

EVIDENCE FOR EFFECTIVE POLICY MAKING TO REDUCE IMPACTS OF AIR POLLUTION.

MICHAL KRZYZANOWSKI, ScD, PhD

Visiting Professor, Kings College London



Formerly: Head of WHO European Centre for Environment and Health, Bonn, Germany

Key questions determining clean air policy:

- Why are we concerned with air pollution?
- What are the recommended AQ levels (air quality guidelines and standards)?
- Where the pollution comes from?

Air pollution – globally recognized health risk



Air pollution

Air pollution

▼ Ambient air pollution

Health impacts

Pollutants

Interventions and tools

Policy and progress

Outreach and advocacy

▶ Household air pollution

Maps & databases

Guidelines

Publications

News and events

Ambient air pollution - a major threat to health and climate



Photography by Jean-Etienne Minh-Duy Poirrie - Smog over New Delhi

Ambient air pollution accounts for an estimated 4.2 million deaths per year due to stroke, heart disease, lung cancer and chronic respiratory diseases. Around 91% of the world's population lives in places where air quality levels exceed WHO limits. While ambient air pollution affects developed and developing countries alike, low- and middle-income countries experience the highest burden, with the greatest toll in the WHO Western Pacific and South-East Asia regions.

Policies and investments supporting cleaner transport, energy-efficient housing, power generation, industry and better municipal waste management can effectively reduce key sources of ambient air pollution.

[Learn more here](#)

4.2 million

deaths worldwide every year are attributed to ambient air pollution

[Ambient air pollution health risks](#)

91%

of the world's population live in places exceeding WHO air quality guidelines

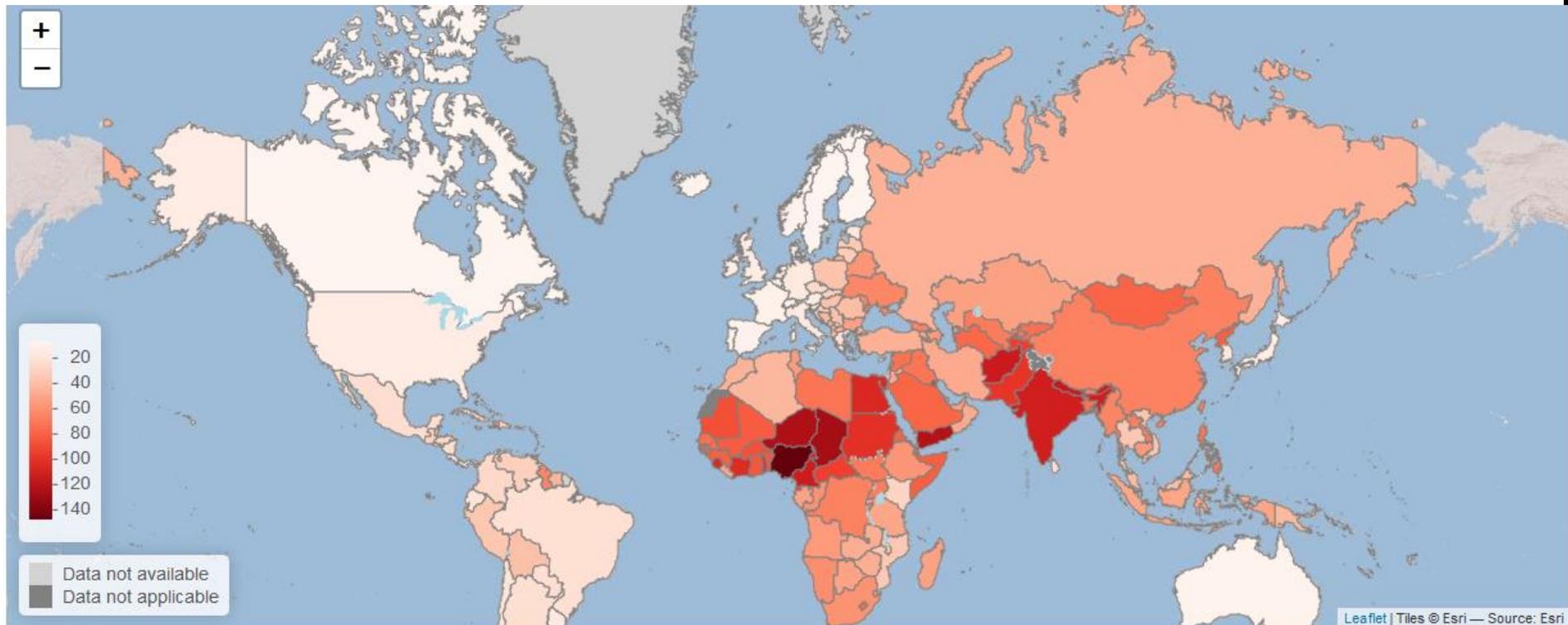
[WHO country estimates on air pollution exposure](#)

Fact sheets

[Ambient \(outdoor\) air quality and health Fact sheet](#)

[Household air pollution and health Fact sheet](#)

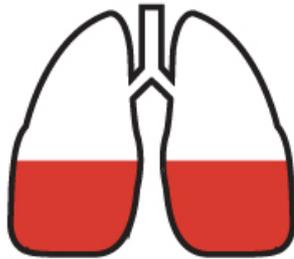
Number of deaths per 100 000 capita (age standardized), attributable to air pollution, for the year 2016



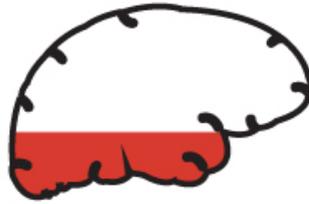
© World Health Organization 2018. All rights reserved. The designations employed and the presentation of the material in this publication do not imply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted and dashed lines on maps represent approximate borderlines for which there may not yet be full agreement.

THE **INVISIBLE KILLER**

Air pollution may not always be visible, but it can be deadly.



29%
OF DEATHS FROM
LUNG CANCER



24%
OF DEATHS FROM
STROKE



25%
OF DEATHS FROM
HEART DISEASE

BREATHELIFE.

Clean Air. Healthy Future.



