

Vehicle Emissions on Health

For LEGCO Subcommittee on Air Pollution Control
Regulation Meeting

Date: 26-Nov-2013

Time: 14:30-16:30

Venue: Rm2, LEGCO Complex

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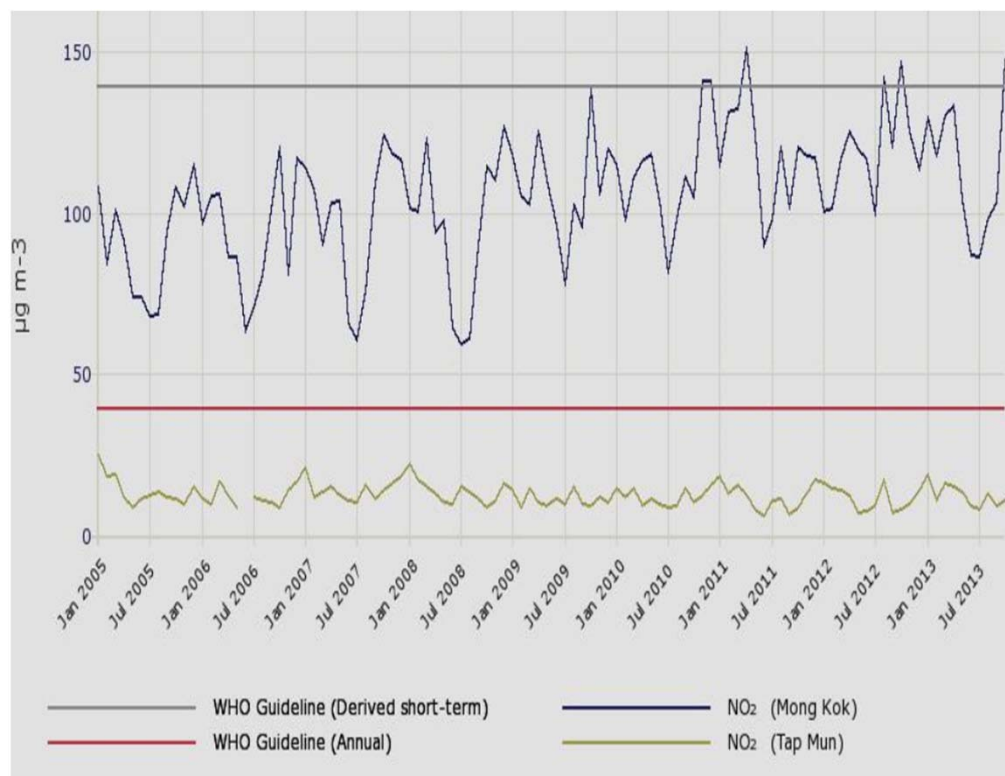
Air pollution due to traffic emissions



In Hong Kong, traffic-related air pollution (NO_x) as indicated by NO_2 and PM is **high** above the WHOAQG

