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Emission inventories in Europe

Supporting policy implementation

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The European Environment Agency (EEA)

The EEA is:

- An independent European Union agency
- Analysing, assessing and providing information
- An interface between science and policy
- Dependent upon strong country networks to carry out our work: 33 member countries

The EEA is not:

- An environmental regulator checking compliance with environmental laws
- Developing or proposing new legislation
- A research or funding body



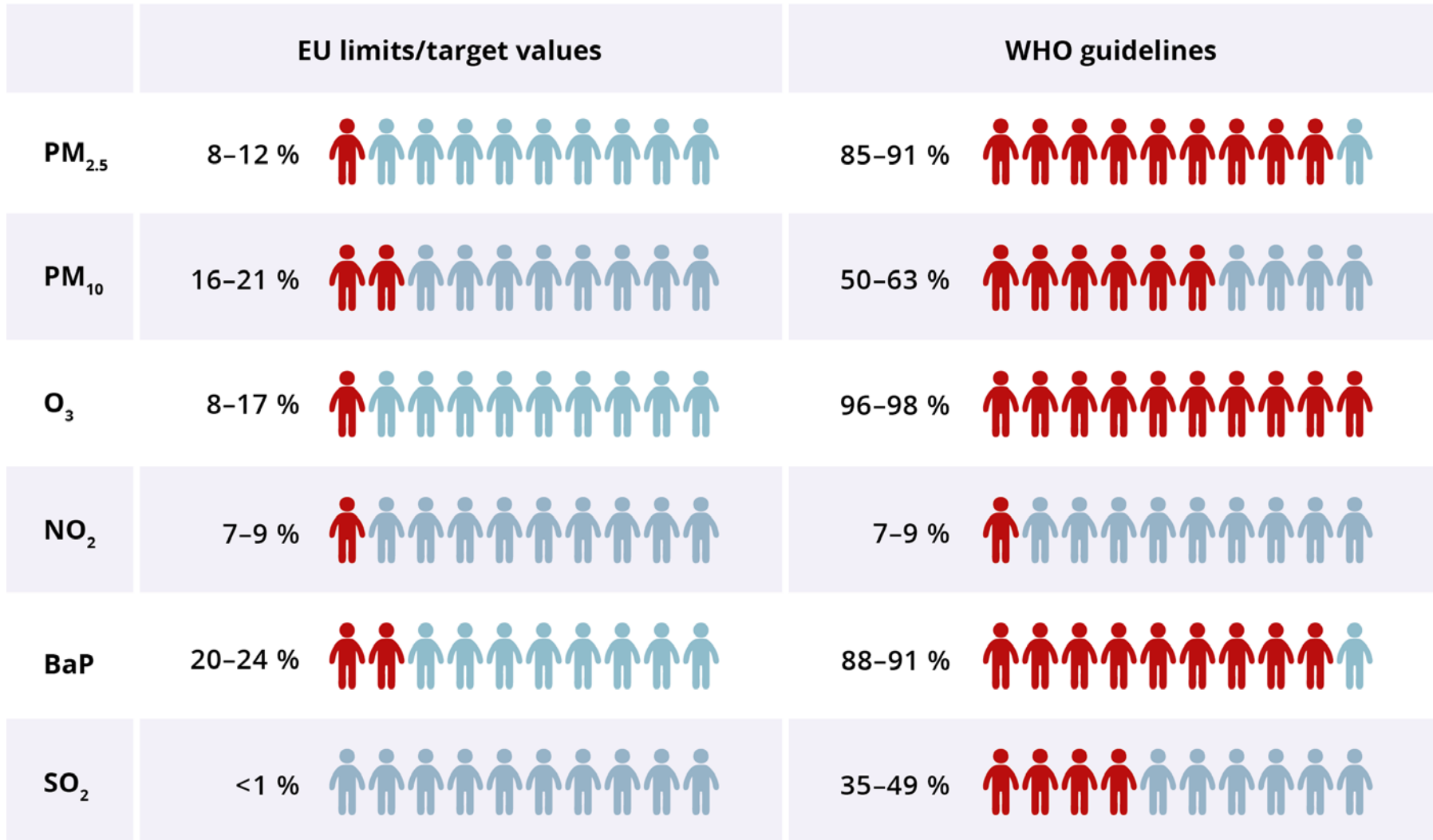


1. Introduction – summary of Europe’s air quality
2. National emission inventory reporting obligations in Europe
3. Using inventories to assess compliance with emission reduction commitments
4. Ensuring emission inventory quality
5. Improving the scientific knowledge base
– on-going needs



Many Europeans are still exposed to harmful levels of air pollution

EU urban population exposed to harmful levels of air pollutant concentrations in 2012–2014, according to:



Comparison of selected air quality standards ($\mu\text{g}/\text{m}^3$)

Pollutant	Period	EU	WHO	U.S.
PM _{2.5}	annual	25	10	12 ^a
PM ₁₀	daily	50 (35)	50 (99P)	150 (1) ^b
	annual	40 (0)	20 (0)	-
O ₃	max. daily 8-hr average	120 (25) ^a	100 (0)	140 (3) ^a
NO ₂	annual	40 (0)	40 (0)	100 (0)
SO ₂	daily	125 (3)	20 (0)	-
BaP	annual	1 (0)	0.12 (0) ^c	-