World Health
Organization



CLIMATE &
CLEAN AIR
COALITION
TO REDUCE SHORT-LIVED
CLIMATE POLLUTANTS

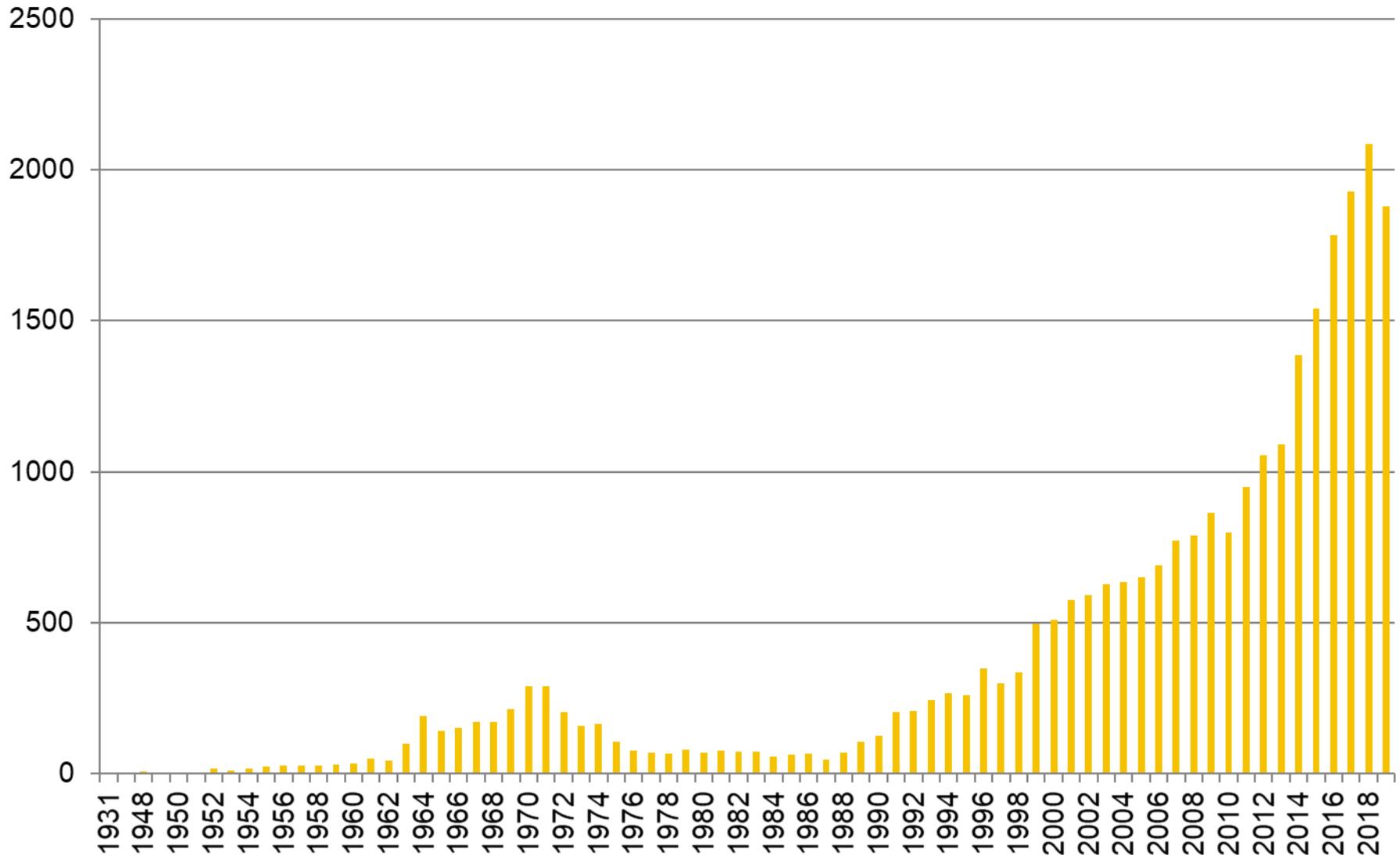
Effects of air pollution on morbidity and other health outcomes

- Pre-natal exposure to air pollution associated with lower birth weight, slower development of respiratory functions and more frequent respiratory diseases in childhood;
- More respiratory and cardiovascular admissions (including MI) to hospitals in days with higher PM, NO₂ and ozone concentrations;
- Higher incidence of diabetes and of asthma symptoms in asthmatics related to the long term exposure;

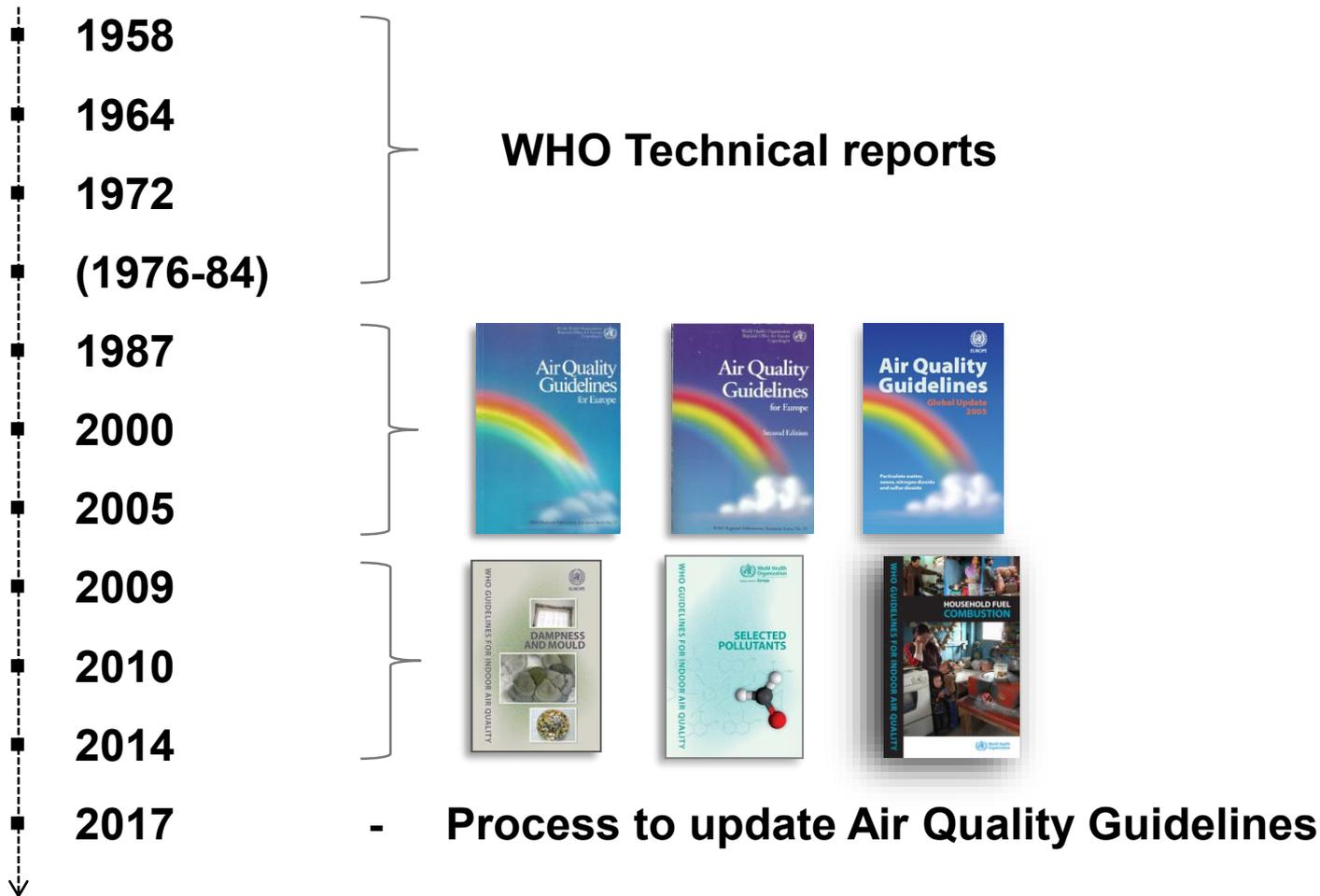
New findings:

- Slower cognitive development in children exposed to traffic-related air pollution;
- Faster deterioration of cognitive functions with age and increased incidence of dementia in adults with higher exposure levels.

