Interconnections Between Air Pollution, Climate Change and Health

Local Impacts, Global Action;
Promoting Sino-US Cooperation

Robert O'Keefe
Jim Zhang
Denise Mauzerall

Woodrow Wilson Center
2009

Air Pollution, Climate Change and Health
Local Impacts, Global Action

Overview

Public Health and Air Pollution in Asia ***PAPA***

- *Representative Asian studies of air pollution health*
  - *Demonstrating relevance of global science to Asia to drive policy*

Health Impacts of Regulatory Interventions

- *Effects of reduction measures taken during Beijing Olympics*
  - *Lessons learned, motivation for future action*

The Intersection of Climate and Health in Asia

- *Co-benefit opportunities to address Greenhouse gasses and traditional air pollutants*
  - *Recent research on Black Carbon*

Why Co-benefits?

- Air Pollutants and GHG are often emitted by the same sources. Reduction measures taken to address one category of emission can have effects on the other
- Some “traditional” pollutants increase radiative forcing (warming), (e.g. ozone, black carbon); others can decrease it (e.g. sulfate, organic aerosols)
- Benefits from reducing GHG can seem distant and non-specific to many (developing) countries relative to near term interests.
- However, actions taken to reduce traditional air pollutants (PM, ozone) can produce near term benefits in local populations that are highly cost effective in terms of avoided health impacts

- *Creating a health-based incentive to reduce traditional air pollutants is a key step to enable concurrent reduction of GHG’s as well*

The Health Effects Institute

- Founded in 1980 to provide impartial, high-quality science on health effects of air pollution
- Joint and balanced core funding from
    - Government (U.S. EPA)
    - Industry (28 Worldwide Vehicle Manufacturers)
- Also partnerships with WHO, ADB, USAID, CAI-Asia, EU, California, Oil, Hewlett foundation, others

- Independent Board and International Science Committees oversee and review all research without sponsor influence
- Over 250 studies, scientific reviews, reanalysis, capacity building
    - Particulate matter (PM), ozone, CO, NO_2, SO_2, diesel exhaust, benzene, butadiene, manganese, MTBE, others
    - Relevant to regulatory decisions in North & South America, Asia, Europe
- *HEI evaluates the science, does not take policy positions*