Numbers in brackets indicate the permissible number of exceedances

a. Averaged over three years

b. Not to be exceeded more than once per year on average over 3 years

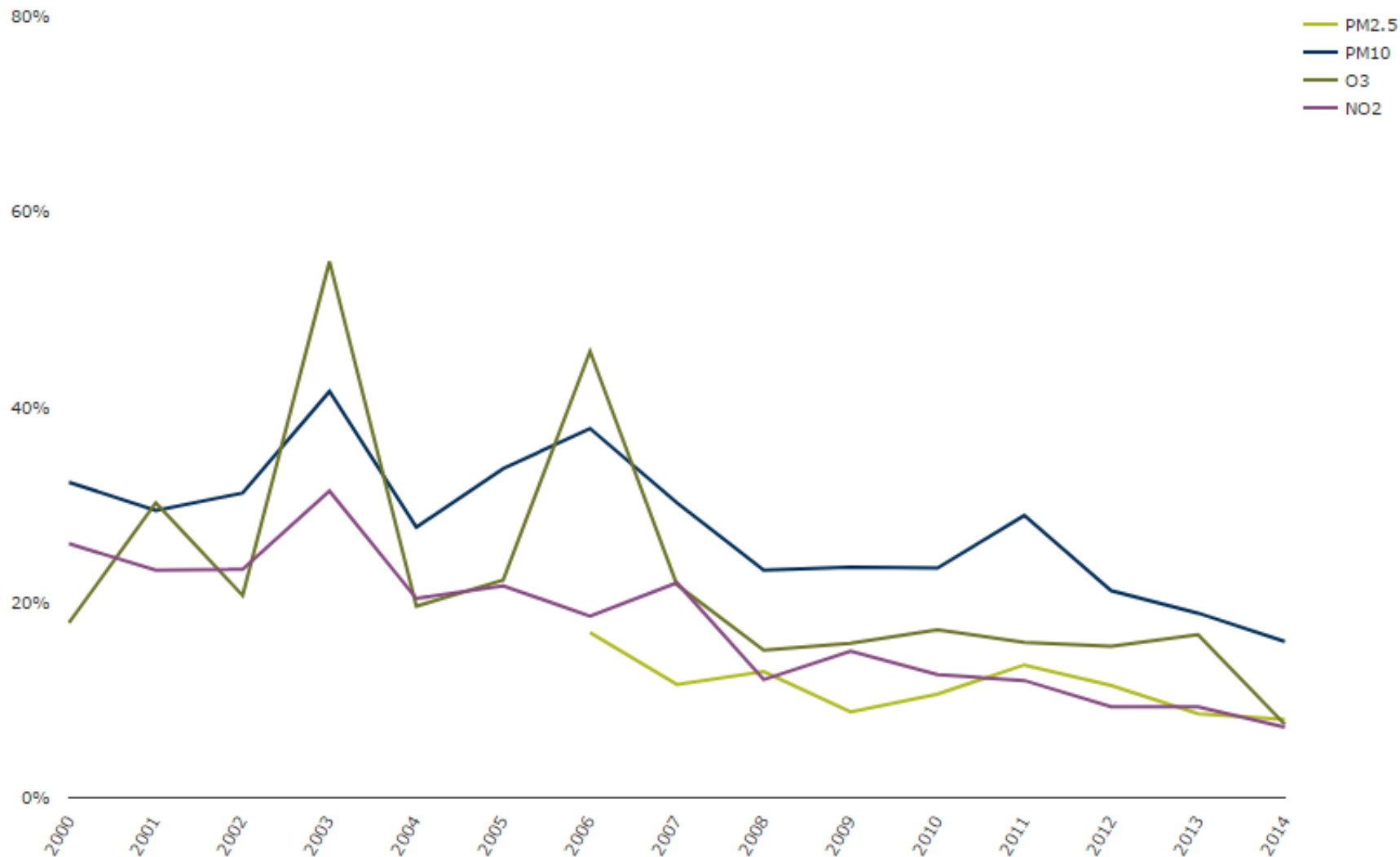