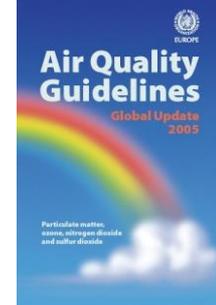
Number of research papers/year with key words „Air pollution” and health in the PubMed, 7 Oct 2019



WHO assessments of air pollution health risks – the milestones



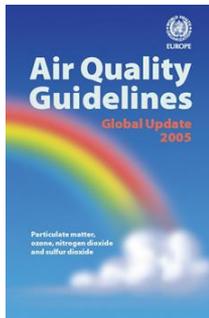
WHO AQG: GLOBAL UPDATE 2005: SUMMARY OF AQG VALUES



Pollutant	Averaging time	AQG value
Particulate matter PM_{2.5}	1 year	10 µg/m ³
	24 hour (99 th percentile)	25 µg/m ³
PM₁₀	1 year	20 µg/m ³
	24 hour (99 th percentile)	50 µg/m ³
Ozone, O₃	8 hour, daily maximum	100 µg/m ³
Nitrogen dioxide, NO₂	1 year	40 µg/m ³
	1 hour	200 µg/m ³
Sulfur dioxide, SO₂	24 hour	20 µg/m ³
	10 minute	500 µg/m ³

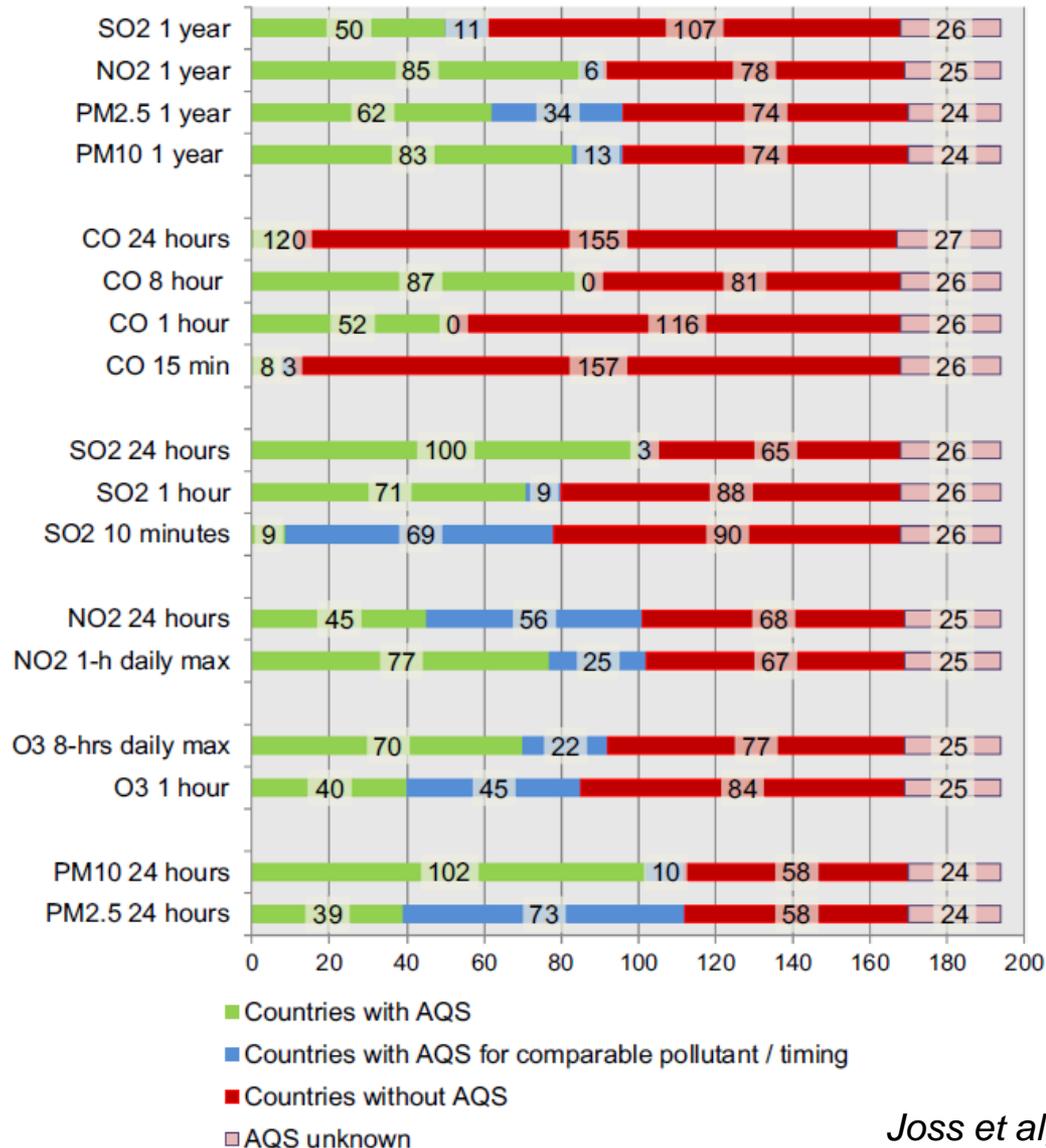
AQG levels recommended to be achieved everywhere in order to significantly reduce the adverse health effects of pollution