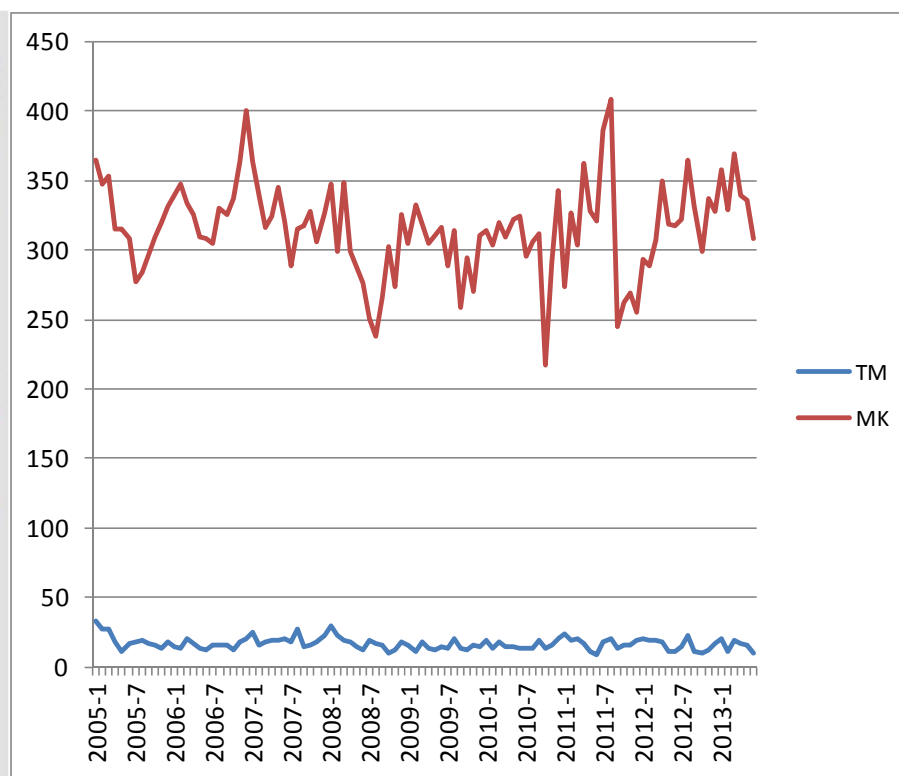
2005-2013 Trend for NO_2

- Increasing in urban area
- Unchanged in the background
- urban-background difference is large ($140\mu\text{g m}^{-3}$)



2005-2013 Trend for NO_x

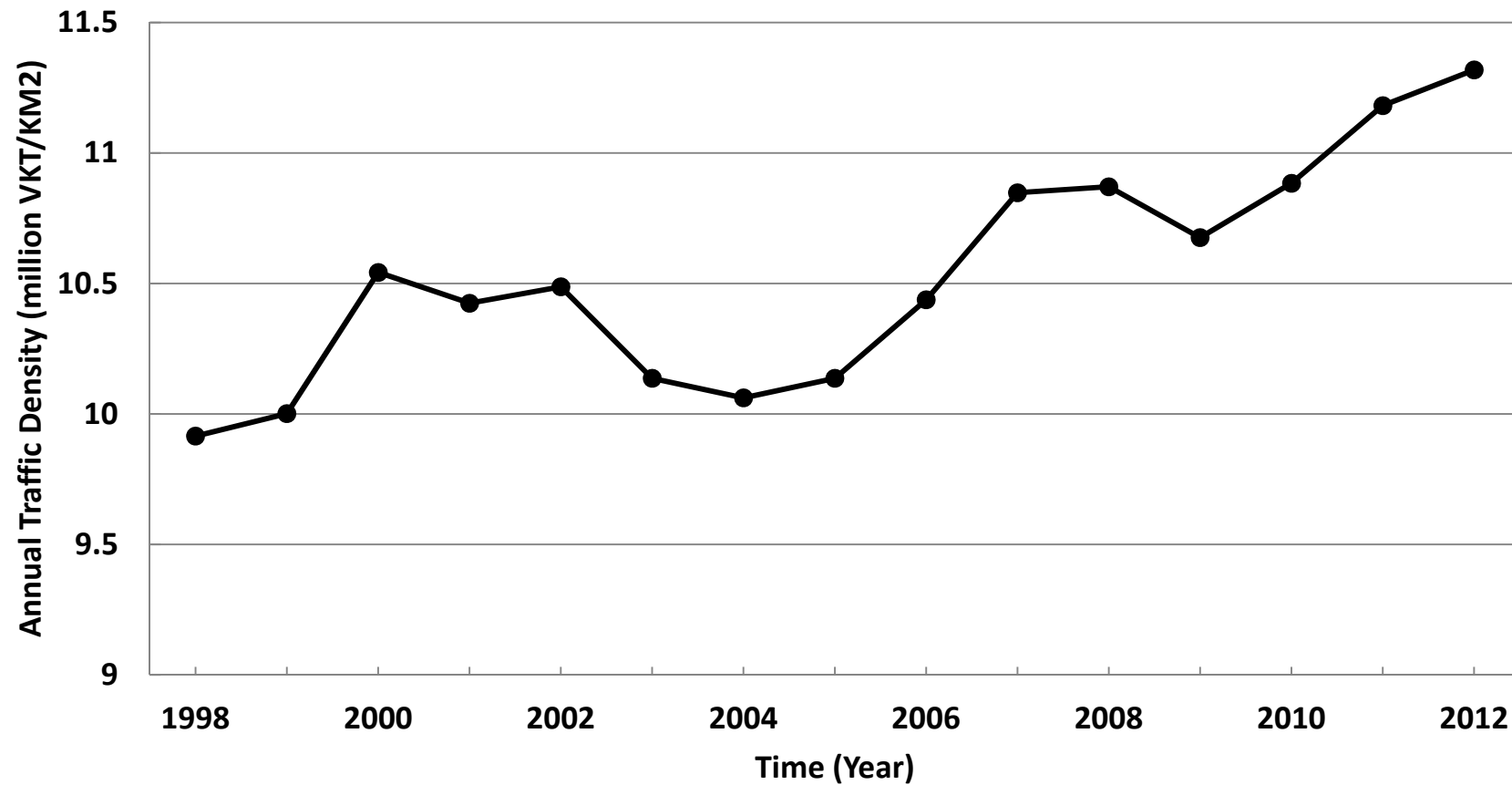
- Stabilizing in urban area
- Unchanged in the background
- urban-background difference is large ($300\mu\text{g m}^{-3}$)