c. WHO estimated reference level

99P: 99th percentile

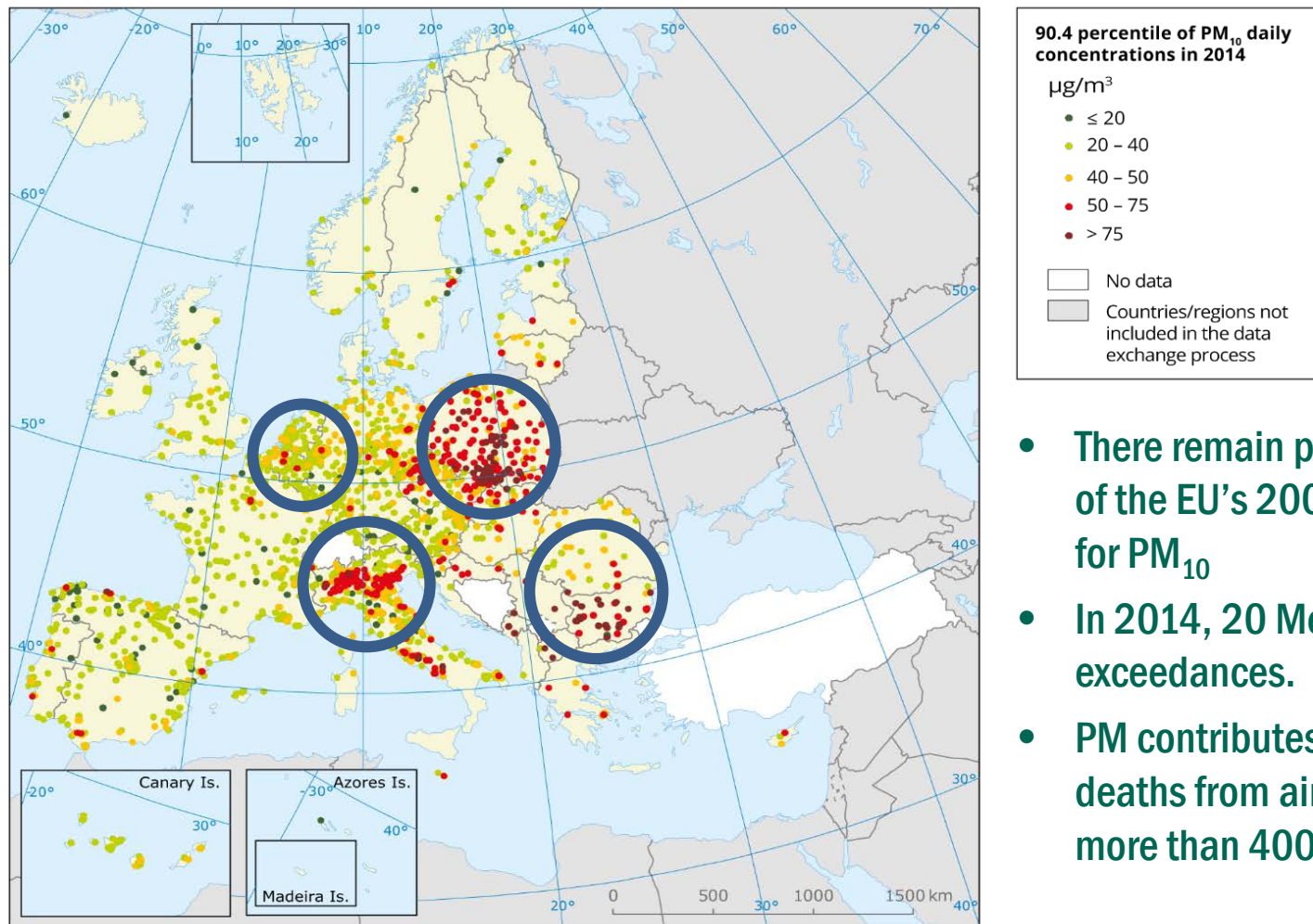


Urban population exposed to air pollutant concentrations above EU limit and target values

Chart – Urban population exposed to