WHO Air Quality Guidelines, Global update 2005: particulate matter

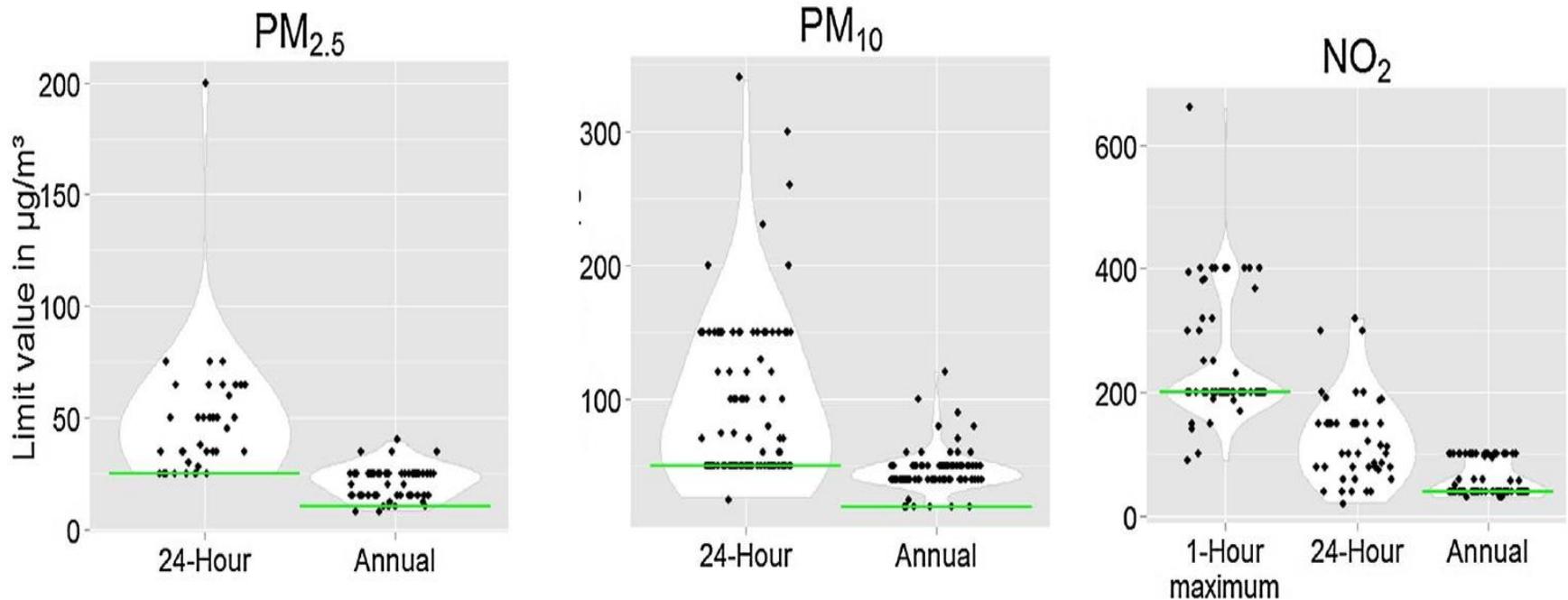


Annual mean level	PM ₁₀ (µg/m ³)	PM _{2.5} (µg/m ³)	Basis for the selected level
Interim target-1 (IT-1)	70	35	Levels associated with about 15% higher long-term mortality than at AQG
Interim target-2 (IT-2)	50	25	Risk of premature mortality decreased by approximately 6% compared to IT1
Interim target-3 (IT-3)	30	15	Mortality risk reduced by approximately 6% compared to IT2 levels.
Air quality guideline (AQG)	20	10	Lowest levels at which total, CP and LCA mortality have been shown to increase (Pope et al., 2002). The use of PM _{2.5} guideline is preferred.

