



Nitrogen dioxide (NO₂) : Status and Trends in Asia

Nitrogen oxide (NO₂) is part of the general set of pollutants of Nitrogen oxides (NO_x) along with Nitric oxide (NO), Nitrous acid (HNO₂) and Nitric acid (HNO₃). NO₂, however, is the component of greatest interest and the indicator for the larger group of Nitrogen oxides.

The majority of NO_x emissions are in the form of Nitrogen oxide (NO), which is subsequently oxidized by ozone (O₃) in the atmosphere to form the secondary pollutant NO₂. NO₂ is the main source of tropospheric ozone in the presence of hydrocarbons and ultraviolet light, thus playing an important role in determining ambient O₃ concentrations. NO₂ is also a key precursor of nitrate particles which form an important fraction of ambient particulates with diameter of 2.5 microns or less (PM_{2.5}).

Sources of Nitrogen dioxide

- **Anthropogenic activities:** burning fossil fuels e.g. for road transport, shipping, electricity generation, road traffic, power stations, heating plants and industrial processes, gas stoves
- **Natural sources:** agricultural fertilization, nitrogen-fixing plants, thunderstorms due to the extreme heat of lightning



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"In some studies, NO₂, rather than particulate matter, was found to be associated with asthma hospital admissions.

Health-Related Impacts

NO₂, a strong oxidant, can irritate the lungs and lower resistance to respiratory infections such as influenza. Frequent exposure to high concentrations decrease lung function growth especially in children. This includes reduced host defense against infectious pulmonary diseases, bronchoconstrictive agents, and other irritant stimuli. NO₂ also increases the risk for adverse birth outcomes including low birth weight, pre-term delivery, intra-uterine growth retardation, birth defects, and stillbirth. Since they come primarily from vehicular sources, NO₂ is also strongly related to PM, and thus very difficult to discriminate its effects from each other pollutants in epidemiological studies.

Status of Nitrogen dioxide in Asia

In a 234 Asian cities- sample for 2008, most cities (73%) complied with the annual World Health Organization (WHO) Air Quality Guidelines (AQG) of $40 \mu\text{g}/\text{m}^3$ for NO_2 , while all of the cities complied with the US Environmental Protection Agency (EPA) Standards of $100 \mu\text{g}/\text{m}^3$ (annual averaging period).

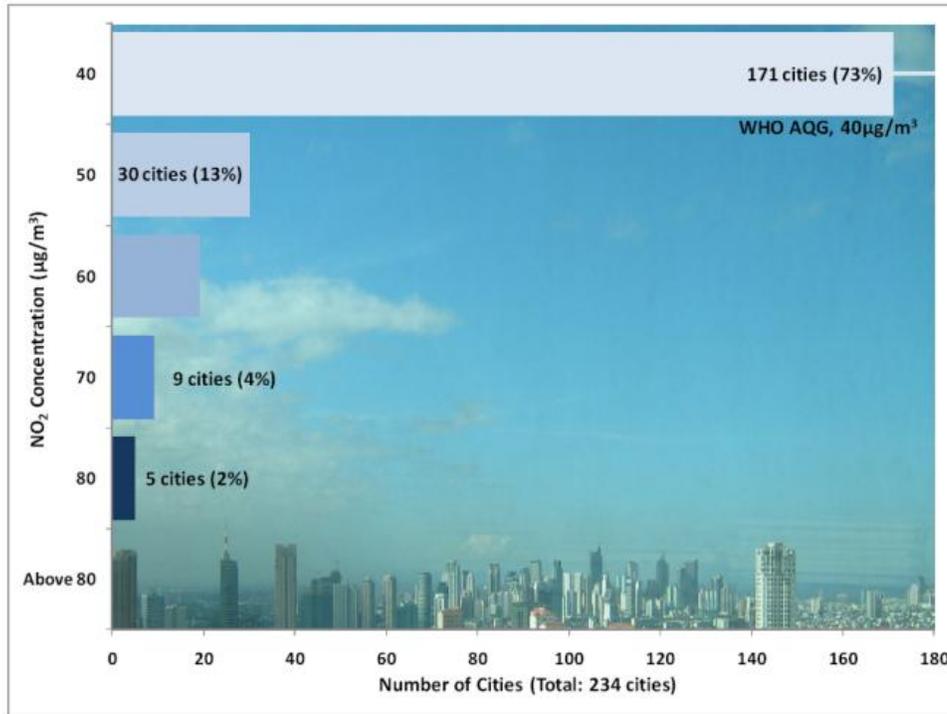


Figure 1. Distribution of Asian Cities relative to NO_2 Concentration (2008)

Source: CAI-Asia, 2010.

The average of annual NO_2 concentrations for 234 Asian cities is $30.7 \mu\text{g}/\text{m}^3$ —within the WHO AQG ($40 \mu\text{g}/\text{m}^3$).