air pollutant concentrations above selected limit and target values



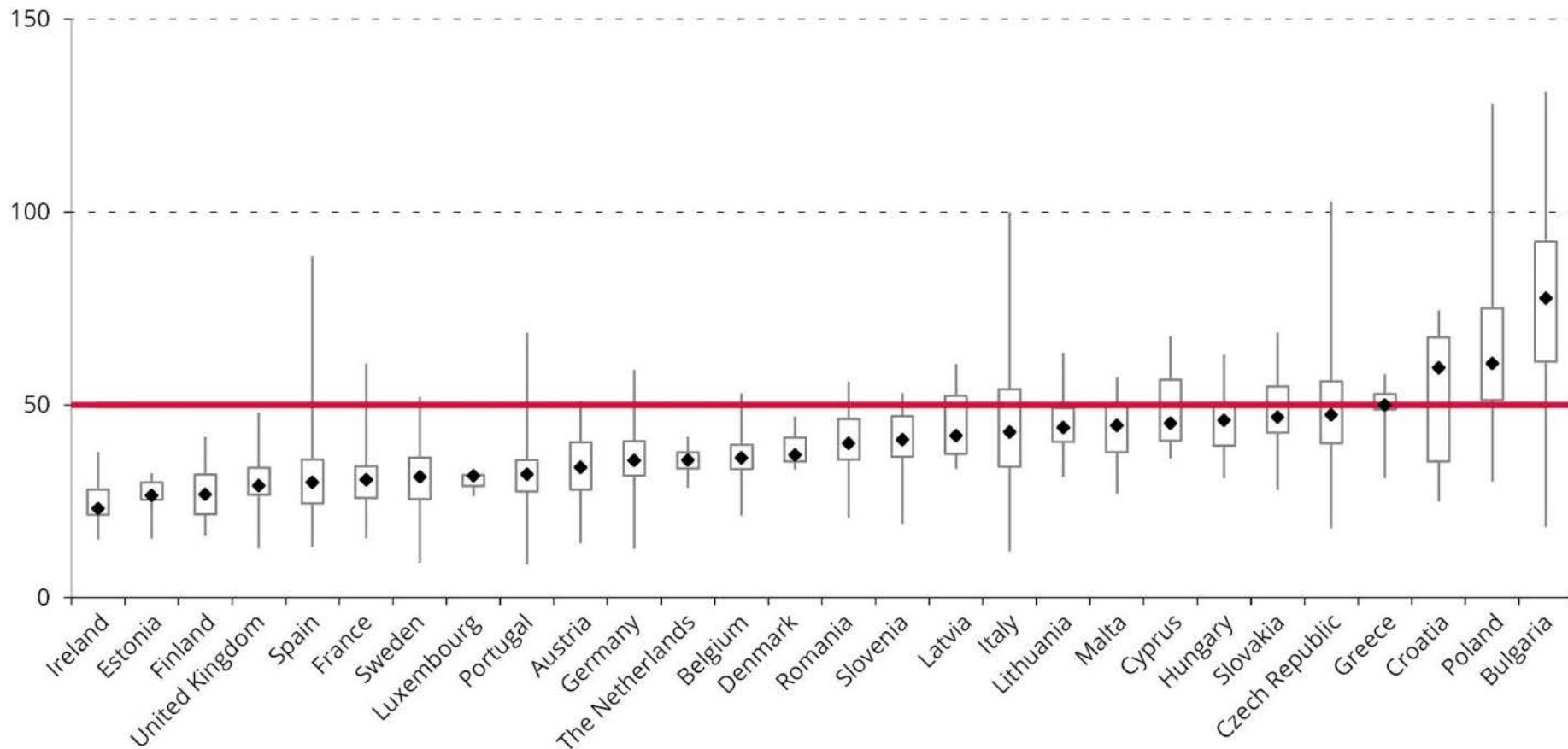
Particulate matter (PM₁₀) concentrations systematically exceed EU standards across large parts of Europe