HEI Studies Worldwide 2009

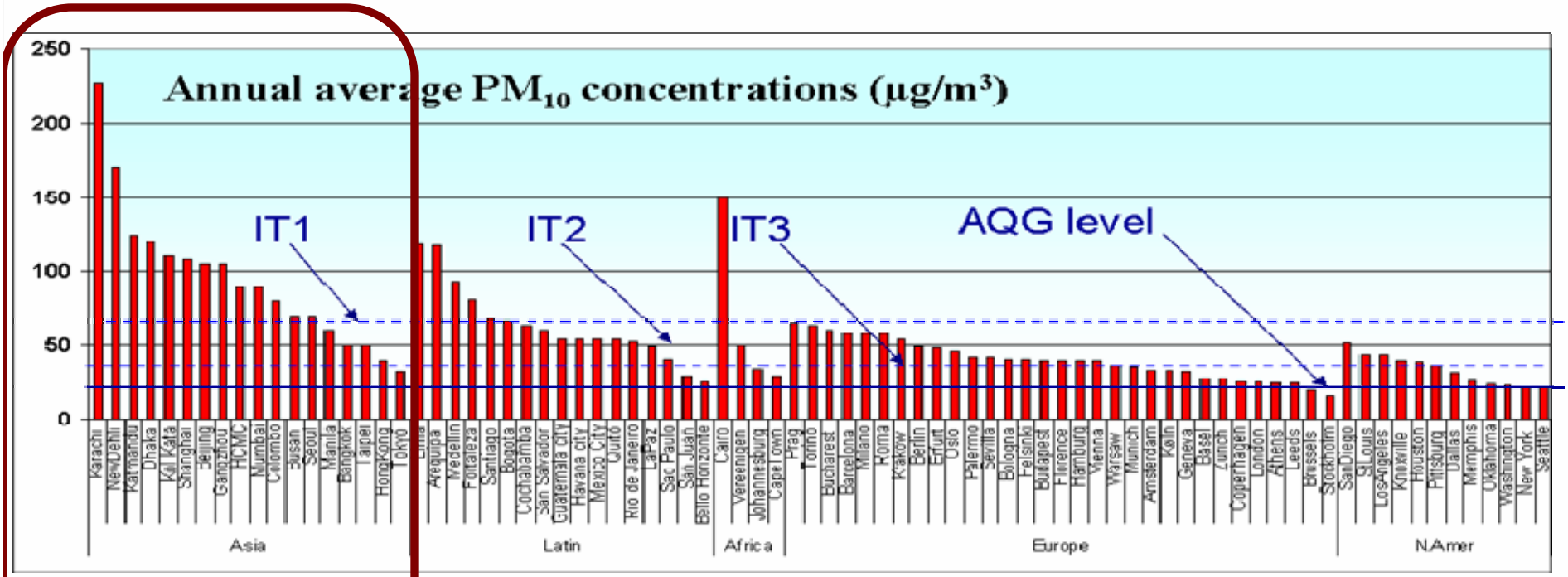
☆ = HEI Study

Air Pollution in Asia

Air Pollution: A Problem Worldwide

Ambient Levels of Particulate Matter Exceed Current WHO Air Quality Guidelines

Especially in Some Asian Countries

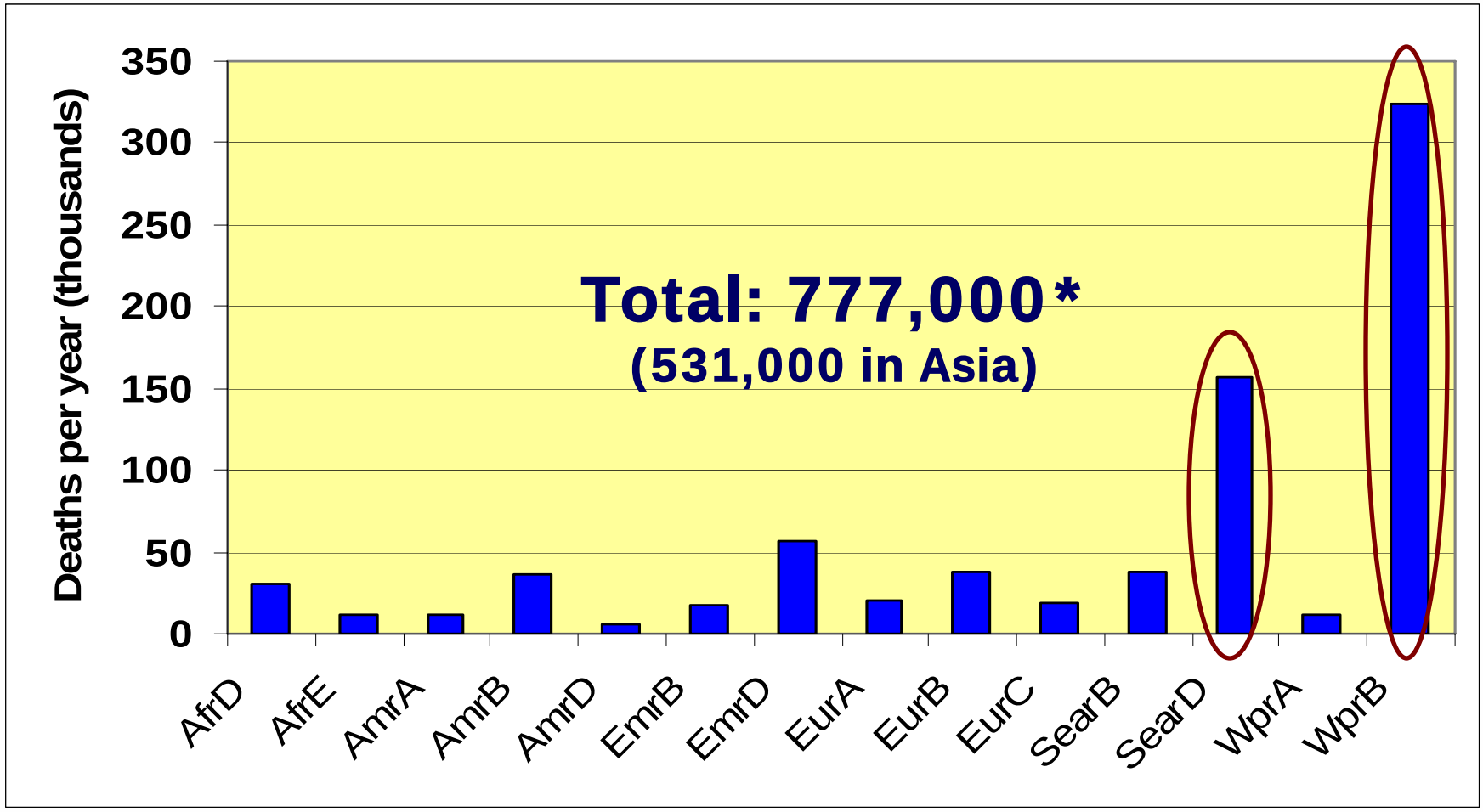


ASIA

World Health Organization 2006

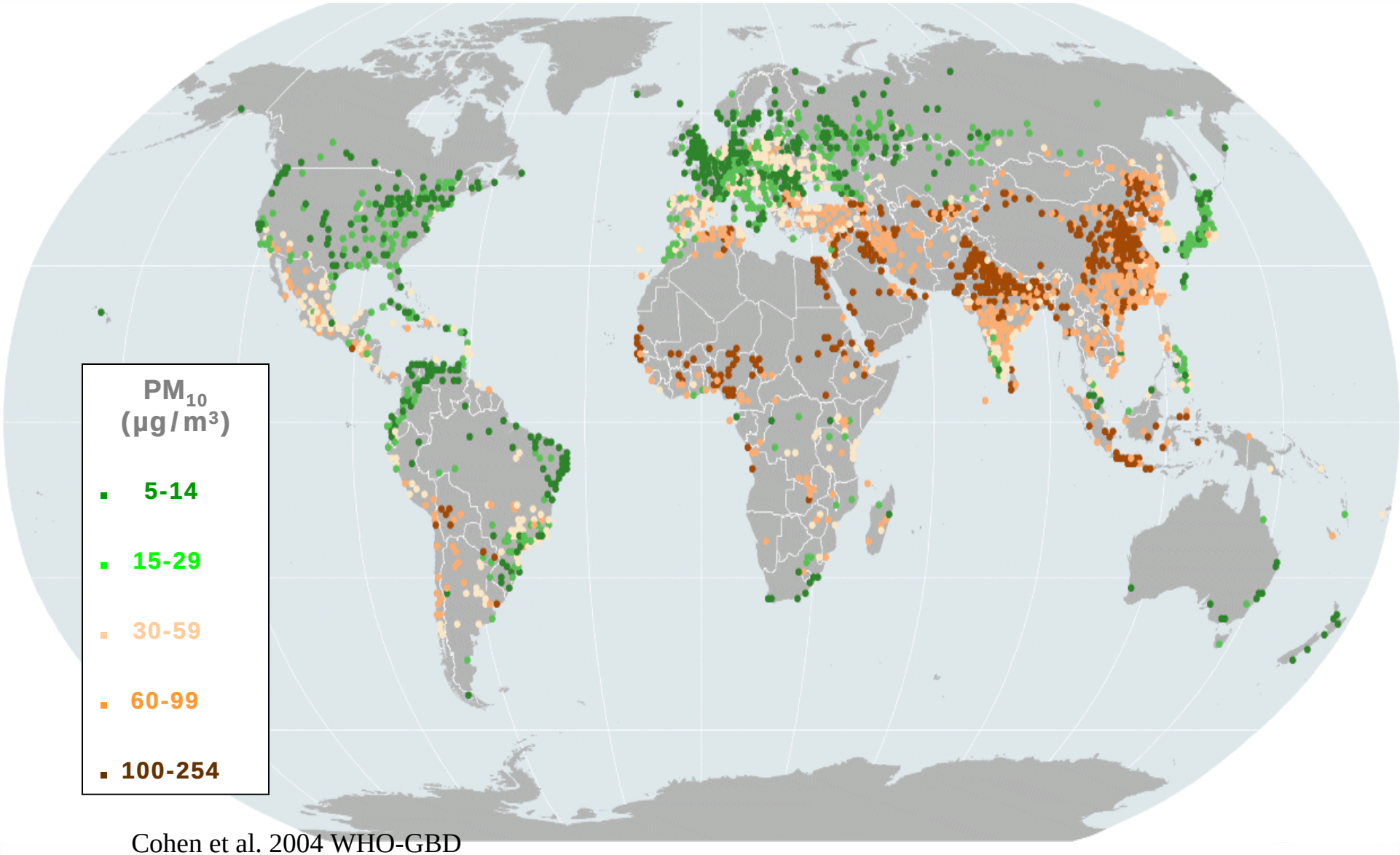
Most Deaths Attributable to Urban PM Are In Asia

