Policy Brief on Air Pollution & Health in Kathmandu Valley – Solid Waste

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 waste management in Kathmandu Valley is part of a series on different sources of air pollution in Kathmandu Valley and its linkage to health.

Open burning of municipal waste and agricultural residue is a major cause of air pollution in many cities in the developing world. A recent study suggests that waste burning could increase PM2.5 concentrations by nearly 30% in India and Nepal and result in approximately 300,000 premature deaths per year in these two countries (Saikawa et al. 2020).

Waste is often burnt to (i) reduce the waste volume either at the source or waste collection points, (ii) treat the waste, such as hazardous waste from health care facilities, (iii) use it as a fuel to generate heat energy for personal heating or in small industries, (iv) produce ash for agricultural purposes and (v) attract attention, such as burning of tires during protests. An effective waste collection and management system can assist in reducing the incidents of waste burning by reducing the availability of waste at public locations, providing people with an environment-friendly alternative to burning the waste, and providing people with incentives to recycle the waste instead of burning it.

Air Pollution due to Waste Burning in Kathmandu Valley

Kathmandu Valley generates approximately 1750 tons of waste per day. Of this, it is estimated that 72 % is collected by municipalities and private waste collectors and about 250 tons per day is recovered for recycling. Of the 28% waste that is not collected, it is estimated that 9% is burnt while 17% is discarded or managed in other ways (KU/WHO, 2020).

Air pollution due to open burning of municipal solid waste and agricultural residue is often not clearly understood and frequently under estimated (Das et al., 2018). Because waste burning is not done at a specific location or at a specific time, it is difficult to monitor such incidents and estimate its impact on air pollution. Das et.al. (2018) estimates that in 2016, 74,000 tons of municipal waste was burned in Kathmandu Valley at the rate of 20 tons per day, which is about 3 % of the total municipal solid waste generated in the Valley. The study further estimates the burning of municipal waste in Kathmandu Valley resulted in 55 tons of PM2.5, 60 tons PM10 and 25 tons of black carbon per year.

Open burning is more common during the winter as dry garden waste or agricultural residue is easily available at this time and many people, burn waste or agricultural residue or other fuel for heat. Kim et al. (2015) identified brick kilns (40%), motor vehicles (37%) and biomass/garbage burning (22%) as the major sources of elemental carbon (black carbon) in the Kathmandu Valley during winter, while motor

vehicles (47%), biomass/garbage burning (32%), and soil dust (13%) have been identified as the most important sources of organic carbon.

Burning of waste can be a major problem because:

- It releases a huge concentration of pollutants or smoke in a short period
- Depending on the materials that is being burnt and the combustion process, this can release very hazardous or toxic pollutants, such as dioxins and furans that are released when PVC plastics are burnt.
- Waste burning happens more often during the winter and dry months when air pollution is also at its peak.

In the future, the amount of agricultural residue burnt may decrease as the land used for agriculture is shrinking quickly with rapid urbanization in Kathmandu Valley. Between 1967 and 2011, the built-up area in the valley floor expanded from 20.11 sq. km to 162.16 sq. or 2.94% to 24.70% of the total land in the valley while agricultural area shrank from 356.48 sq. km to 275.67 sq. km or 52.07% to 41.99% of the total land in the valley (KU/WHO, 2020). This trend will continue in the future with continued urbanization and the government's plans to build four new towns in the Valley. The amount of municipal waste generated will continue to rise with increase in urban population as well as increase in per capita waste generation with rising incomes and changing consumption patterns. Therefore, the amount of waste burnt could increase in the future if municipal waste is not managed properly.

Health Care Waste Management

Incineration, which is a common method used to manage hazardous or infectious waste from health care facilities, can also cause air pollution, particularly if the incinerators are not properly built and operated and the temperature at which the waste and the gases are burnt is not very high. According to DoE (2017) 42 hospitals in Kathmandu Valley have incinerators and it is estimated that of the 28.4 tons/day of waste produced by hospitals, 59% is segregated, while the remainder is labelled as hazardous waste and are burnt or incinerated. While the amount of health care waste continues to increase, the past year, the amount of health care waste must have increased significantly due to the COVID-19 pandemic.

Health Impacts of Air Pollution due to Ineffective Waste Management

As part of the UHI, Kathmandu University (2020) estimated the health impacts of air pollution caused by waste under different scenarios. The Solid Waste Emission Estimation Tool (SWEET 2.0) was used to calculate emissions and emissions reduction of methane, black carbon, and other pollutants from municipal solid waste, while the tool Air Q+ was used to estimate the extent of the health burden and the health effects of air pollution caused by the emission. The baseline situation and the assumptions made for the three different scenarios (business as usual, moderately progressive, and aggressively progressive) are shown in Table 1.

Table 1: Waste management in baseline year (2015) and under different scenarios in 2030

S.N.	Items	Baseline Situation	Business As Usual	Moderately Progressive	Aggressively Progressive
1	Waste collection efficiency	72%	80 %	90 %	98 %
2	Waste management				
	a. Landfilling	68%	60 %	40 %	20 %
	b. Recycle	14%	6.8 %	30 %	40 %
	c. Compost	10%	13.9 %	20 %	25 %
	d. d. Biogas	-	-	6 %	15 %
	e. Others	8%	5%	4 %	0
3	Uncollected waste	28%	20 %	15 %	1 %
	a. Reduce open burning	9%	8.86%	4 %	0.5 %
	b. Others	19%	13%	8 %	0.5 %

Source: KU/WHO (2020)

The SWEET model results indicate that the $PM_{2.5}$ emission attributable to SWM reduces from 486 tons per year in BAU to 258 tons per year in moderate scenario and 83 tons per year in the aggressive scenario. Similarly the concentration of $PM_{2.5}$ also reduces from 2019-2030. The health benefits as a result of this decrease in air pollution under the different scenarios are shown in Table 2.