- There remain persistent exceedances of the EU's 2005 air quality standard for PM₁₀
- In 2014, 20 Member States reported exceedances.
- PM contributes most to premature deaths from air pollution in the EU – more than 400 000 each year.

Air quality status – particulate matter PM₁₀, EU Member States (2014)

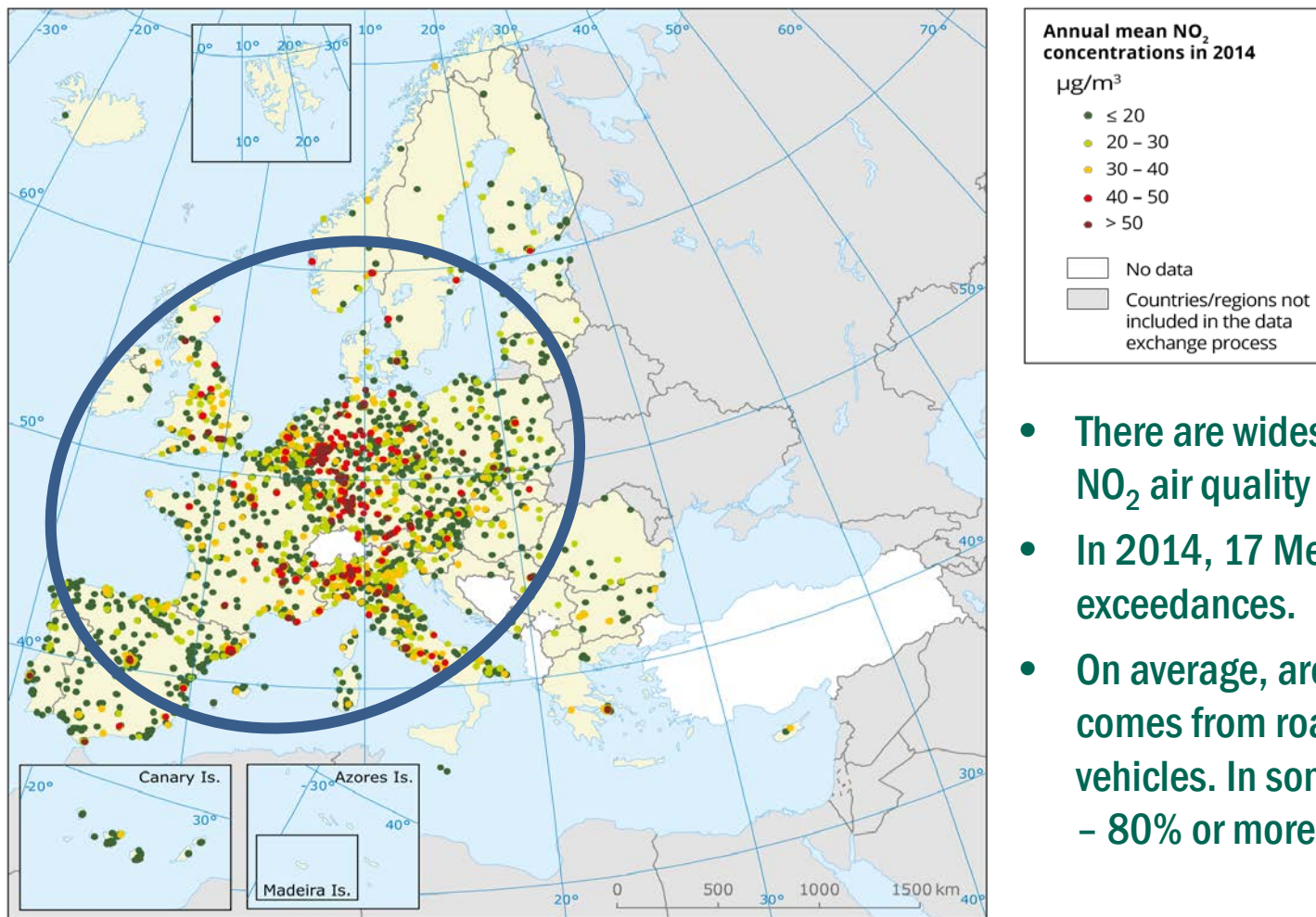
Concentration (ug / m³)



Attainment of PM₁₀ daily limit value (EU-28)