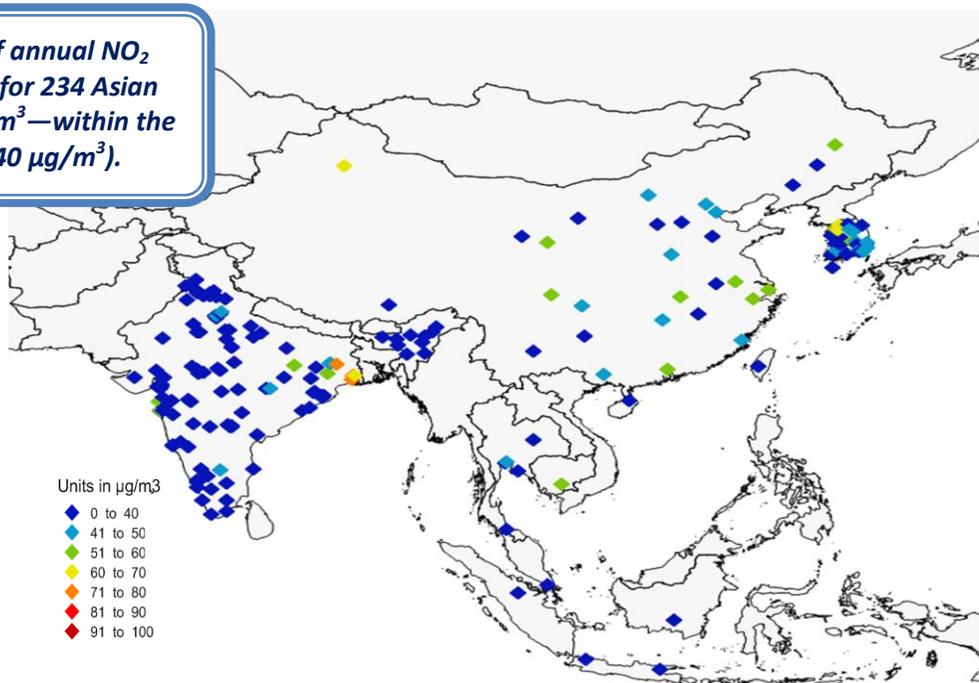


Figure 3. Annual NO_2 concentrations in 234 cities in Asia (2008)

Source: CAI-Asia, 2010.



While most Asian countries have adopted the NO₂ standard in differing degrees, more is needed in the development of a NO₂ standard in its 1-hr averaging period.

Only five of 19 countries surveyed had annual NO₂ standards equivalent to the WHO AQG. Most of the countries have 24-hour NO₂ standards even though WHO does not have a guideline for this.

Trends of NO₂ in Asia

For the past two decades, the average of annual NO₂ levels in Asia are within the annual European Union Air Quality Standards (EU AQ), WHO AQG, and USEPA National Ambient Air Quality Standards (NAAQS).

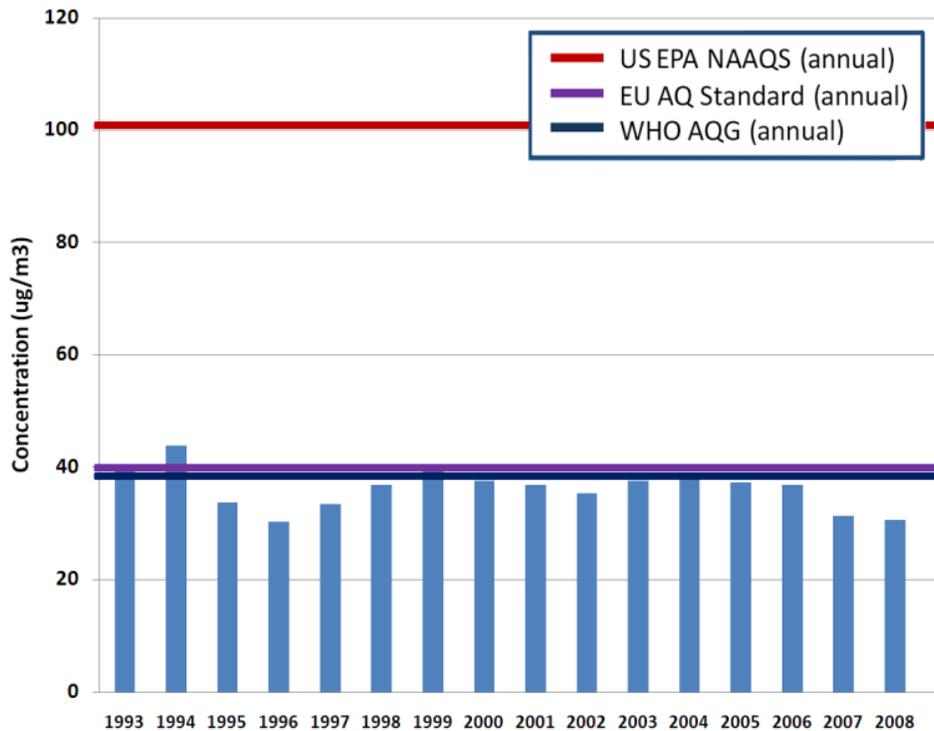


Figure 4. Average of Annual Average NO₂ concentrations in 234 cities in Asia (1993-2008)

Source: CAI-Asia, 2010.

References

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