Availability of AQ standards across the world

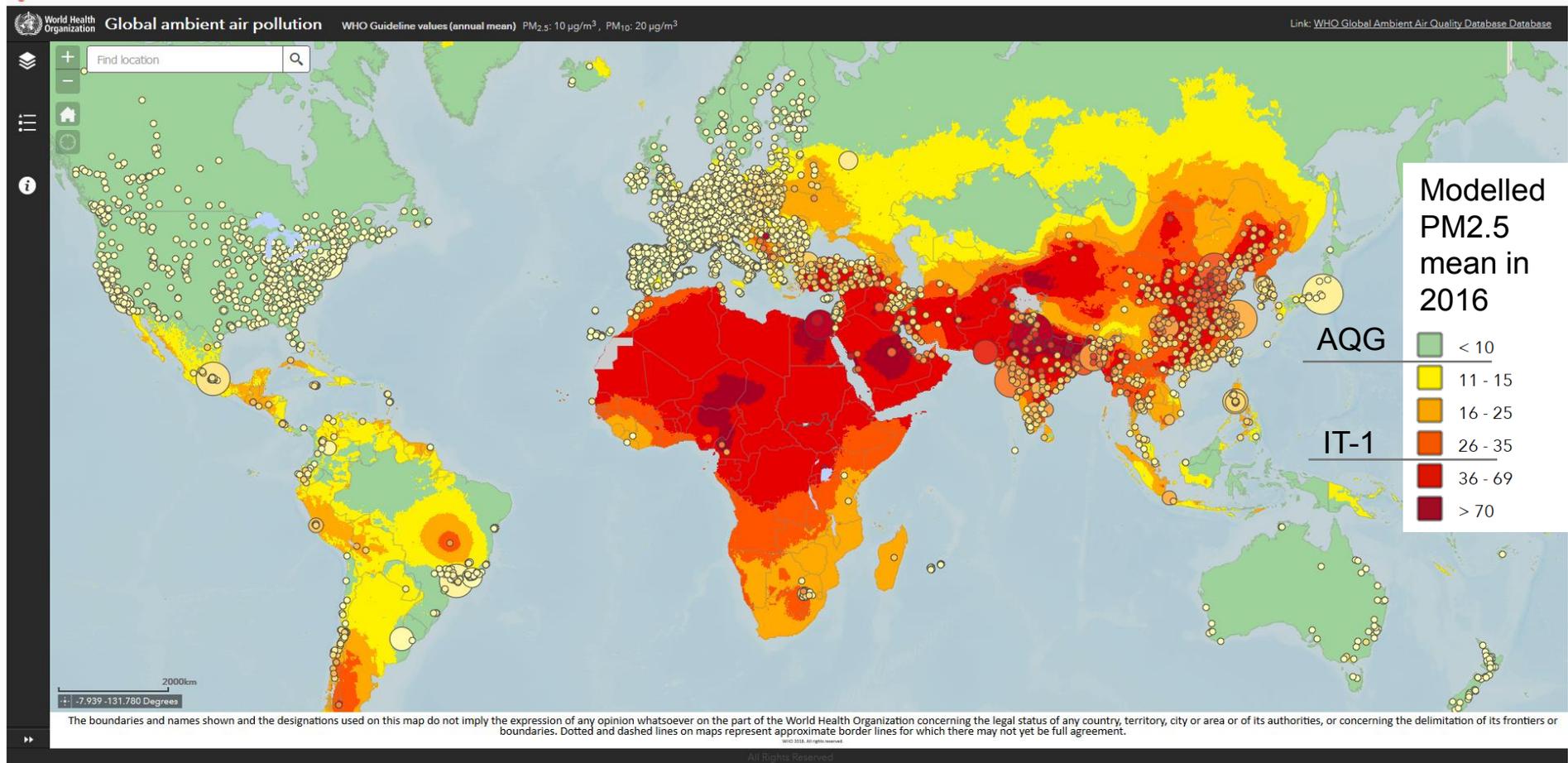


National standards for PM_{2.5}, PM₁₀ and NO₂ vs. WHO AQG

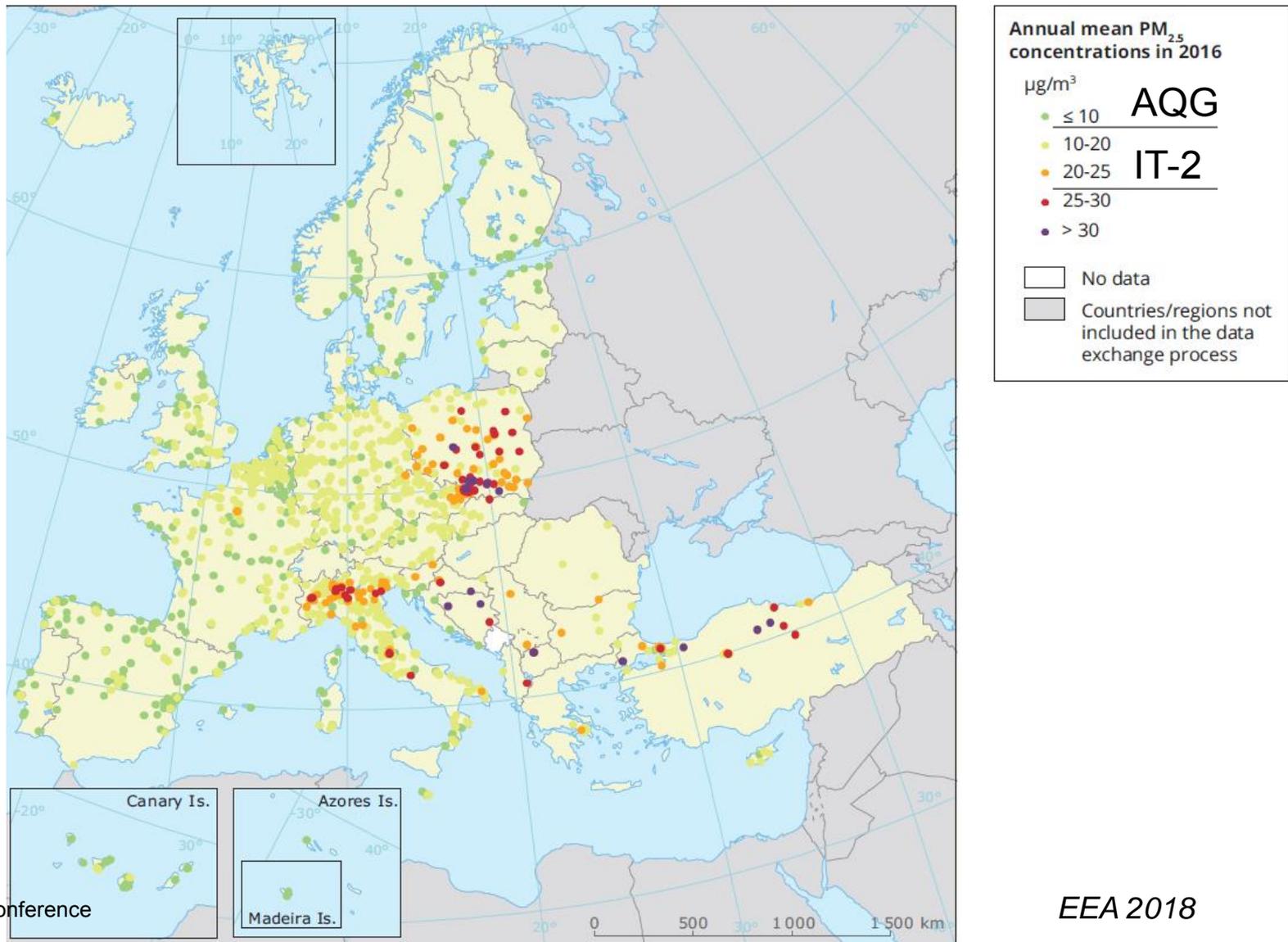


———— WHO AQG

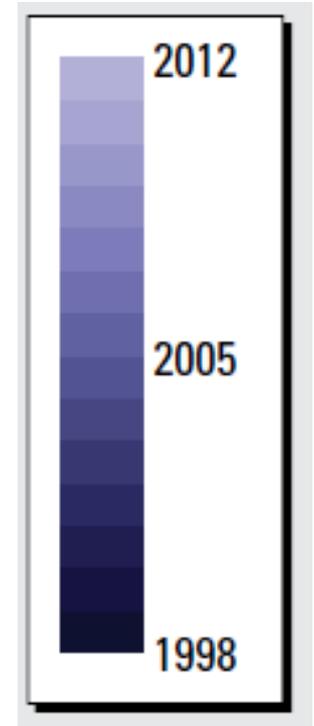
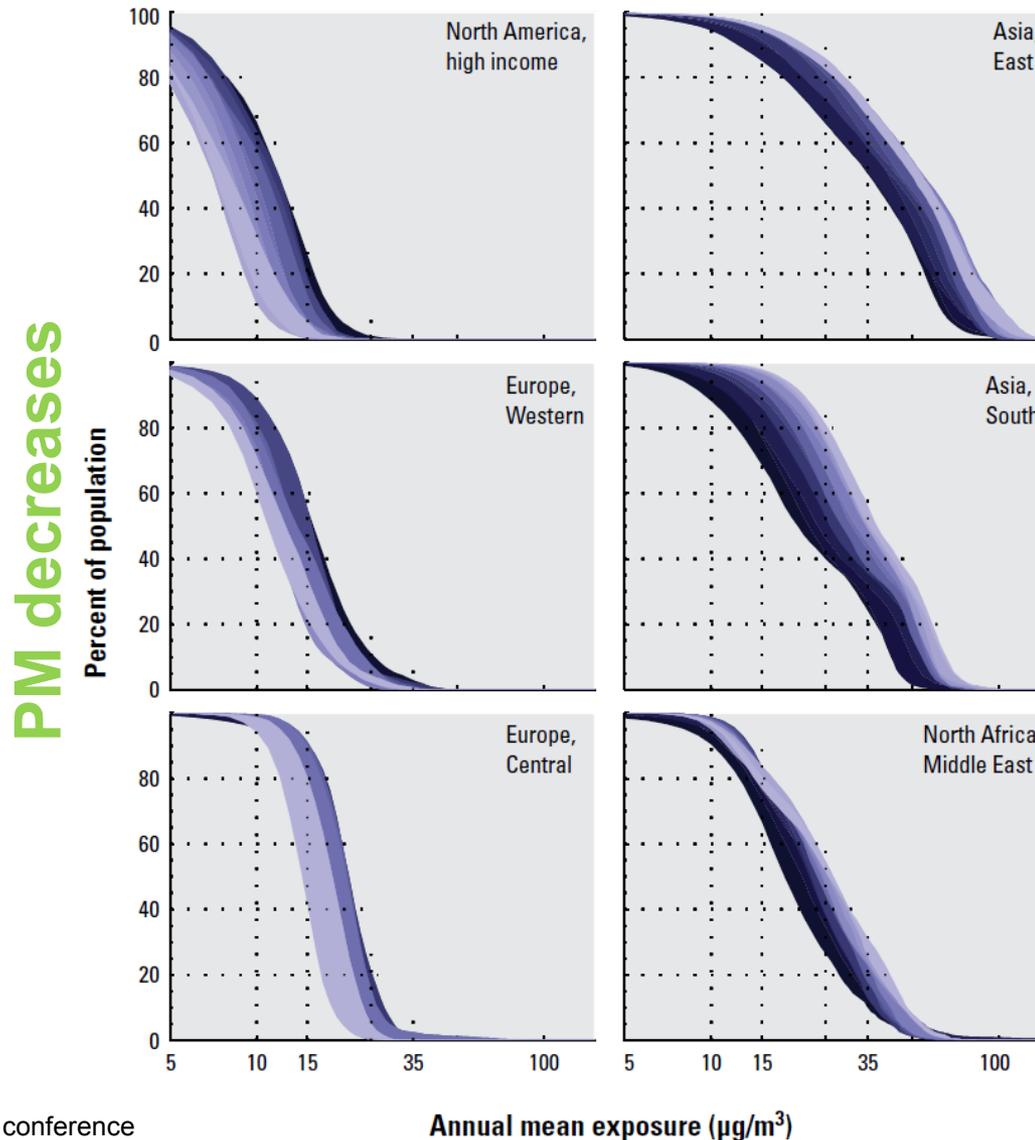
Global estimates of annual mean PM2.5, 2018 update