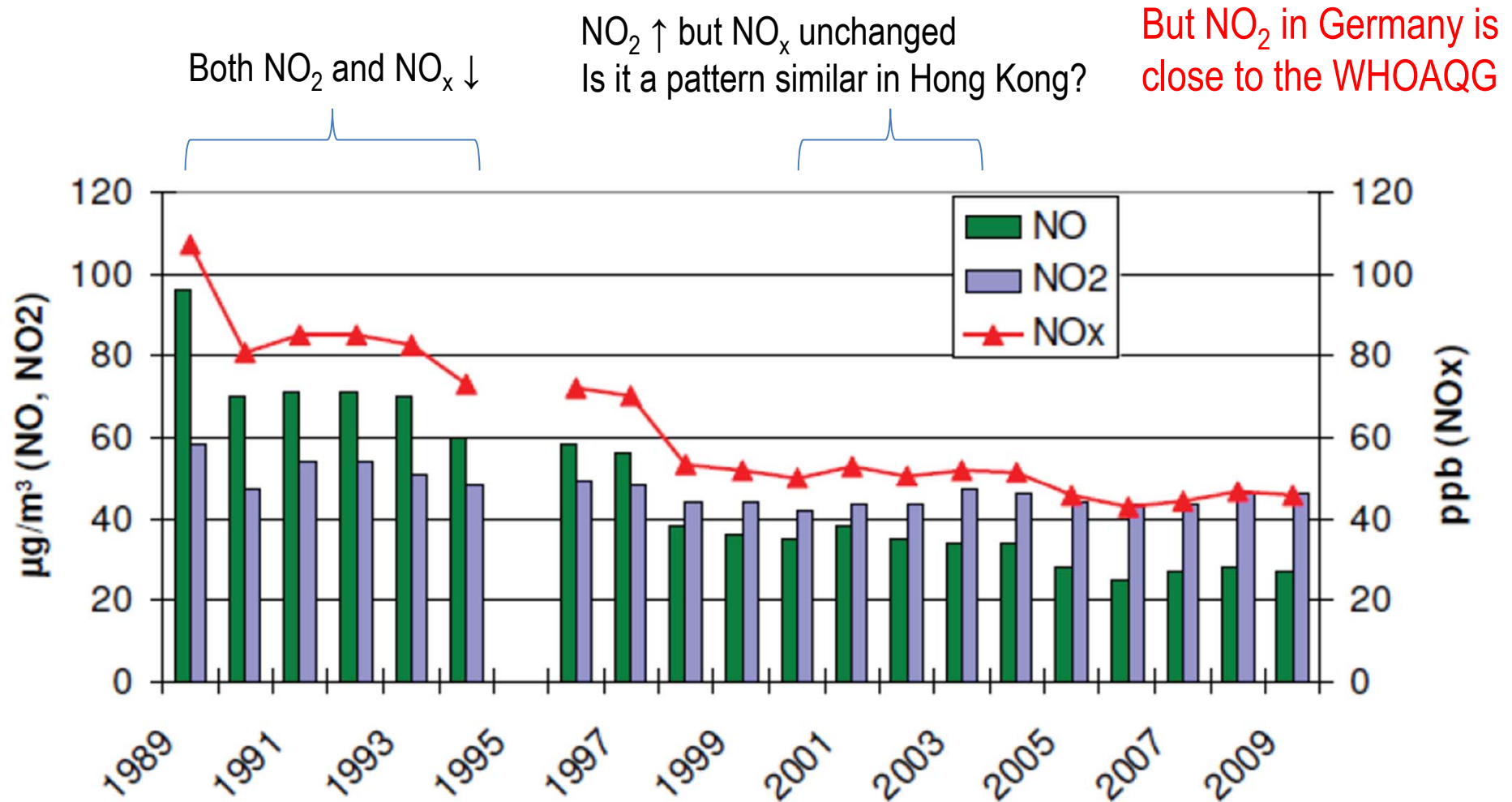
Source: The Hedley Index (<http://hedleyindex.sph.hku.hk>)