WHO 2006 Global Burden of Disease Estimates



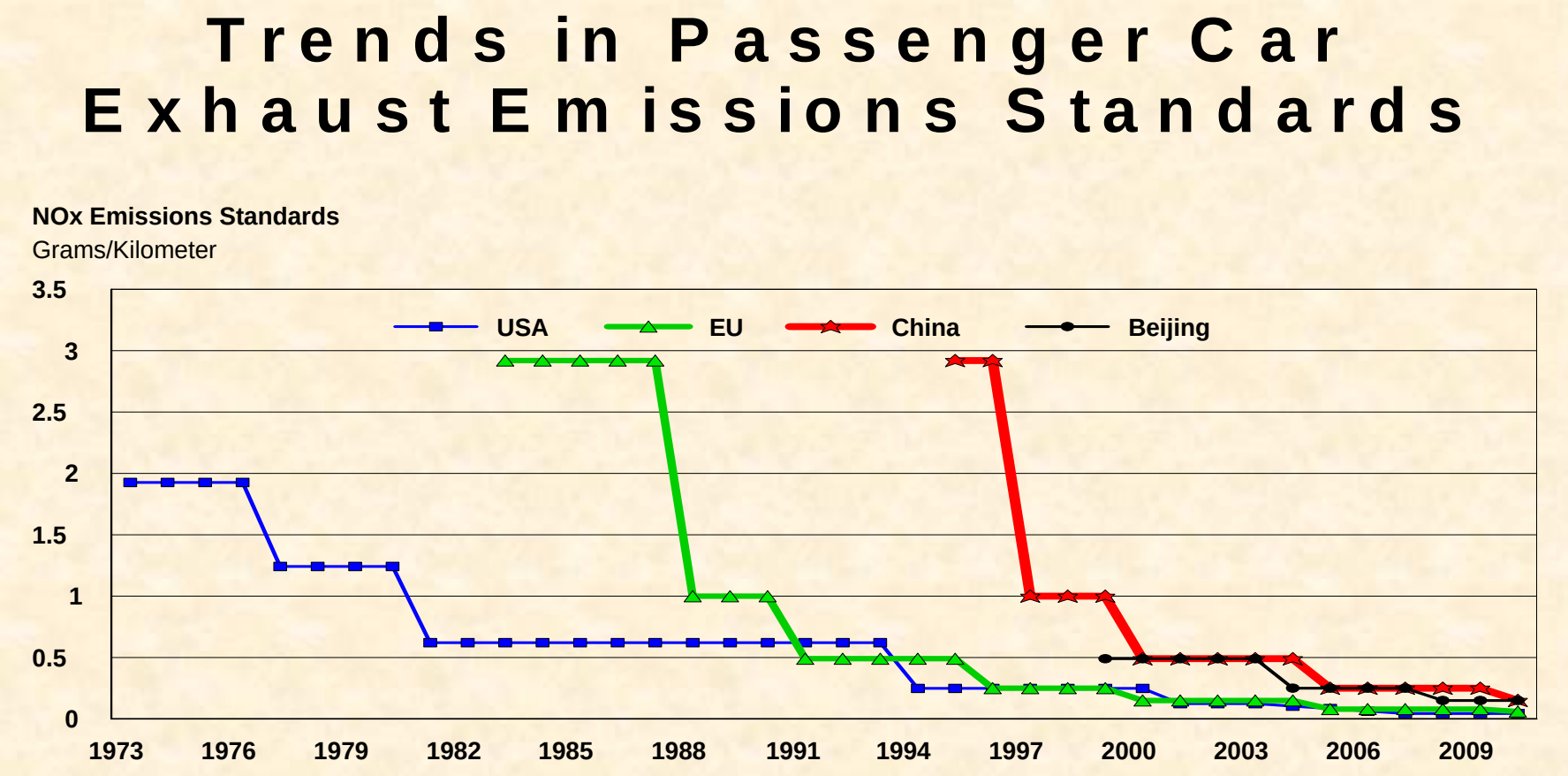
**Deaths at levels above WHO Air Quality Guidelines*

Estimated PM_{10} Concentration in World Cities
(pop >=100,000, Annual Average)