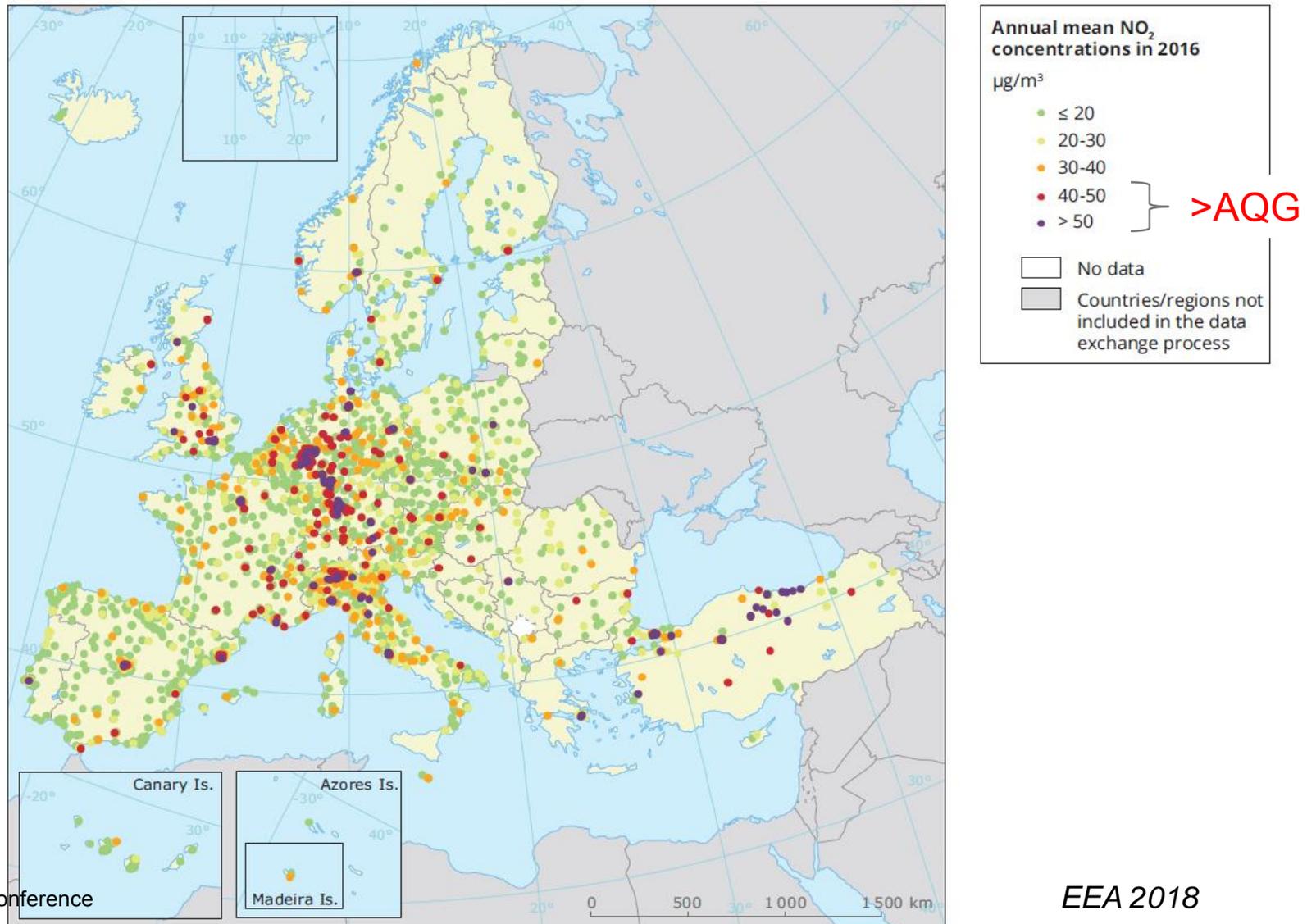
Observed concentrations of PM_{2.5} in 2016