In Hong Kong, increasing trend of traffic-related air pollution is related to the increasing traffic density

Figure 1: Annual average traffic density in Hong Kong



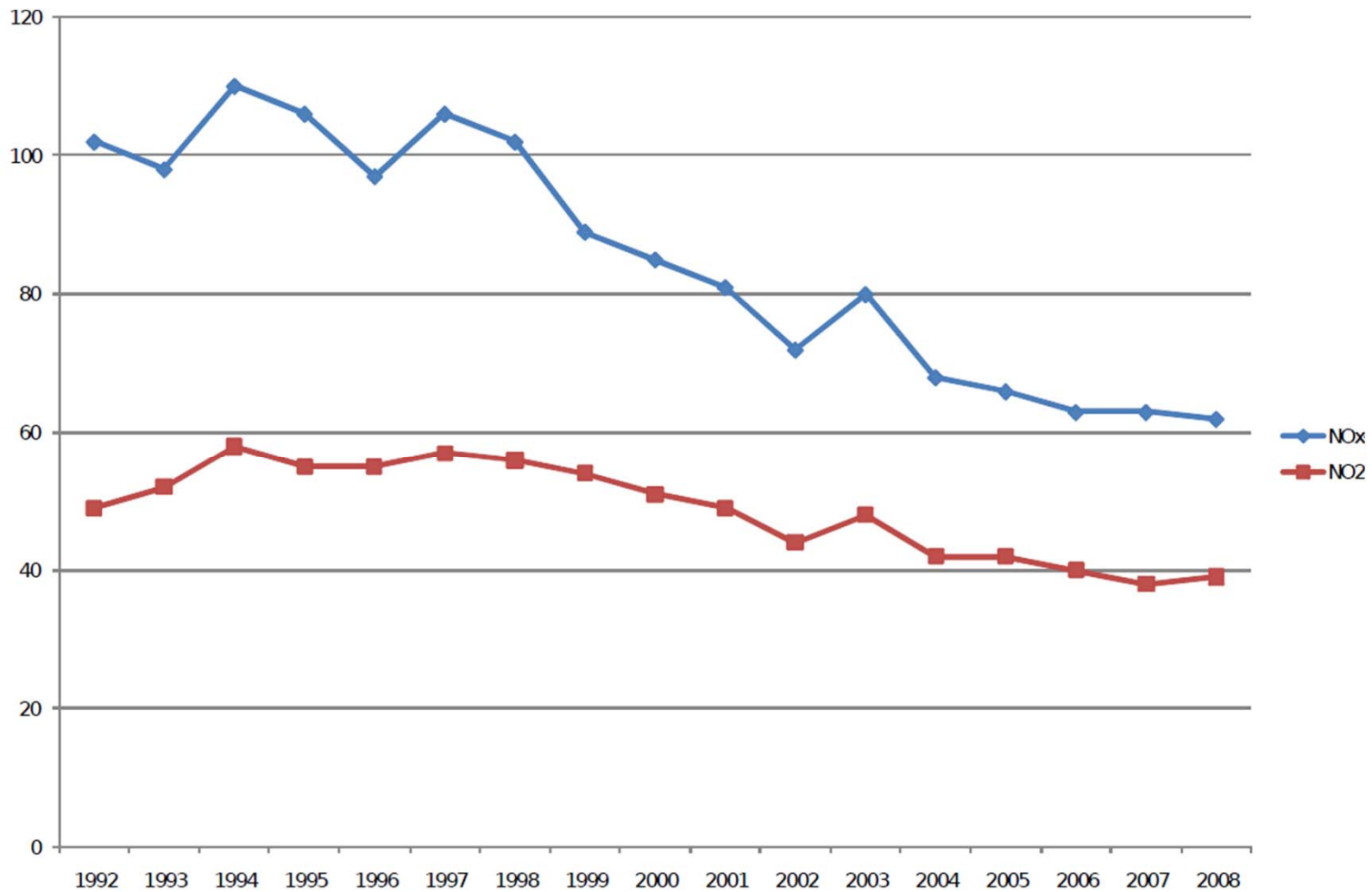
NO₂ and NO_x in a roadside station in Germany