Cohen et al. 2004 WHO-GBD

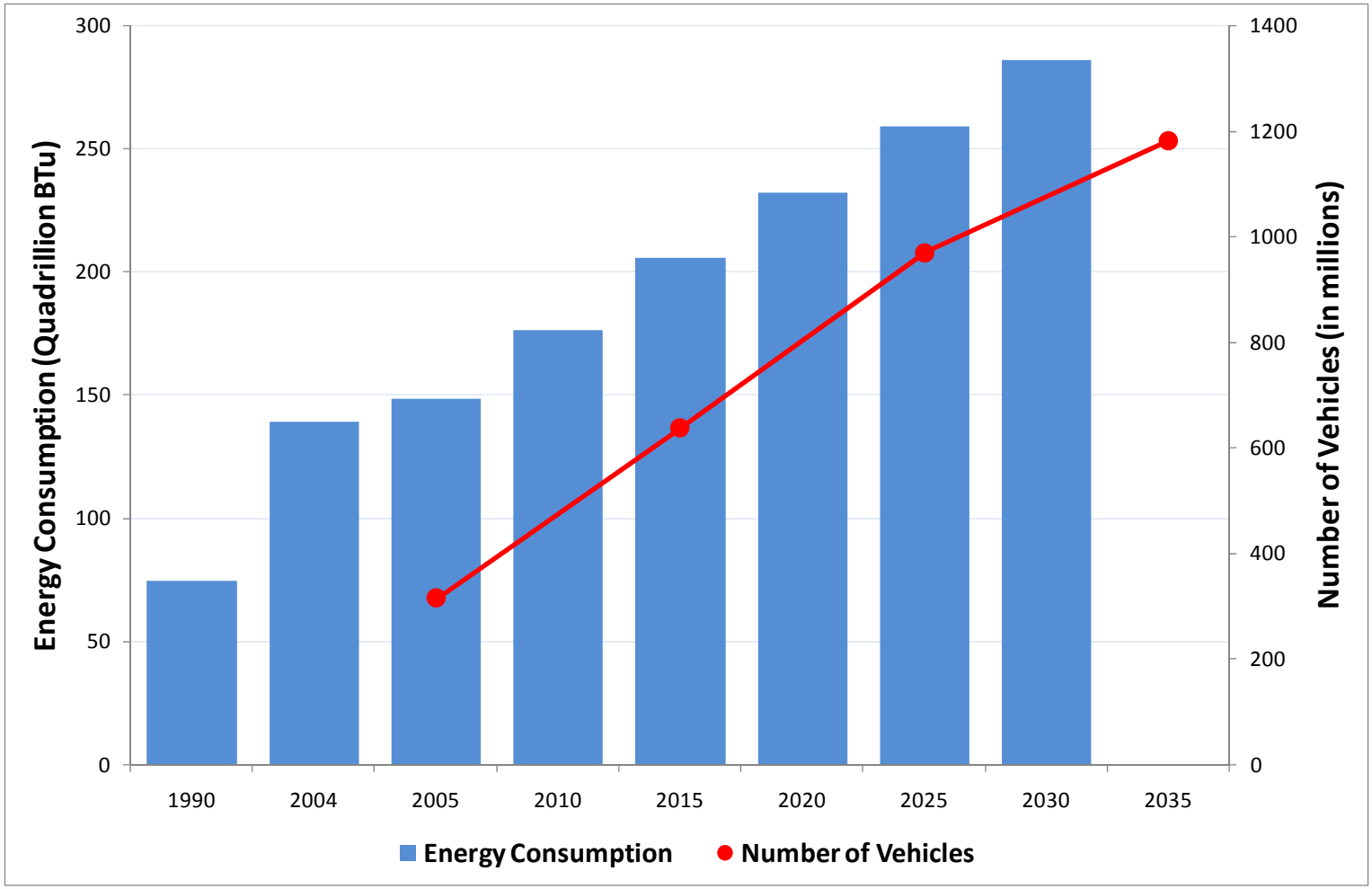
China has made progress in some areas



Also, lead from gasoline, lower fuel sulfur, some stationary source controls, advanced coal technology

But much more remains to be done…..

Total Energy Consumption and Vehicle Growth in Asia



Notes:
The energy consumption figures reflect Non-OECD and OECD countries as stated in the EIA Annual Energy Outlook 2008. The vehicle projection figures include Japan, Pakistan, Singapore, Bangladesh, South Korea, Malaysia, Nepal, Sri Lanka, China, India, Indonesia, Thailand, Philippines, Viet Nam.
Sources: EIA (2008) and CAI-Asia calculations based on Segment Y Ltd

Expanding current science base to drive Asian air quality actions

- Challenge: Limited, or unorganized studies of air pollution and health in Asian populations
  - *Reliance on Western studies alone easily dismissed*

- Goal: *Spur policy makers by demonstrating relevance of existing global science by documenting representative impacts in* ***local*** *Asian populations*

- Provides near term incentive to reduce traditional air pollutants and some GHG's (e.g. black carbon, ozone)

Public Health & Air Pollution in Asia "PAPA" Program

- ***Partnership with HEI and CAI-ASIA*** to understand & communicate the health effects of air pollution in Asia through:
  - ***Scientific Review*** and ***Meta Analysis*** of the health effects in Asian cities
  - ***PAPA-SAN, a*** **Web–based compendium** *of over 420 Asian studies*
  - ***Support for epidemiological studies*** **in 8 Asian cities**
  - **C*omprehensive Assessment* of air pollution and health across Asian cities**
  - ***Strong commitment to build capacity*** of local scientists
    - **Creating ability for Asian scientists to gain skills, have impact**
- ***Overall Goal:***
  - **Communicate quality science to policy makers to drive key Asian policy decisions to improve air quality**

PAPA Literature Review: *Health Effects of Outdoor Air Pollution in Developing Countries of Asia*

- **Systematic identification of 140 peer-reviewed Asian studies 1980-2003 (over 60 from China)**
- **Special focus on studies of daily changes in air pollution and health**
- **Conduct first ever Asian meta analysis" 28 "time series" studies evaluated in depth effects in Asia and to assess relative to West**
- **Translated to Chinese, widely distributed**
- **<u>Major expanded update in 2009</u>**

