

AIR POLLUTION STATUS
KATHMANDU, NEPAL

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Air pollution in the Mega cities of Asia
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I. Country Background

Nepal covering an area of 147, 181 sq. km and an average north-south width of 193 km and east-west length of 850 km consists of three main physiographic regions, viz, mountains, hills and terai (plains). Of the country's total area, the mountain and hill regions together account for nearly 77% while the Terai region accounts for the remaining 23% of the area. But in terms of population, the terai region had nearly 47% of the country's estimated total population of 22.37 million in 1999 and the mountains and hills the rest.

The general environmental conditions of the country can be considered under two headings; environmental resources and social and economic driving forces. The country has diverse environmental resources; water, forests, land, climate and weather and biodiversity. The country has enormous hydropower potential. Forests still occupy the largest proportion of the land area. The diverse climate conditions make it possible to grow a wide variety of agricultural crops. With the diverse climate conditions, together with the forests, the country is rich in biodiversity. Due to the lack of capital and human resources, commitment on the part of the government and awareness among the general mass of the people, the country has not been able to utilize these vast resources to the extent desired. The resources are deteriorating instead. Landslides, soil erosion, deforestation, forest fires and so on have caused the land to deteriorate, water sources to dwindle away, rivers to flood, biodiversity to deplete and people to migrate into urban areas and elsewhere. Urban areas have developed haphazardly creating acute problems of solid waste, water pollution, air pollution, noise pollutions and others. The country has a broad-based population structure indicating a high fertility rate. The gainful population is increasing and is quite large compared to the availability of employment opportunities. Roads, the backbone of industrial development and social, economic, political and spatial integration, have not yet reached all parts of the country and therefore, most of the human settlements cannot be reached by road. The existing infrastructure facilities, including roads, electricity, health, schools and water are inadequate, not only for the needs of the people but also in terms of use of existing resources. The country's 2001, state of environment thus addresses five key environmental issues. Forest depletion, soil degradation, solid waste management, uncontrolled growth of population and poor management and use of resources are the major reasons for environment deterioration.

II. Kathmandu Valley

The Kathmandu valley, which has the capital city Kathmandu along with four other municipal towns, Lalitpur, Bhaktpur, Kirtipur and Madhyapur-Thime, are the main urban area of Nepal. The valley is located between the Himalayan in the north and the mahabharat mountains in the south. The Kathmandu city is located at a plain about 1325 meter above sea level and is surrounded by hills and mountains.

The climate condition of Kathmandu valley depends on the prevailing wind regime from central Asia and the northern hemisphere's cold pole. In the summer and early autumn the prevailing wind regime in Kathmandu valley is the southwest monsoon. In the winter the prevailing winds are more westerly. The high mountains in the north present the outbreak of cold Siberian winds from the northeast. The wind pattern is dominated by weak winds. Because of the high occurrence of calm and low winds speeds, the dispersion conditions in Kathmandu are poor. The mean annual air temperature in Kathmandu is 19°C. The coldest month is January, with a mean temperature of 11°C. The warmest month is July with an average rainfall of 27mm. The driest months is November/December when the average rainfall is less than 1 mm. Due to this topography and wind pattern, Kathmandu valley has been subjected to temperature inversion especially during winter period which is the dry season, when atmosphere acts as a lid over the city and the air pollutants have built up considerably.

The population of Kathmandu valley, which grows at an average annual rate of 4.6% in 1970's, went up to 6% growth rate in 1980's. The population of Kathmandu is now estimated to be one million, making one of the most populous cities in South Asia region. The migrant population is from mountain, hill and terai in search of jobs, education and other opportunities.

Nepal's total energy demand is estimated to be 7,340 thousand tones of oil equivalent (1998), out of the total energy consumption, 92% is consumed by the residential sector, and the remaining 8% by other sectors. About 88% of the energy demand is met from traditional sources such as fuel wood, agricultural residues, animal dungs, the remaining 12% is met from commercial sources such as petroleum products 9%, coal 2% and electricity 1%. All petroleum products are imported in to Nepal, of which considerable amount is used for automobiles, followed by industry.

The total consumption for Kathmandu is divided into domestic use, vehicle fleet and industry. For domestic use, fuel wood has been replaced by kerosene and liquidified petroleum gas (LPG), coal is used mainly in the brick and one cement industry. The coal and other energy sources used to fire the bricks in these facilities have been sources of air pollution emissions of significance to the air quality of the valley. The increase in the number of smaller industries using fuel oil, high-speed diesel (HSD) and agricultural refuse, although less significant for air pollution than big industries, but has significant local air pollution exposure, especially in semi-urban Kathmandu. Tobacco smoking also comes under this category of air pollution.