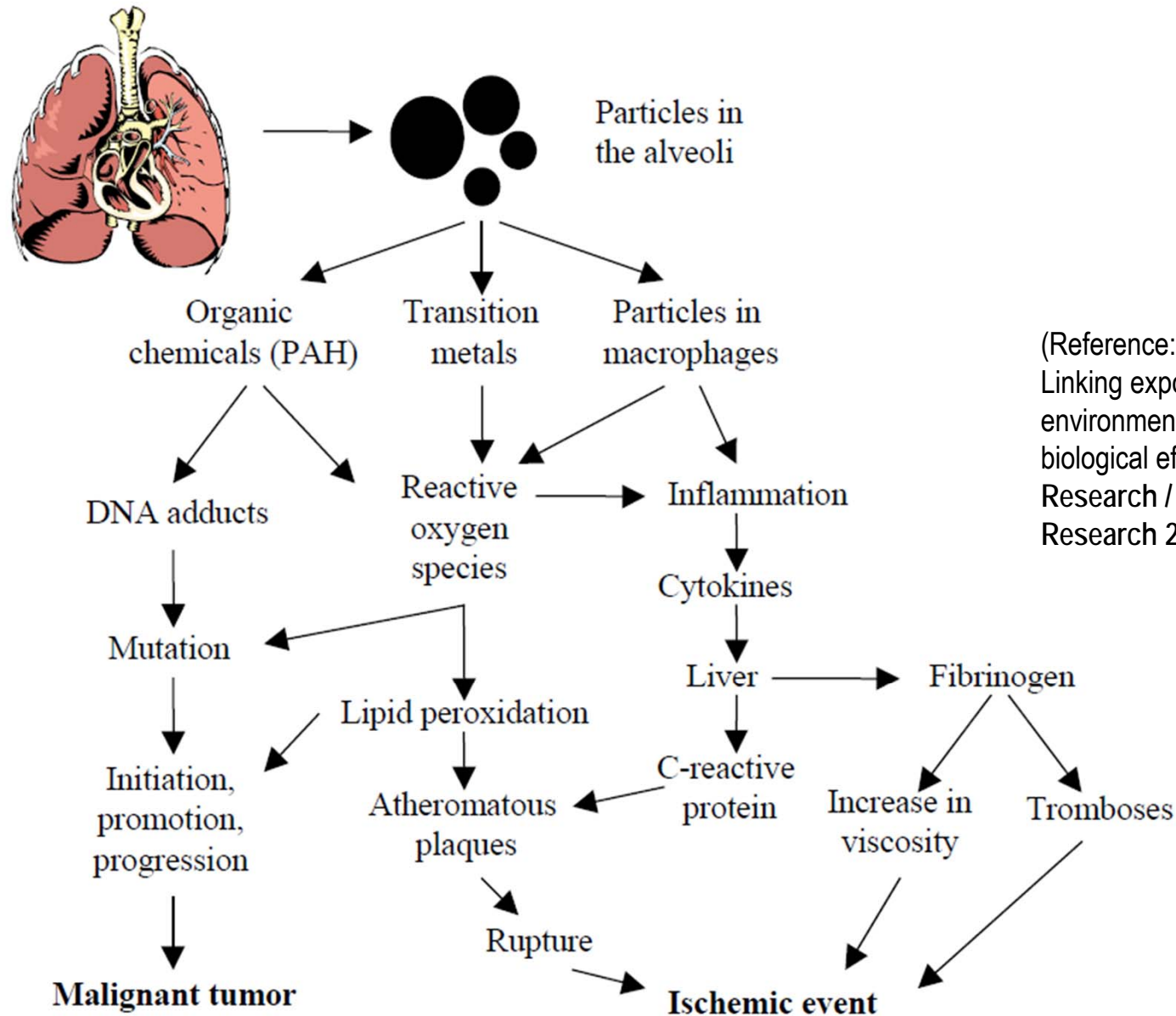
(Reference: Carslaw *et al.* Trends in NO_x and NO₂ emissions and ambient measurements in the UK. DEFRA, UK.