Tracking the Scientific Literature: The PAPA-SAN Asia Compendium

-**Unique resource for scientists, policy makers,**

-Over 400 studies of air pollution, exposure, health effects across Asia

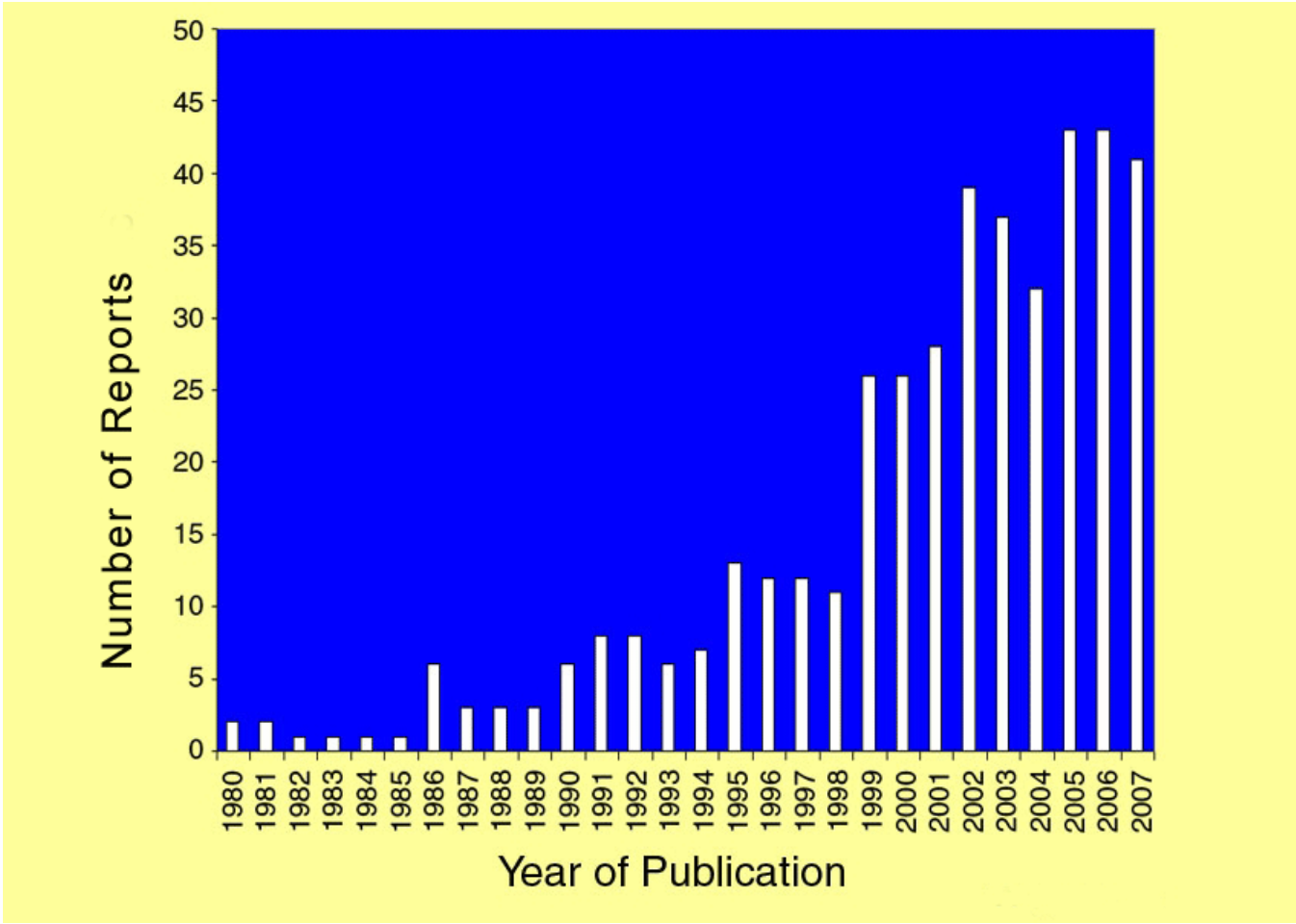
-Over 110 in China

-Complete listing of studies, pollutants, locations, results

Documents existing knowledge for decisions

http://www.healtheffects.org/Asia/papasan-home.htm

Yearly Publication of PAPA-SAN Studies



PAPA
HEI

Epidemiologic studies of the health effects of air pollution in China (1980–2006)

PAPA: *Research in Asian Cities*

- "Time series" studies of daily levels of air pollution and mortality
- PM10 sulfur dioxide (SO2), nitrogen dioxide (NO2) ozone (O3)
- In Major Asian cities:

Bangkok	**Ludhiana**
Chennai	**Shanghai**
Delhi	**Wuhan**
	Hong Kong

To understand effects in key Asian cities, and across the region in a combined analysis, inform policy development, build local capacity

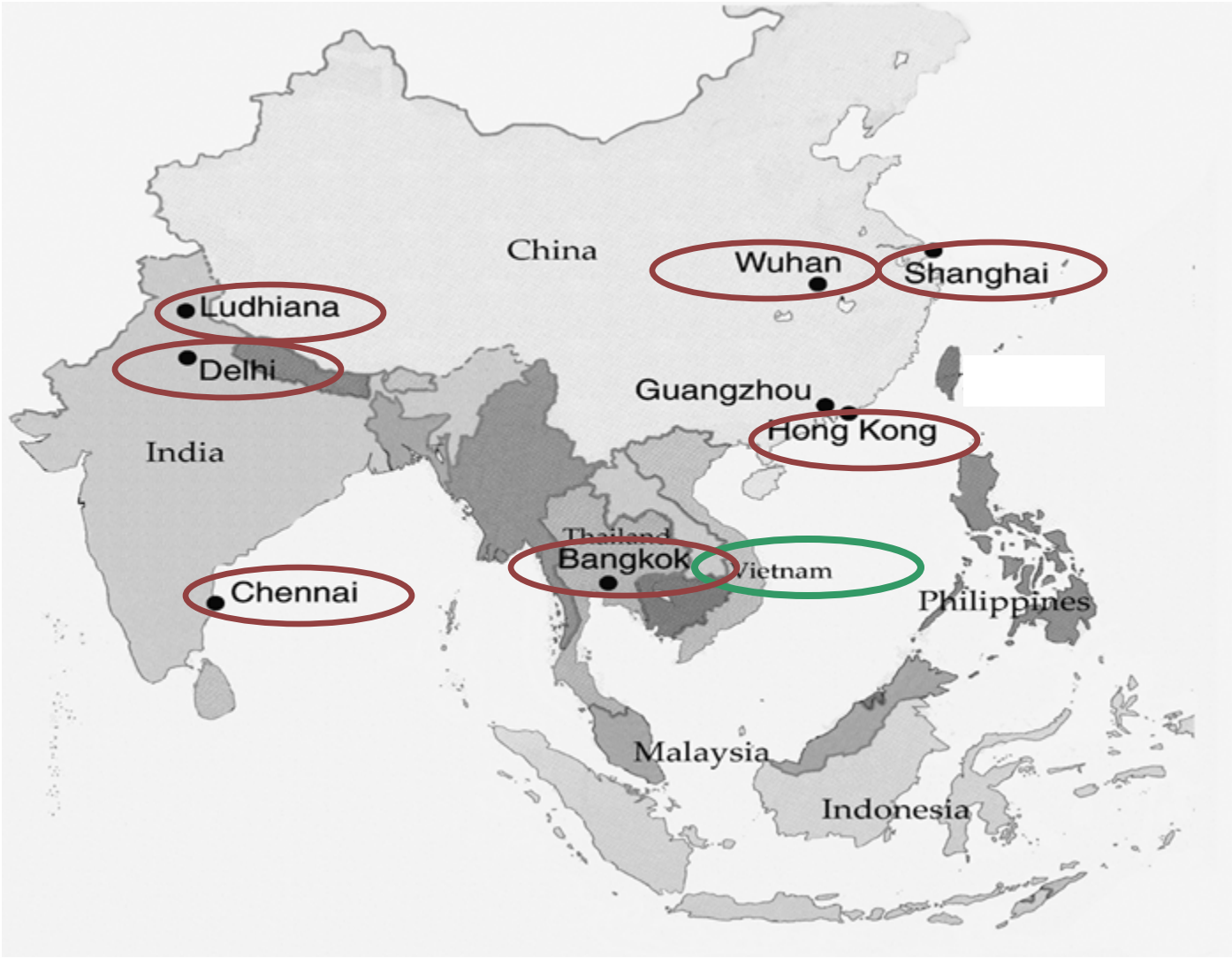
Building capacity for credible science within country, across Asia

- *Asia led & staffed investigator teams*
  - Paired with highly qualified international scientists to design studies
  - Active technical assistance throughout implementation
  - Rigorous Data Quality Audits

- *Studies Designed for Asia-Wide Coordination and exchange*:
    - Building strong networks of health scientists across Asia
    - Required linkage to respective air pollution and health agencies
    - Help build credibility, responsiveness to science