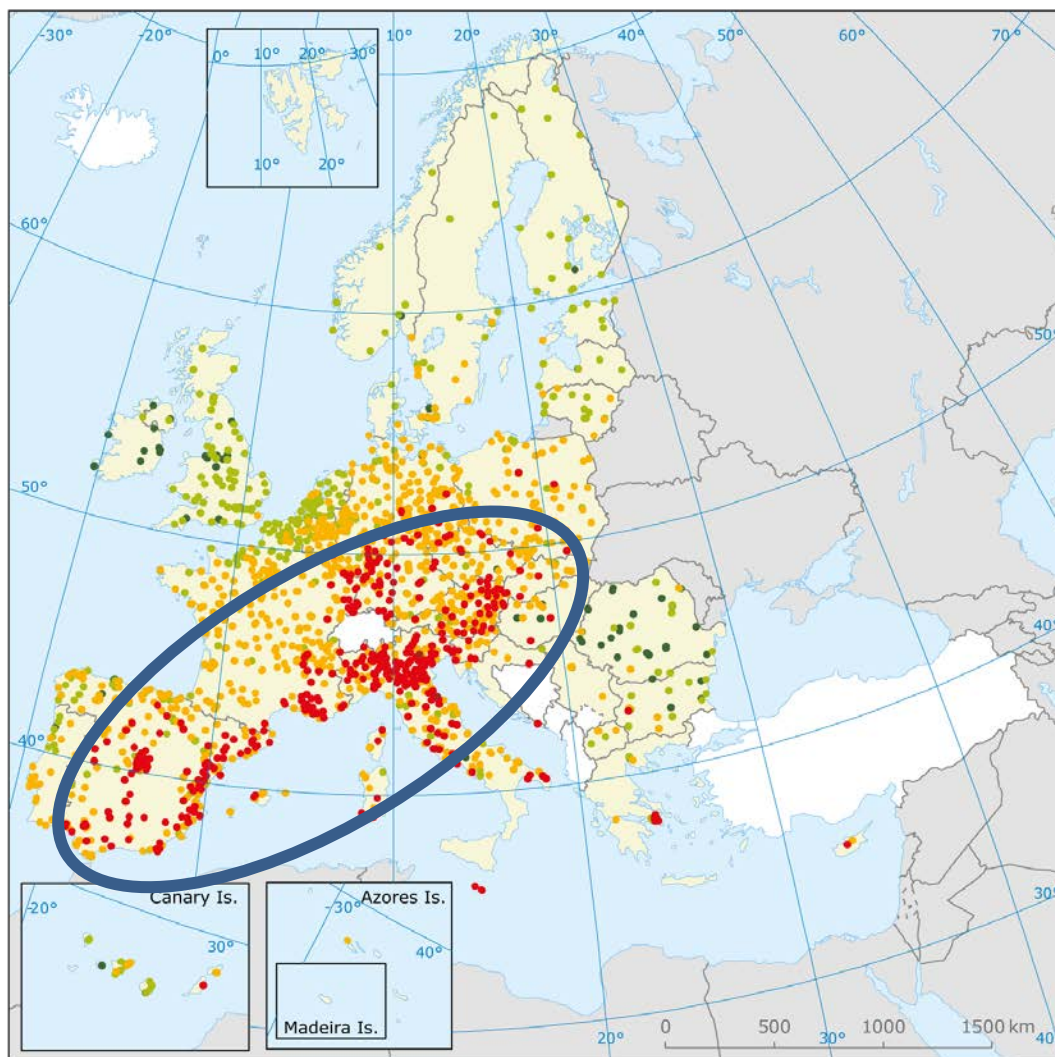
EEA Air Quality in Europe – 2016 report

Nitrogen dioxide (NO₂) harms the respiratory and cardiovascular systems



- There are widespread exceedances of the EU NO₂ air quality standard.
- In 2014, 17 Member States reported exceedances.
- On average, around 60% of NO₂ in cities comes from road traffic, especially diesel vehicles. In some countries it is much higher – 80% or more.

High ozone (O₃) concentrations harm both health and ecosystems (including crops)