How about emission controls of NO₂ and NO_x in Paris?

(Population: 12 million)



Biological mechanisms for cancers and heart diseases

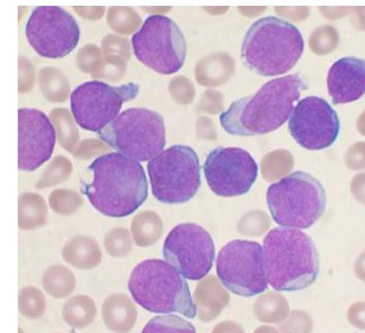
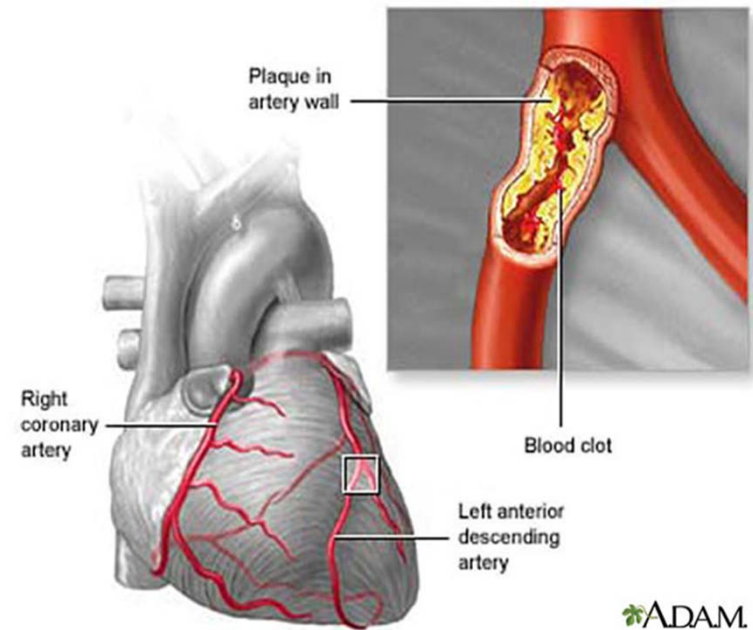


(Reference: Sørensen *et al.*
Linking exposure to
environmental pollutants with
biological effects. *Mutation
Research / Reviews in Mutation
Research* 2003; 544: 255-271)

Epidemiological evidence due to vehicle emissions

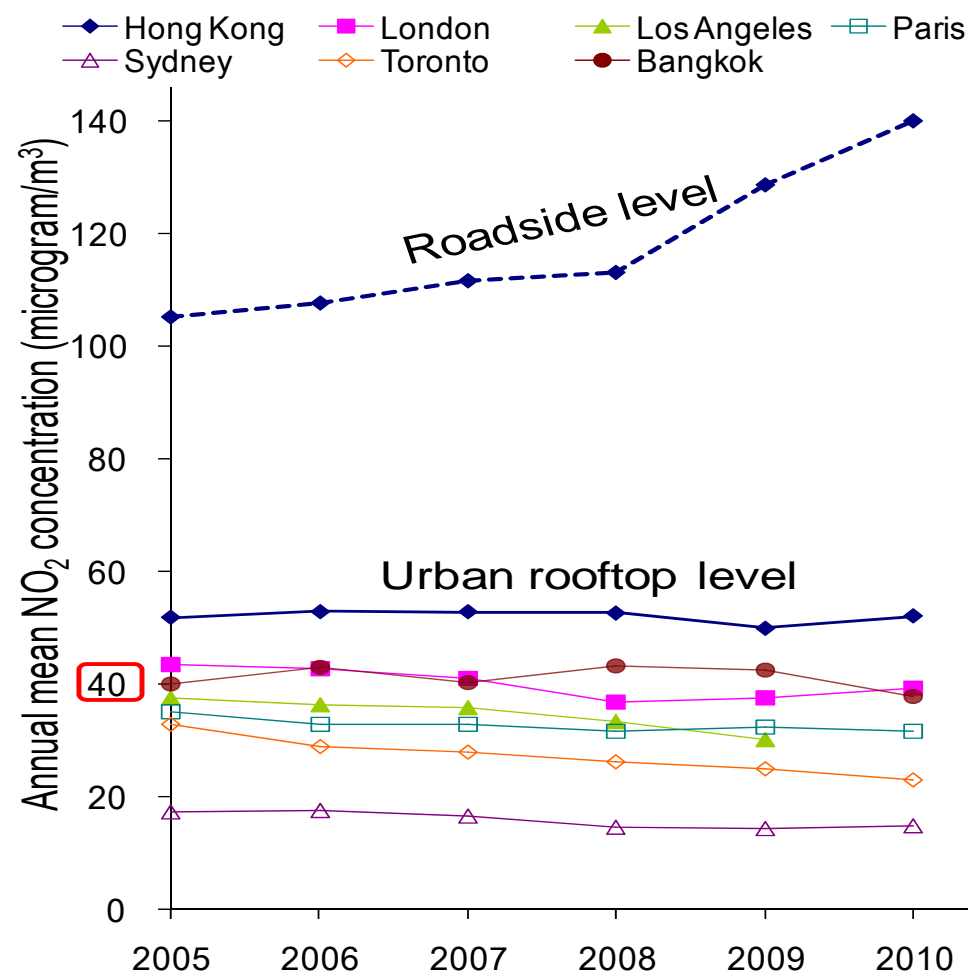
Exposure to vehicular source pollutants (including NO₂ and black carbon) was associated with:

- (i) **hardening of major arteries** (Rivera *et al* 2013),
- (ii) **blood cancer in children** (Amigou *et al* 2011), and
- (iii) **shortening of genetic sequences** – a cause of cell replication problems leading to aging, heart disease, and cancers (McCracken *et al* 2010).



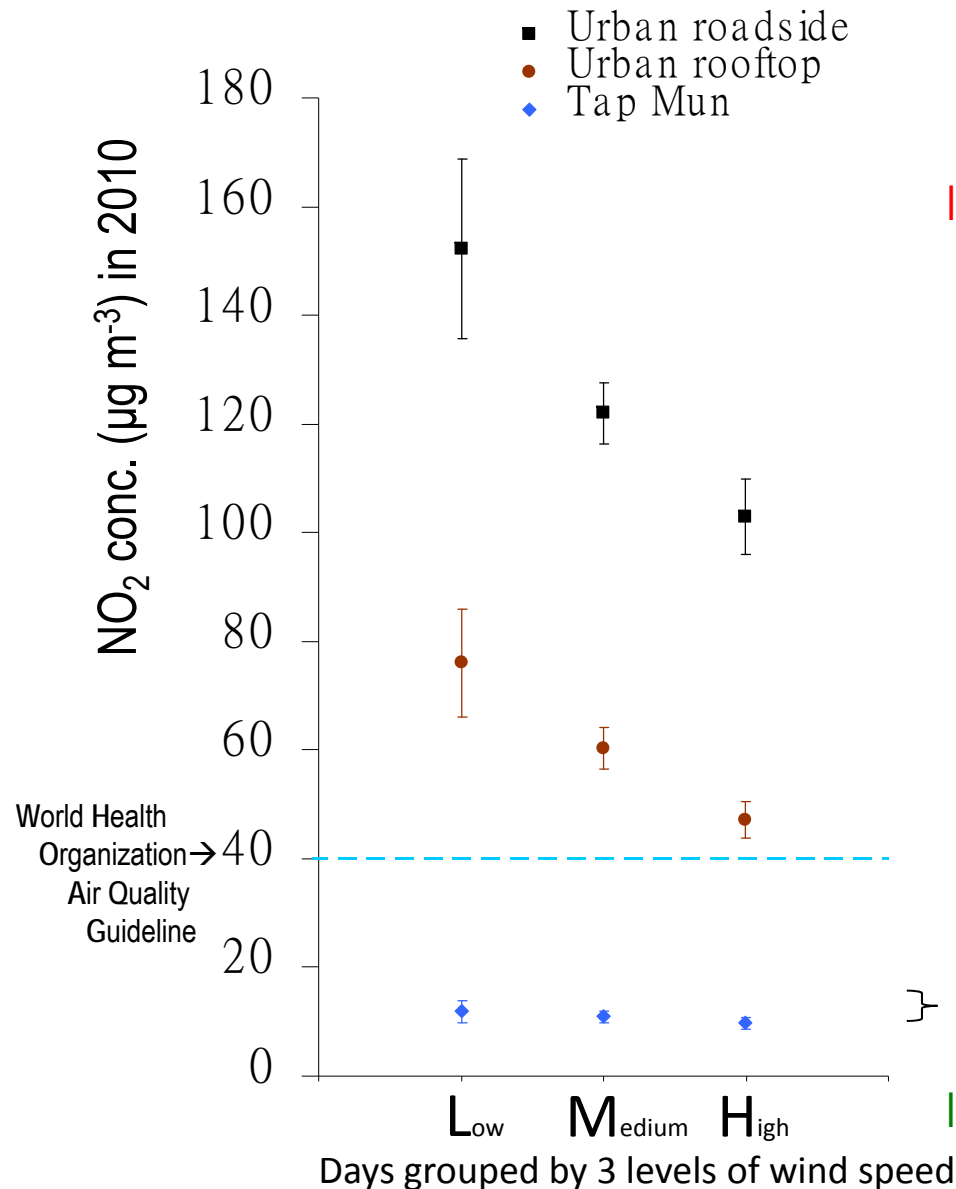
(Reference: (1) Rivera *et al*. Association between long-term exposure to traffic-related air pollution and subclinical atherosclerosis: the REGICOR study. *Environ Health Perspect* 2013;121:223-30. (2) Amigou *et al*. Road traffic and childhood leukemia: the ESCALE study (SFCE). *Environ Health Perspect* 2011;119:566-72. (3) McCracken *et al*. Annual ambient black carbon associated with shorter telomeres in elderly men: Veterans Affairs Normative Aging Study. *Environ Health Perspect* 2010;118:1564-70)

