	177
TOTAL	660	1128.64	2680

Source: DoE (2017b)

In recent years, emission from Kathmandu Valley's brick industry has decreased with reduction in number of brick kilns and improvement in technology and operating practices. Following the 2015 earthquake when almost all the brick kilns in the valley were damaged, most of the kilns were rebuilt using improved zig zag fixed chimney technology which were more structurally sound, used 20 to 30% less energy and emitted about 40 percent less suspended particulate matter (SPM).

An assessment of 30 brick kilns by Department of Environment showed that the average SPM of FCBTK was 326 mg/Nm3, VSBK was 144 mg/Nm3 and Hoffmann was 374 mg/Nm3. Although these were within the national standards, the study noted that "black smoke is still seen in some chimneys during firing" and compared to Indian and Chinese standards, "these kilns were emitting much higher level of pollutants" (DoE 2017b).

According to DoE (2017a), bricks kilns are responsible for 9% of the PM10 emission in Kathmandu Valley. Kim et al. (2015) estimates that the brick kilns are responsible for 40% of Black Carbon (BC) in Kathmandu in the winter.

Air Pollution and Health Impacts from Brick Kilns

According to Eil et al. (2020), air pollution from brick kilns caused approximately 600 premature deaths in Nepal in 2015. The report further estimates that the total excess DALYs (Disability Adjusted Life Years) due to PM10 emissions from brick kilns in Kathmandu Valley to be 5,770, which is about 85% of the total estimated DALYs due to PM10 from the brick industry in Nepal as whole. Eil et al. (2020) estimates the health care costs associated with excess morbidity due to pollution from brick kilns in Kathmandu Valley to be USD 28 million per year. As these estimates only take into account respiratory illnesses, the total health impacts and its costs can be much higher if other illnesses are also considered.

Table 2: Health End Point Estimates and Costs Attributed to Emissions from Kathmandu's Brick Kilns

Health End Point	Number	Cost (2015 million USD)
Chronic Bronchitis	806	2
Hospital Admissions	1,112	0.1
Emergency Room Visits	21,809	0.3
Restricted Activity Days	5,304,076	9
Lower Respiratory Illness in Children (LRI)	156,574	2
Respiratory Symptoms	16,954,513	15
Total cost of health care		28

Source: Eil et al. (2020)

Workers in the kilns are also exposed to occupational hazards, including chemical, physiological, and physical hazards. Brick kiln workers are exposed to high concentrations of particulate matter, dust and silica which have been linked to increase risk of cancer, acute and chronic respiratory disease, and potentially anemia. Additionally, frequent repetitive motion and carrying heavy loads make workers vulnerable to musculoskeletal disorders (Eil et al, 2020).

A study done by Kathmandu University (KU) as part of UHI analyzed the PM2.5 emissions reduction and health impacts of brick kilns under four scenarios as shown in Table 3, using the tool AirQ+ and found the PM2.5 went down by 30.4%, 61.8% and 84.8% respectively under the business as usual, moderately progressive and aggressively progressive scenarios. The total averted deaths per year due to reduction in emissions from brick kilns were found to be 15, 31 and 44 for business as usual, moderately progressive and aggressively progressive scenarios.

Table 3: Air Pollution and Health Impacts from Different Scenarios

Scenarios	Description	PM2.5 Emissions (tons per year)	Averted Mortality
Baseline scenario (2015)	110 brick kilns (107 FCBTK-Zigzag, 2 Hoffmann and 1 VSBK) with no alternatives to bricks.	329.30	
Business as Usual (2019 - 2030)	Market share of alternatives to bricks increase to 3%, 1% and 1% respectively. FCBTK-Zigzag brick kilns reduced to 101 and VSBK is increased to 2.	229.16	15
Moderately Progressive (2019 -2030)	Market share of eco-friendly bricks, prefabs and AAC blocks increase to 30%, 10% and 8% respectively	125.80	31
Aggressively Progressive (2019 - 2030)	Number of VSBK is increased to 8 Market share of alternatives to bricks increase to 55%, 15% and 12% respectively for eco-friendly bricks, prefabs and AAC blocks.	49.93	44

Source: K /WHO (2020)

Policies Related to Brick Kilns

Government of Nepal has formulated several policies related to industries and industrial pollution. These include Industrial Policy, 2010, which has a vision of sustainable and broad based industrial development and promotes environmentally friendly production processes. The Policy also states that technical and financial assistance shall be provided to industries that use environment friendly and energy saving technologies. The Industrial Enterprises Act, 2076 and the Environmental Protection Act, 2076 have provisions for conducting Initial Environmental Examination (IEE), for brick kilns with production capacity of up to 30 million bricks per year, and environmental impact assessments (EIA) for larger kilns prior to their establishment. Brick kilns also need to be at least 1 km away from densely populated areas and meet standards for emissions and chimney height. The government has also allowed for industries to deduct 100% of the expenses incurred for equipment used for improving energy efficiency for the purpose of income tax and up to 50% deduction is allowed for equipment used for pollution control.

The Kathmandu Valley Air Quality Management Action Plan, 2076, which was approved by the cabinet in 2020 has mentioned "minimize industrial pollution" as one of its objectives and identified "reduction in industrial emissions" as one of the main strategic areas of intervention. The action plan includes 16 activities related to industrial emission, particularly brick kilns. These include regular monitoring of the kilns to ensure compliance to emission standards and promotion of cleaner brick kiln technologies as well as alternate building materials. It also calls for stopping new registration of brick kilns in Kathmandu Valley and conducting a study on the relocation of brick kilns from Kathmandu Valley (GoN, 2020).

Way Ahead

Following measures can be used to reduce air pollution from brick industry:

1. Use of improved technology and practices in brick kilns - The recently concluded Clean Brick Initiative implemented by ICIMOD, Federation of Nepal Brick Industries and MinErgy has demonstrated innovative techniques for further reducing energy and emissions through improved zigzag fixed chimney kilns, the use of LPG for initial firing and use of biomass pellets as an alternative fuel in the kilns. Other innovations that have been introduced include hollow bricks, mixing with coal with the clay as an internal fuel and use of cleaner kilns such as tunnel kilns and vertical shaft brick kilns. These measures now need to be scaled up.
2. Use of alternative building materials – Several different alternative building materials that are more environment friendly than fired bricks are now available in the market. These include Compressed Stabilized Earth Blocks (CSEB), rammed earth, concrete blocks and Autoclaved Aerated Concrete (ACC) blocks.
3. Removal of kilns from human settlements and environmentally sensitive areas – As brick kilns cause significant pollution in its immediate vicinity, kilns that are located near residential areas or areas near schools or hospitals, these kilns need to be removed. In this context, the government regulations that require at least one km distance between kilns and settlements should be strictly followed and all polluting industries should be gradually displaced from Kathmandu Valley.

Overall, the action plan proposed by the Kathmandu Valley Air Quality Management Plan should be implemented and its implementation should be carefully monitored and enforced.

References

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