Table 2: Mortality due to air pollution caused by waste in Kathmandu Valley under different scenarios

Health effects due to changes in air emissions	**Scenarios**		
	Business as usual	**Moderately progressive**	**Aggressively Progressive**
All-cause (natural) of mortality for adults age 30+ years ($PM_{2.5}$ attributable cases)	5408	5321	5255
Mortality due to COPD for adults age 30+ years	7525	7488	7470
Mortality due to Lung Cancer for adults age 30+ years	5844	5803	5784
Total cause-specific mortality	13369	13291	13254

Source: KU/WHO (2020)

Institutional and policy framework for solid waste management

The 18 municipalities in Kathmandu Valley are the main institutions responsible for waste management in the Valley. The municipalities invest significant amount of financial and human resources to collect waste from households and institutions and landfill most of it at the Sisdol landfill. The municipalities either do this with their own staff and equipment or work with private companies to provide waste collection and management services. Different private companies and many informal waste workers are also involved in recycling and composting waste.

The main policy and legislation that regulate the solid waste management sector are the Solid Waste Management Policy, 1996; Solid Waste Management Act, 2011 and its Regulations, 2013; and the Local Government Operations Act, 2017. These policies and regulations make local governments responsible for waste management but also encourage them to work closely with local communities and private

sector to minimize and manage the waste in a sustainable manner. Open dumping and open burning of waste is not allowed and municipalities can charge up to Rs. 15,000 for anyone engaging in such acts.

The National Health Care Waste Management Standards and Operating Procedures, 2020 provides details on how medical waste is to be minimized, segregated, stored, transported treated and safely disposed. It states that various non-burn technologies can be used to treat infectious waste.

The Kathmandu Valley Air Quality Management Action Plan, 2076 (KVAQMAP), has mentioned 'minimize air pollution through environmental friendly waste management' as one of its objectives and identified "effective management of industrial, household, agricultural, and medical waste in an environment friendly manner" as one of the main strategic areas of intervention. Within this strategic area, the Action Plan proposes 10 different activities which need to be implemented within the next two years, although some of them can be implemented immediately. While these 10 activities are very relevant and necessary for reducing waste burning, the action plan could also mention the promotion of recycling in partnership with private sector as one of the activities in order to maximize recycling and minimize the possibility of recyclable materials such as paper and plastics being disposed and burned in the open.

Way Ahead

Air pollution from waste management can be reduced through improved waste management practices. Some measures that can be taken are as follows:

1. Implement door-to-door source separated waste collection: In order to avoid piling up of waste in public spaces, where it can be easily burnt, and encourage waste recycling, waste should be separated at source at least into its organic and inorganic components and collected door-to-door so that the segregated waste goes straight from the source to the collection vehicles.
2. Maximize recycling: Scrap dealers who collect recyclable waste, process it and send it to recycling factories need to be supported and promoted. Companies such as Khaalisisi.com are using innovative ways to connect the scrap dealers to people who want to recycle their waste so as to increase recycling rates. Similarly companies such as Blue Waste to Value, Doko Recyclers, Tyre Treasures, Jamarko, Biocomp, NEPCEMAC and NEPCO are engaged in recycling and composting waste. Municipalities need to work hand in hand with these entrepreneurs and local people to boost recycling of waste so as to reducing waste burning.
3. Strictly enforce a ban on waste burning: Municipalities need to strictly ban the practice of waste burning by engaging local communities in monitoring. Local initiatives such as the Clean Up Baudha Campaign which is working with local people to stop open waste burning need to be supported and scaled up in other neighbourhoods as well.
4. Manage health care waste safely: Health care waste should not be burnt and be managed as per the National Health Care Waste Management Standards and Operating Procedures, 2020

As the KVAQMAP has clearly identified numerous activities that need to be conducted to minimize air pollution from waste burning and the responsibilities for waste management are also clear, this plan should be implemented immediately. Furthermore, as many of the activities can be implemented

immediately with minimum resources, this should be seen as a low hanging fruit on the road to clean air in Kathmandu.

References

Das, B., Bhave P.V., Sapkota, K., Maskey, R. (2018). "Estimating emissions from open burning of municipal solid waste in municipalities of Nepal" Waste Management. Volume 79, September 2018, Pages 481-490.

DoE (2017). *Air Quality Management Action Plan for Kathmandu Valley* [Unpublished], Department of Environment. Kathmandu.

KU/WHO (2020). *Technical Report on Health Impacts and Economic Analysis of Air Pollution in Kathmandu Valley* [Unpublished]. World Health Organization & Kathmandu University, Kathmandu.

Kim, B.M., Park, J., Kim, S., Kim, H., Jeon, H., Cho, C., Kim, J., Hong S., Rupakheti, M., Pandey A., Park, R., Hong J., Yoon, S. (2015). "Source apportionment of PM10 mass and particulate carbon in the Kathmandu Valley, Nepal" Atmospheric Environment 123 (2015), 190-199.

Saikawa, E., Wu, Q. Zhong, M., Avramov, A., Ram, K., Stone, E.A., Stockwell, C.E., Jayarathne, T., Pandey, A., Yokelson, R.J. (2020). "Garbage Burning in South Asia: How Important Is It to Regional Air Quality?" Environmental Science and Technology, 2020, 54, 16, 9928–9938.

WHO (2018). WHO Global Ambient Air Quality Database (update 2018). Geneva. https://www.who.int/data/gho/data/themes/topics/topic-details/GHO/ambient-air-pollution