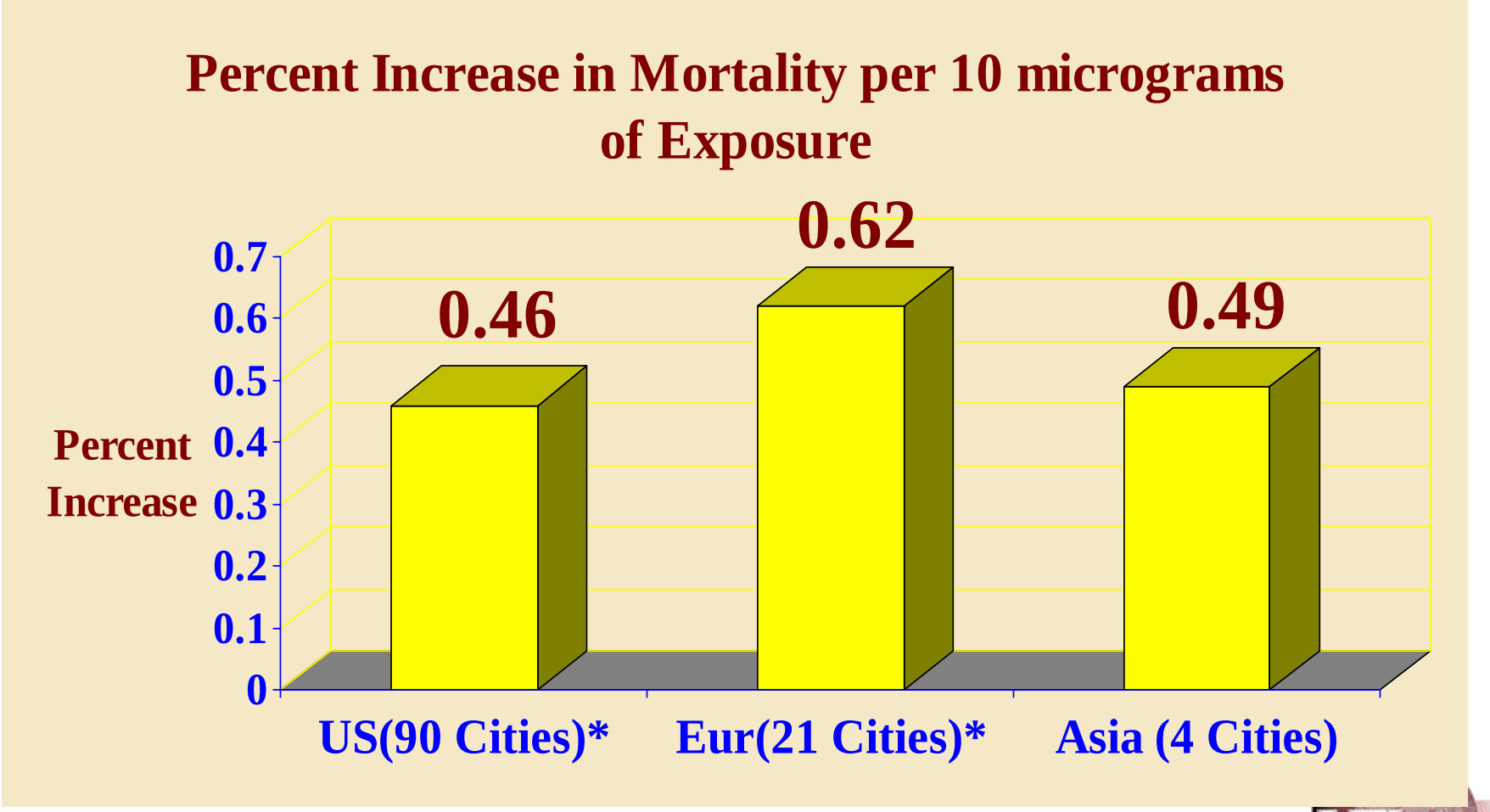
- Briefings of agencies, stakeholders across Asia on all PAPA studies and reports, *by Asian scientists, to Asian policy makers*

The PAPA Studies



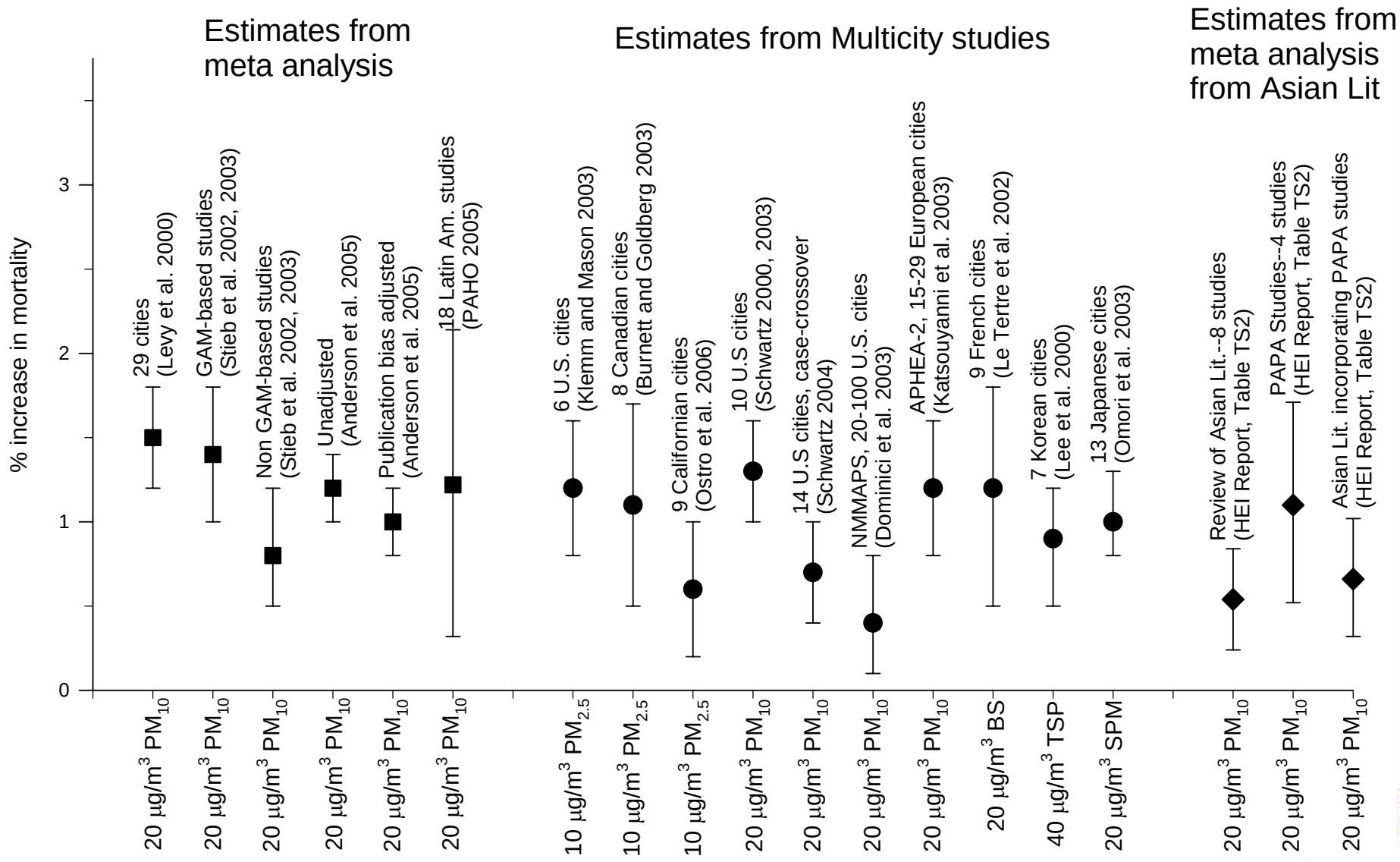
Capacity Building: Frequent Workshops on Study Design, Analysis
亚洲当地的科研能力培养：经常举办研究方案设计分析研讨会