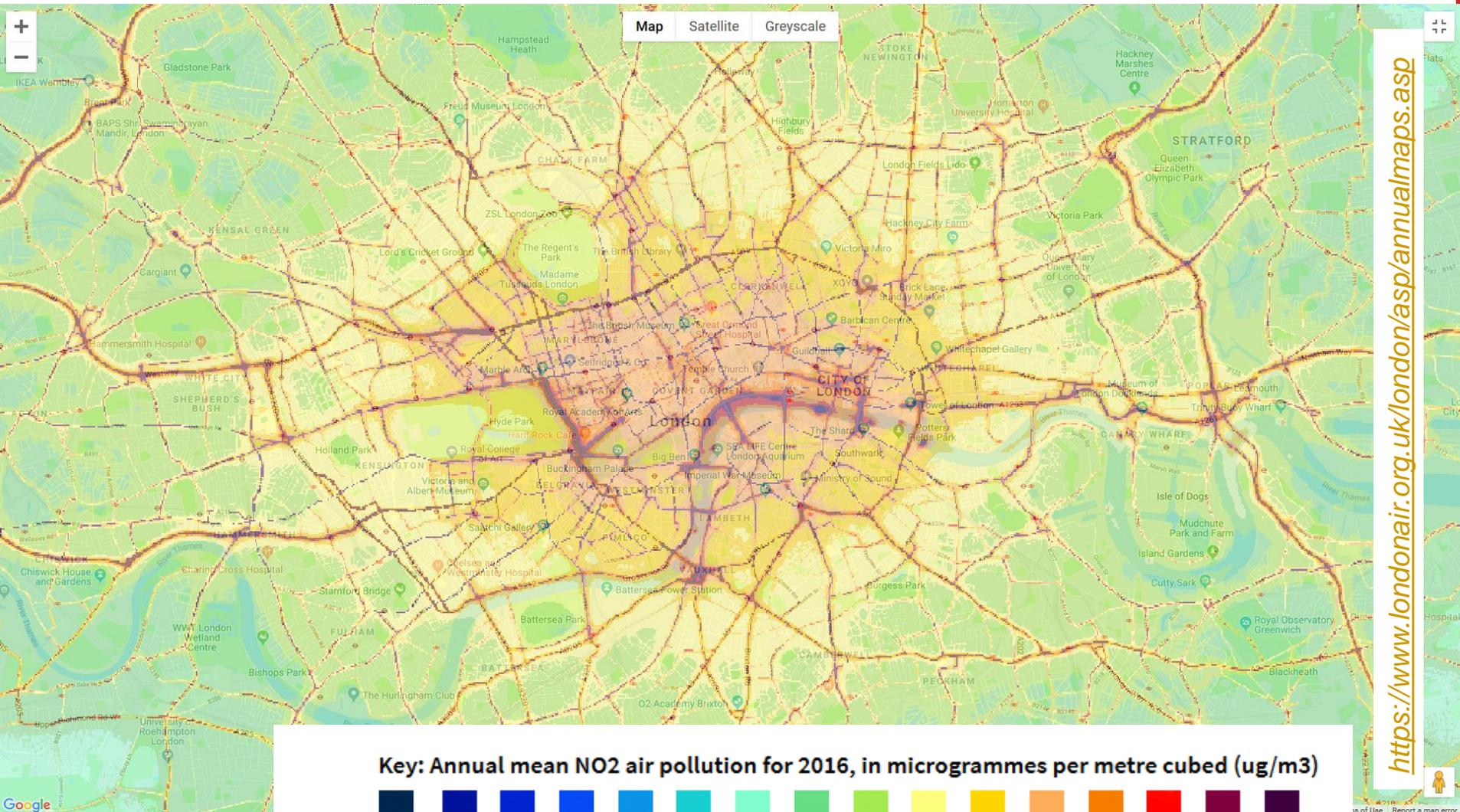
Cumulative distribution of regional annual PM2.5 for 1998 - 2012



Annual mean NO₂ concentrations in 2016

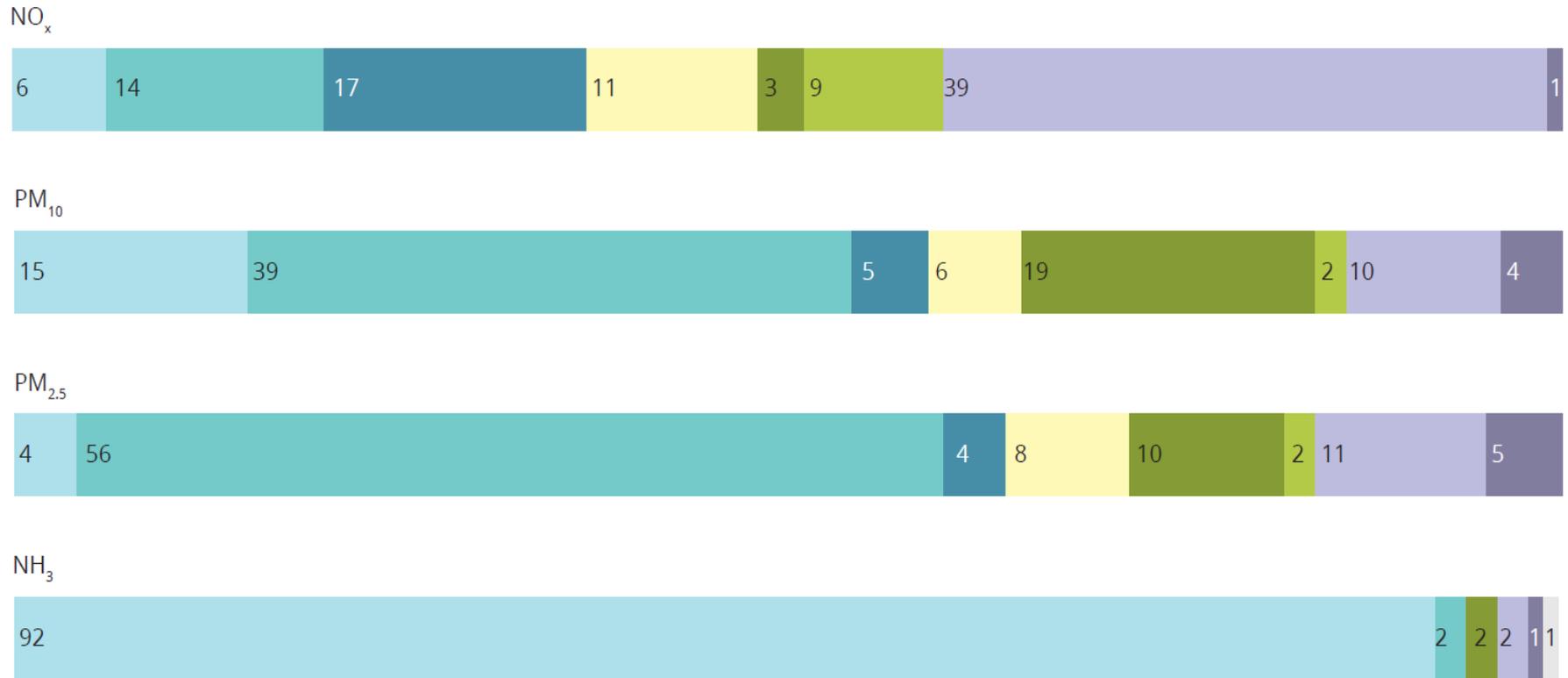


Modelled annual mean NO2 in London, based on measurements in 2016



<https://www.londonair.org.uk/london/asp/annualmaps.asp>

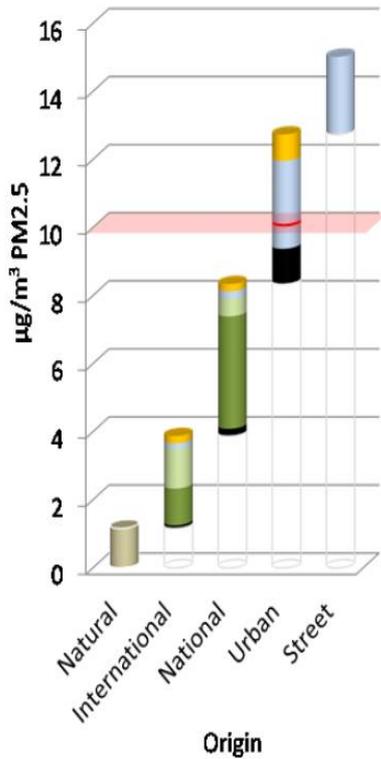
Contribution to EU-28 emissions from main source sectors in 2016



