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POSITION PAPER ON BENZENE CONCENTRATION IN KATHMANDU'S AIR

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1. Background

Benzene is a volatile, colourless aromatic hydrocarbon found in liquid form in the atmosphere. Benzene is emitted due to the burning of fossil fuel in vehicles and in industries. It is also produced during the petroleum refining process and evaporation during handling. Naturally benzene is emitted by biomass burning and forest-fire. However, more than 90 percent of the benzene in atmosphere is due to the anthropogenic sources and only 3 – 5 percent are from natural causes. The most important and significant anthropogenic sources are combustion sources, where benzene is emitted as unburned compound. In Europe, about 80 - 85 percent of the benzene emission come from vehicular emission.

In case of Kathmandu, previously, benzene was not considered as a major air pollutant. However, after the introduction of unleaded petrol on January 1999, it has become a concern because it is used in petrol as an anti-knocking agent instead of lead. This has resulted to the high concentration of benzene in Kathmandu's air.

2. Ambient Level of Benzene in Kathmandu

A three-week study conducted by Environment Sector Programme Support (ESPS)/Ministry of Population and Environment (MoPE) during January and February 2002 at the 7 locations in Kathmandu indicated that benzene has become a major air pollutant. Weekly averages of ambient level benzene concentrations using the passive diffusive method were found as high as 77 $\mu\text{g}/\text{m}^3$ in *Putalisadak*. In all the seven locations, concentration distribution was found according to the properties of the sampling locations. *Putalisadak*, known as the high traffic area, accounted very high concentration however, *Matsyagaon*, a valley background has very low concentration. Similarly, other high concentration zones were *Chabahil*, *Paknajol* and *Patan*, where average value of benzene were found to be 44 $\mu\text{g}/\text{m}^3$, 30.3 $\mu\text{g}/\text{m}^3$ and 23.3 $\mu\text{g}/\text{m}^3$ respectively.

3. Health Impacts of Benzene

Benzene can be inhaled by many means however intake of benzene by food and water is only minor source. Smoking is the large source of personal exposure. Extended travel in automobiles with elevated air benzene levels (from combustion and evaporative emissions) result in cumulative exposures that are second major exposure to human. Similarly, in the context of Kathmandu, pedestrians walking side of the busy streets are vulnerable to ambient level benzene inhalation.

Benzene is known to be carcinogenic to humans and no safe level of exposure has been recommended. The most significant adverse effect of benzene on human beings has been characterised as haematotoxicity, genotoxicity and carcinogenicity. Long-term benzene exposure can result in bone marrow depression expressed in leucopenia and anaemia. Similarly, it has also been found that high benzene concentration can result to structural and numerical chromosome aberrations.

Benzene has been classified as a human carcinogen by International Agency for Research on Cancer (IARC). Benzene exposure has been linked to all types of Leukaemia further increasing the chance of the patient to death.

¹ Clean Energy Nepal (CEN), Prepared on September 15, 2002

4. International Concentrations and Standards

Internationally benzene has been taken as the major air pollutants in urban areas with high vehicular movement and industrial zones. In European cities the value of benzene concentration in air range from a few $\mu\text{g}/\text{m}^3$ to more than $50 \mu\text{g}/\text{m}^3$ with maximum values found near to high traffic streets.

After accessing the health threat by benzene concentration in air, World Health Organisation (WHO) has recommended annual average guideline value of $5 - 20 \mu\text{g}/\text{m}^3$. Similarly, some European countries have fixed their national standards which is around $10 \mu\text{g}/\text{m}^3$ in most of cases and they have also recommended a long-term guideline much lower than the current standard.

5. Benzene Concentration in Fuel

As vehicles are the major source of benzene in air, benzene concentration in the gasoline plays a vital role. Internationally, most of the countries have assured that there should be minimum level of benzene in gasoline, which is less than 1 percent. However, in Nepal, fuel quality data from Nepal Oil Corporation indicates that 3 - 5 percent benzene has been found in the gasoline being used.

Benzene and Lead are used in the gasoline as additive to boost the octane number. The octane number, which measures the anti-knock characteristics of fuel, is an important performance criteria of the vehicle. Now that unleaded fuel is used in Nepal, benzene has been used as octane boosting agent in gasoline.

6. Government's Response

Nepal's government is currently drafting a national standard on air pollution and benzene may be included in the standard. Similarly, MoPE with the help from ESPS, is planning to monitor ambient level benzene concentration in six locations of Kathmandu valley on a regular basis. The Nepal Oil Corporation, which supplies all petroleum products in Nepal, however, has not done anything to import low-benzene petrol.

7. Conclusion

Because of the high concentration of benzene in petrol, ambient concentration of benzene in Kathmandu's air is at dangerous levels. Benzene, a known carcinogen, causes Leukaemia. Therefore in the interest of the public health of Kathmandu's residents it has become urgent to address the problem of benzene in Kathmandu's air. Clean Energy Nepal strongly urges NOC to import low benzene fuel and demands that the government take concrete measures to discourage the use of fossil fuel powered vehicles and encourage the use of zero emission electrical vehicles.

Low-benzene petrol is available in India and widely used in large Indian cities such as Delhi. As NOC gets all its oil from India it should demand low benzene petrol, with benzene concentration of less than 1 percent, from the Indian Oil Corporation. NOC should also look into alternatives to substitute the use of benzene as anti-knocking agent.

Similarly, zero-emission electric vehicles such as trolley bus and Safa Tempo, have proven to be suitable for Kathmandu. The old trolley bus system should be revived and extended with the support of the private sector and the battery operated three and four-wheelers should be promoted by providing financial incentives and removing polluting vehicles from crowded urban streets.