PAPA Review Results Particulates 2005:
Asian Risk Estimates Similar to West



* Estimates Using Pre-GAM Results (without revision)

Results: Effects of PM_{10} on Daily Mortality: Asian effects consistent with West



D1

Having and Impact

PAPA Review & Science Widely Sought

Use of PAPA studies and briefings:

- **World Health Organization** (Global Air Quality Guidelines)
- **China** (US\EU\MEP High-level Bilaterals - Power plant impacts, National fuel standards, Development of 5 year plan)
- **Ho Chi Minh City** (National Tier II auto standards)
- **Thailand** EPA (Particulate Matter standards)
- **India** Cabinet level briefings: Public Health, Environmental, Economic Ministry; numerous industrial and NGO workshops
- **Indonesia** Public Health Ministry (PM, fuel policy)
- **Pakistan** Health and Environmental Ministry (1st ever national air quality control plan)
- **UNEP** (development of health based priorities)
- **Industry**: India, China, Japan auto, oil, electric
- **NGOs** In India, Indonesia, China, Vietnam
- Regional, National and International **science and policy forums**
- **EPAs (US, Japan, Asia) EU** regulatory decisions
- **Asian Development, World Banks**, **bilateral aid agencies**, many others science basis for analytic reports

Slide 25

D1 Format suggestions, a few edits (e.g. World Health instead of Work Health

End User, 10/10/2005

Delhi still polluted: Study

Chetan Chauhan
New Delhi, May 19

DELHI'S AIR may appear clean to its citizens. But it is not so clean if pollution levels of some other Asian cities are looked at.

A study done by a Boston-based institute says that the national Capital is still one of the most polluted cities o though the pollutic have fallen since it tion of CNG.

The worrying f that while sulphur and nitrogen levels er than in many cities, the total su particulate (TSP) i still remains high. compare Delhi wit Asian cities whic

Air Pollution in Asian Cities programme, was released in the Capital on Wednesday. Abut 34,000 people were examined during the study. "The main objective of the programme is to study the impact of pollution on health of citizens in these cities," he said.

Scientists from TERI

THE HINDU

Date:22/05/2004 URL:
http://www.thehindu.com/2004/05/22/stories/2004052209660400.htm

New Delhi

Report to help tackle air pollution

By Our Staff Reporter

NEW DELHI, MAY 21. The Boston-based Health Effects Institute has in its report on "Health Effects of Outdoor Air Pollution in Developing Countries of Asia: A Literature Review" noted that given the high levels of air pollution in many Asian cities -- exceeding 100 microgramme/cum -- the public health impact could be substantial as even an increase of just 10 mg/cum increases mortality by 0.5 per cent.

Capacity Building Network At Its Best:

First Wave PAPA scientist providing Asia – to - Asia technical assistance in Vietnam

NEW: MEP funds major expansion of PAPA studies across China by PAPA's Shanghai team

Summary

- Air Pollution in Asia significant local health impacts
- China has made some progress (lead, vehicle standards low sulfur fuels, some point source controls
- Escalating energy demand, vehicle increases underscore need for further reductions of “traditional” pollutants and GHG
- Reliance on Western studies, calls for GHG reduction alone can have limited success
- Representative studies using capacity building models and “marshalling the existing science” can:
  - Foster Sino-US co-operation
  - Document effects in local Asian populations
  - Increase Asian confidence in relevance of extensive Western science
  - Motivate reductions in Asia, providing benefits at the local regional and global level