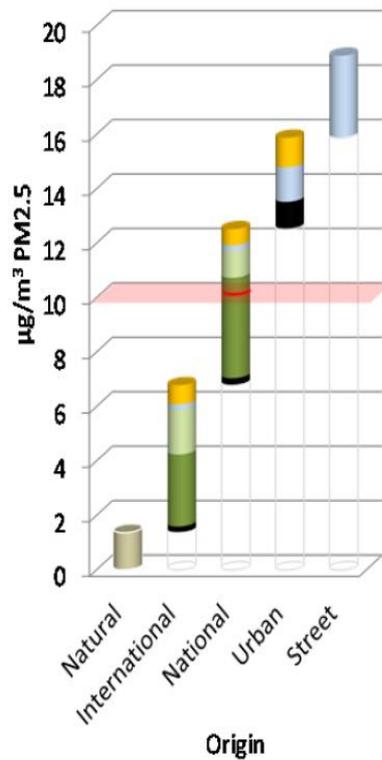
■ Agriculture
 ■ Commercial, institutional and households
 ■ Energy production and distribution
 ■ Energy use in industry
 ■ Industrial processes and product use
 ■ Non-road transport
 ■ Road transport
 ■ Waste
 ■ Other

Source contributions to ambient PM_{2.5} at urban traffic stations in 3 countries, 2009

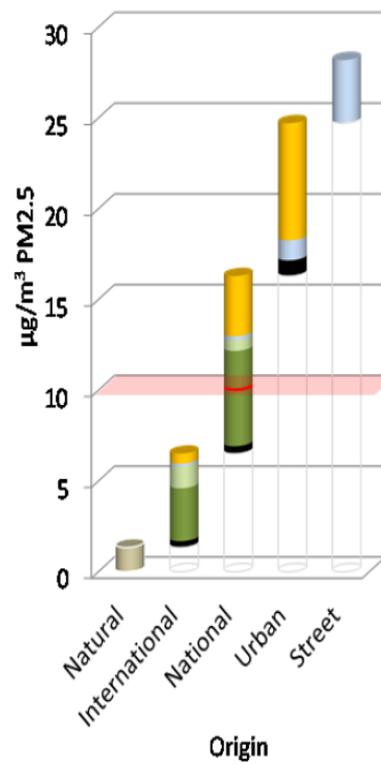
U.K.



Germany



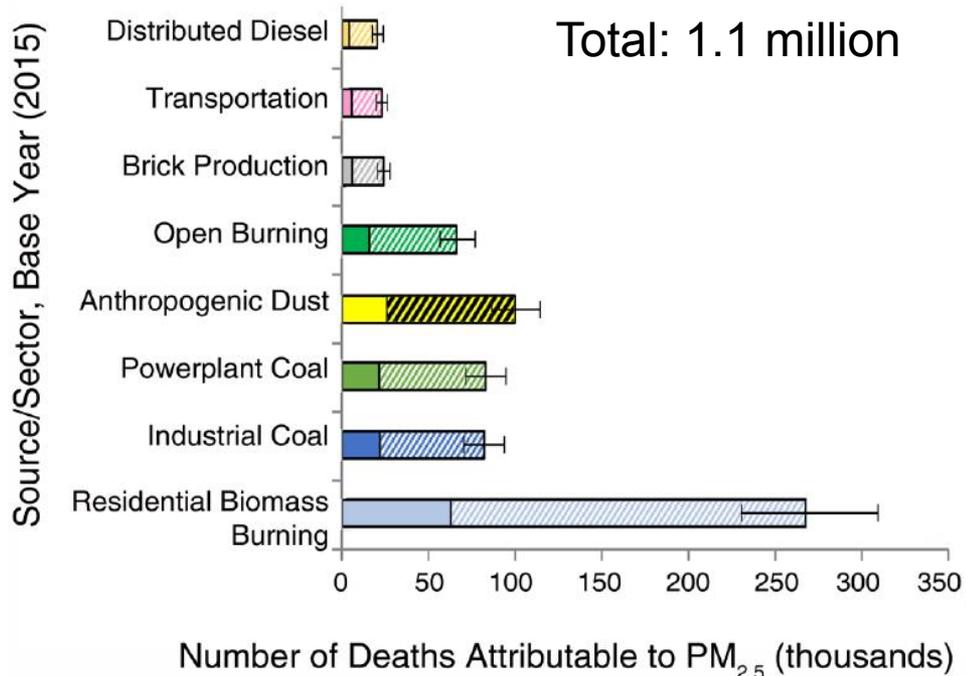
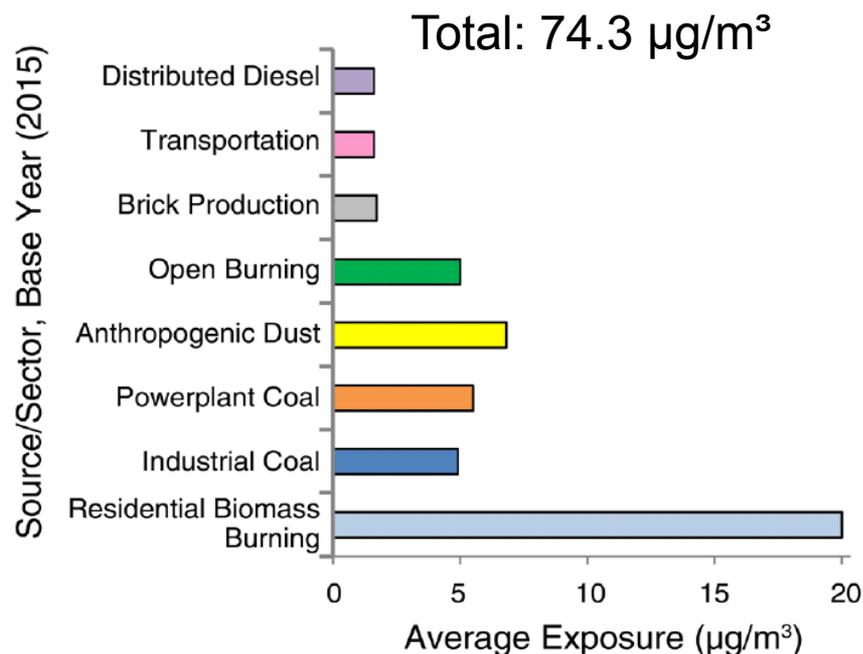
Poland



- Households
- Primary PM: Traffic
- Sec. PM: Traffic + agri.
- Sec. PM: Industry + agri.
- Primary PM: Industry
- Natural

Source contributions to PM_{2.5} population exposure and its health effects in India, 2015

Results of GDB MAPS project, 2018



Urban Rural

Conclusions

- **Evidence on health risks** of air pollution is well established and has increased substantially in recent decades;
- **WHO Air Quality Guidelines** give health-based objectives for clean air policy making;
- **National, legally binding, AQ standards** are still missing in many countries;
- **Air quality monitoring and modelling** are essential for assessment of air quality as well as its spatial and temporal patterns;
- Linking population exposure to (type and location of) **pollution sources** sets priorities in pollution abatement;
- **Health impact assessment** helps to measure the seriousness of the problem and gain political support to the actions cleaning the air.

Thank you