Nitrogen dioxide level in Hong Kong is higher than in other cities



(Reference: Lai *et al.* A method to derive the relationship between the annual and short-term air quality limits—Analysis using the WHO Air Quality Guidelines for health protection. Environment International 2013; 59 :86-91)

Can we blame traffic-related air pollution sources from mainland China?



WITH
local emissions

WITH low or no
wind-speed

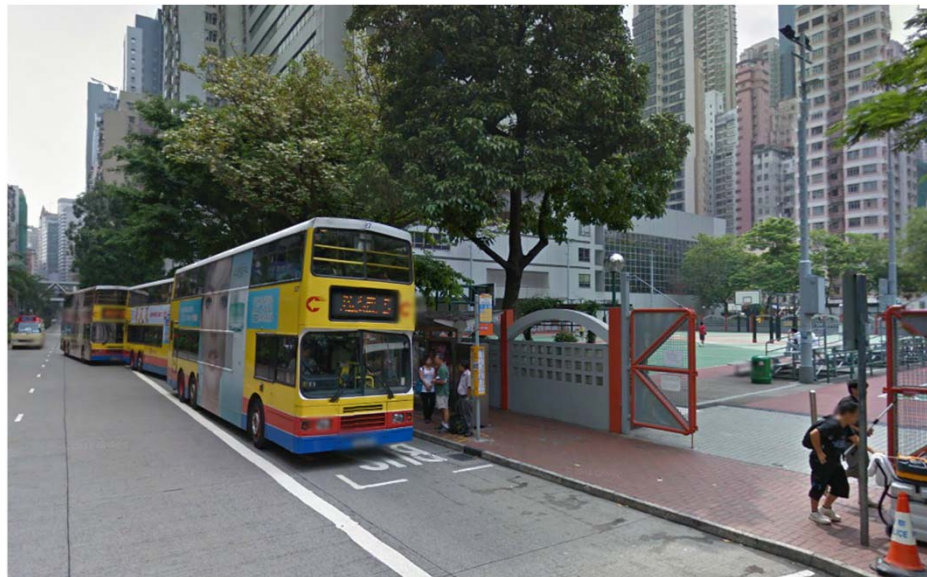
WITH medium
wind-speed

Main points:

- (1) Pollutants on days without wind were very unlikely travelled from mainland China. They were generated locally.
- (2) The major meteorological factor, wind, only contributed to small increase of traffic-related pollution when compared with the local emission factor.


WITHOUT
local emissions

Traffic-related air pollution is a major issue in social inequity and outdoor activities



The public can now learn from HEI:

The estimated health impacts due to air pollution per year have been increasing

 Hedley Environmental Index Measuring Hong Kong's air pollution costs	Hedley Environmental Index
Premature deaths per year	3,200
Hospital bed days per year	160,000
Doctor visits per year	7,400,000
Economic loss per year (HK\$)	40,000,000,000

Averages of annual total in 2007-2011