Health Impacts of Regulatory Interventions

Health Effects of Reduction Measures Taken During Beijing Olympics

HEI "Accountability" Study

Professor Jim Zhang

Associate Dean for Global Health

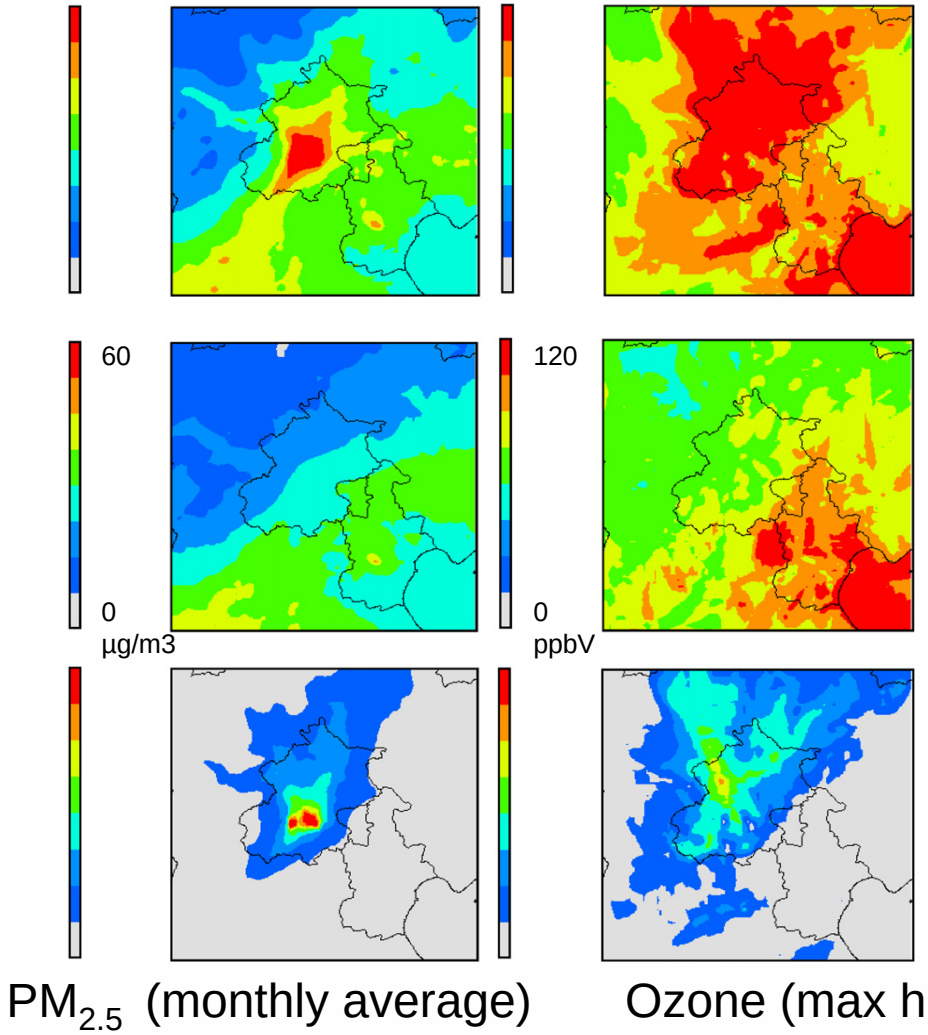
Rutgers University

Beijing Air Pollution: The baseline

Air Quality in Beijing – A Regional Problem

David Streets et al, Atmospheric Environment 41 (2007) 480-492

CMAQ model simulations of $PM_{2.5}$ and ozone concentrations for Beijing, July 2001



All sources

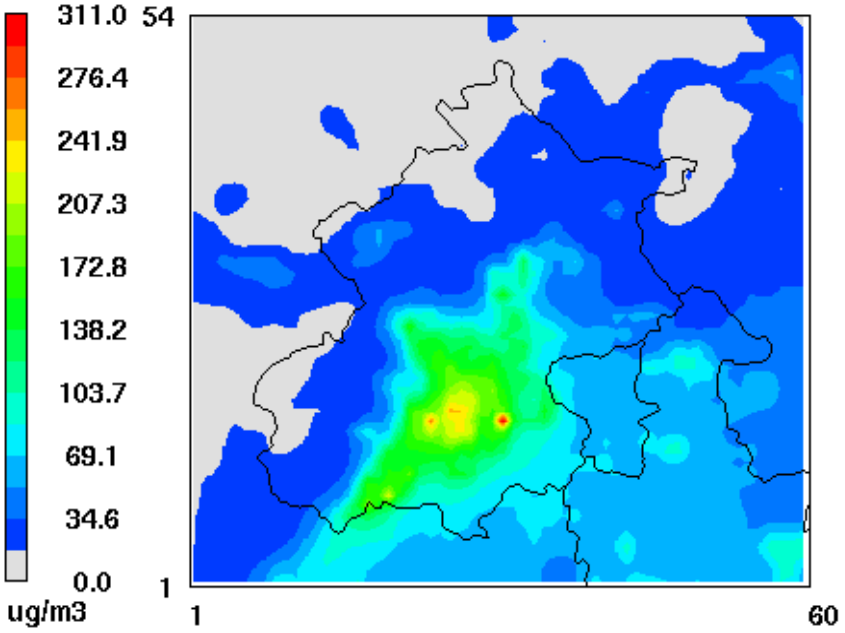
Sources outside Beijing

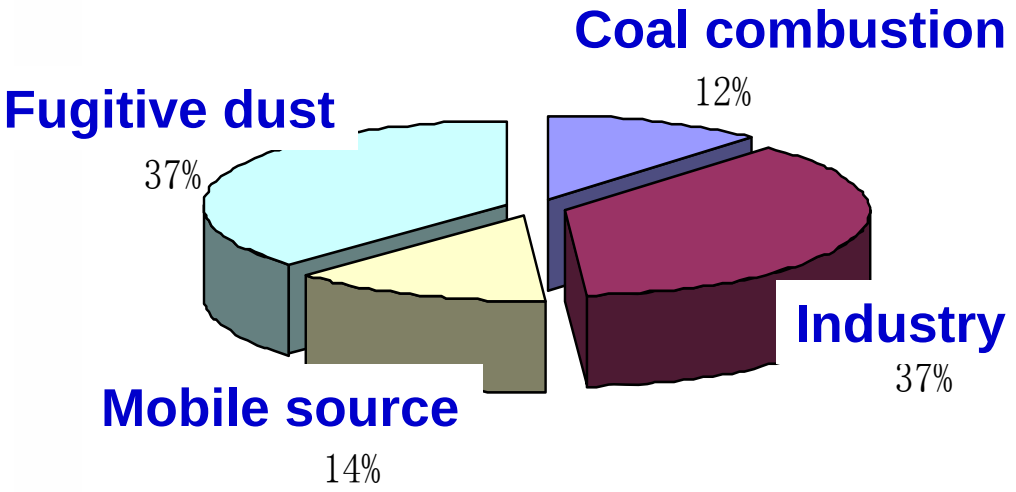
Beijing sources alone

$PM_{2.5}$ (monthly average)

Ozone (max hourly)

Contribution of different local sources: PM_{10}





PM_{10} Conc. in August

Contribution from different sources

Industrial process and fugitive dust contribute 74%

Measures to Improve Air Quality in Beijing

J. Hao Tsinghua

Since 1998, air pollution control has been carried out in 14 stages, with more than 200 concrete steps

- Increased use of natural gas in stationary sources
- Regional Coal-fired power plants install FGD and SCR
- Implementation of emission standard level IV on new vehicles
- More than 90 percent of buses meet level III emission standards
- Relocation of heavily polluting industries: Beijing Coking plant

Urban Air Quality in Beijing – Improving

J Hao Tsinghua

	SO_2	NO_2	CO	PM10	NAAQS II days
2001	0.064	0.071	2.6	0.165	185
2002	0.067	0.076	2.5	0.166	203
2003	0.061	0.072	2.4	0.141	224
2004	0.055	0.071	2.2	0.149	229
2005	0.05	0.066	2.0	0.142	234
2006	0.053	0.066	2.1	0.161	241
2007	0.047	0.066	2.0	0.148	246
Changes	-26.56%	-7.04%	-23.08%	-10.30%	32.97%