By in large road vehicle fleet, using fossil fuel accounts for the major ambient air pollution in Kathmandu. It is estimated that 51 vehicles ply per km of road in Kathmandu. Of the 207, 579 vehicles (1998) registered two stroke engines account for 51% followed by light vehicles such as cars, jeeps, vans 21% and rest are trucks,

buses etc and some 57% of vehicles are registered in Bagmati Zone, which includes Kathmandu valley.

III. Status of ambient air quality in Kathmandu valley

Rapid urbanization, industrialization, poor maintenance of road, poorly maintained vehicles and public awareness is responsible for deteriorating ambient air quality in Kathmandu valley. The main emission sources of air pollutants are:

- smoking vehicles of all types
- resuspension of street dust and litter
- black smoke plumes from numerous bricks kilns
- refuse burning

In addition, one large point source, the cement factory has highly visible particles emissions.

The major air pollutant is total suspended particles (TSP) and PM₁₀, due to the following main sources (in approximate order of importance).

For TSP: resuspension from roads, bricks kilns, domestic fuel combustion, diesel vehicles, gasoline vehicles.

For PM₁₀: Diesel vehicles, gasoline vehicles, resuspension, domestic fuel, brick kilns.

The TSP observed at different sample sites in the valley were found to be higher than the WHO guideline values (TSP-120 mg/m³ and PM₁₀ – 70 mg/m³ for eight hours) at all sample sites except residential and control sites. The TSP in the ambient air varied by month, highest level observed during April/May and lowest in July. The other air pollutants NO₂ and SO₂ are below WHO guideline representing little risk at present. The CO concentrations may be fairly high at rush hours along with the roads with the heaviest traffic. Atmospheric lead, although measured from time to time by different agencies, has not shown significant problem, this may be due to measurement technique. Therefore, health impact assessment for lead is based on conceptualization, rather than actual value.

IV. Health and environment impacts of air pollution.

Information regarding health impact is very limited. URBAIR 1996 is the first scientific study done regarding health impact assessment. The study shows that 50% of the population is exposed to a TSP concentration above the WHO Air Quality Guideline (AQG) (90 µg/m³ annual average) and some 4% of the population is exposed to TSP concentration above 2x WHO AQG (180 µg/m³). These are residents in the brick kiln areas and drivers and roadside residents of the roads with the most heavy traffic. The prominent disease is chronic bronchitis in adults and asthma in children. One recent study (Leaders 1999) from a city hospital, show that respiratory infections increased from 10.9% of the total outpatient visits (5, 167, 378) in 1996 to 11.6% of the total outpatient visits (7, 115, 981) in 1998. The other health impacts observed are eye irritation and infection during dry months.

The environment impact is hard to substantiate. Some observes that dust particles have caused an adverse impact on vegetation growth as well as low visibility and low degree of incoming sunlight.

V. Management of urban air pollution in Kathmandu valley

His Majesty's Government of Nepal to mitigate air pollution are varied and timely bound. They are

- Industrial Enterprises Act (1992)
- Environment Protection Act (1996)
- Vehicle exhaust emissions tests.
- Ban on three wheelers diesel tempos in Kathmandu valley: introduction of electric and gas powered vehicles.
- Protect to establish air quality monitoring stations in Kathmandu
- Master plan for adoption of alternative energy technology

In context of Nepal, all acts and legislation have bearing on environmental mitigation and control.

The gaps, which exist in Nepal and specifically to, Kathmandu is;

- Lack of a strategic air quality monitoring policy, infrastructure and technology. Furthermore, the concept of an Air Quality Management System (AQMS) is absent from the national policy.
- Similarly, there is no Air Quality Information system (AQMS) and this has limited the scope for comprehensive presentation of the state of the atmospheric environment.
- No ambient air quality standards.
- No organization responsible for air quality monitoring.
- Lack of scientific data on human health impact, since URBAIR-1996 report.

VI. Conclusion and Recommendation

The sources of air pollution in Nepal are varied and include combustion of fossil fuel, vehicular exhaust, industrial emission, refuse burning to some extent and smoke emissions caused by combustion of biomass.

At present, the air pollution problem of immediate concern includes particulate matter in major urban area, for example Kathmandu city and indoor air pollution in general, in rural area and to some extent in semi urban areas. Ongoing developmental activities, especially in Kathmandu, changes in life style have caused an increase in concentration of air pollutants such as TSP, NO₂, SO₂, CO and to some extent lead. Therefore, Nepal needs to introduce measures, first focusing in preventing the problems of air pollution at source and then on control measures to abate problems.

Therefore, the recommendations are:

- establishment of air quality monitoring system,
- mass public awareness and education programmes
- studies on impact of air pollution on the health of people
- on the basis of above, air quality standards to be established and maintained.