93.2 percentile of O₃ maximum daily 8-hours mean in 2014

µg/m³

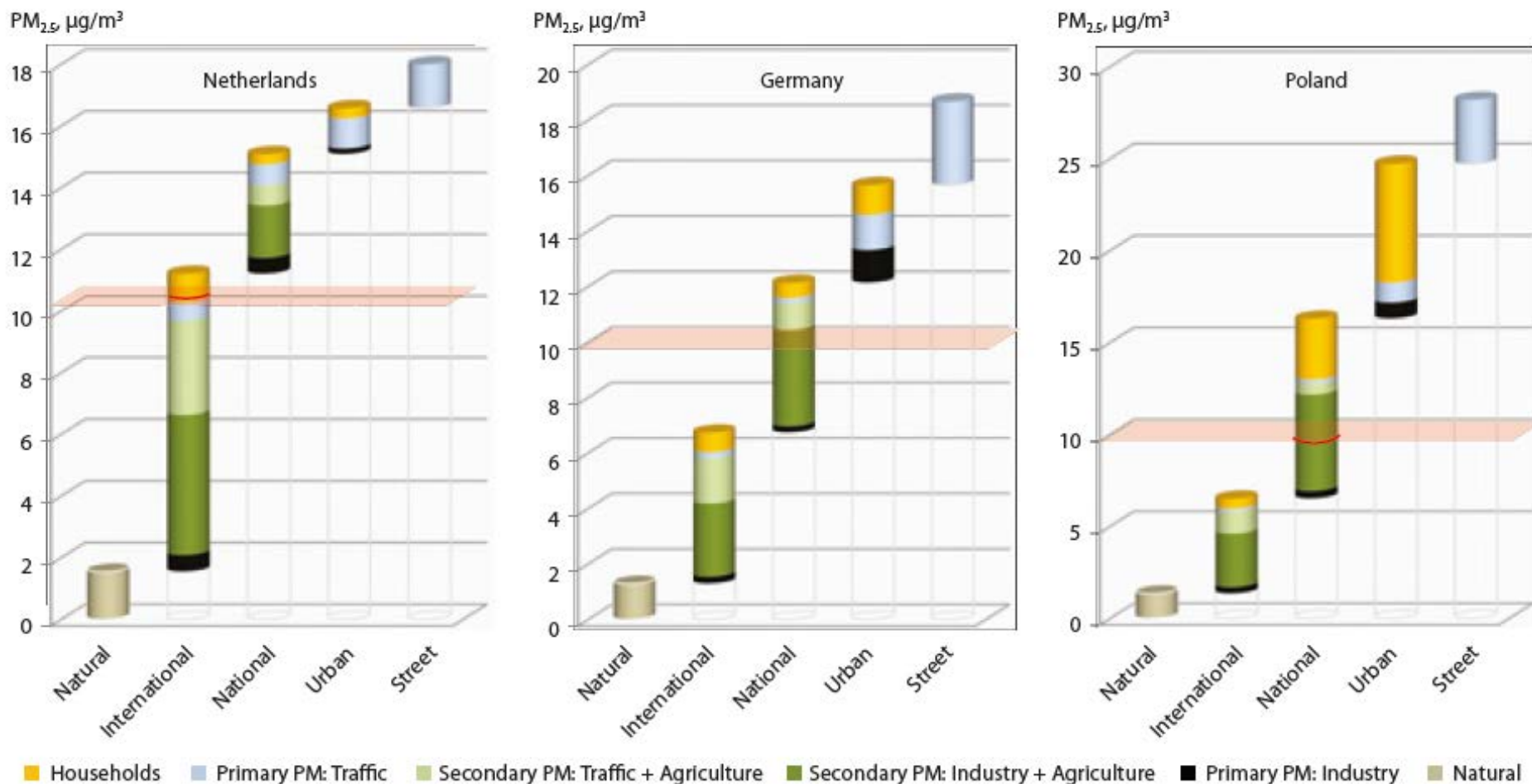
- ≤ 80
- 80 - 100
- 100 - 120
- 120 - 140
- > 140

- No data
- Countries/regions not included in the data exchange process

- High levels of ground-level O₃ typically occur across southern Europe in summer periods.

The importance of regional and international transboundary air pollution

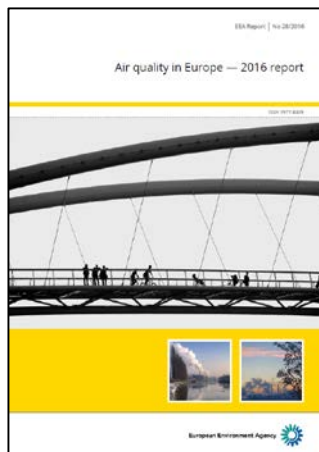
Sectoral contributions to PM_{2.5} exposure in cities in the Netherlands, Germany and Poland in 2009.



Health impacts from air pollution - latest estimates

European Union (EU-28):

- Around 400 000 premature deaths occur each year due to long-term exposure to PM_{2.5}.
- An estimated 70 000 premature deaths occur from exposure to NO₂.



EEA Air Quality in Europe - 2016 report

Country	Population	PM _{2.5}		NO ₂	
		Annual mean (°)	Premature deaths	Annual mean (°)	Premature deaths
Austria	8 451 860	15.7	6 960	19.3	910
Belgium	11 161 642	16.6	10 050	23.6	2 320
Bulgaria	7 284 552	24.1	13 700	16.5	570
Croatia	4 262 140	16.8	4 820	15.8	160
Cyprus	865 878	17.1	450	7.3	< 5
Czech Republic	10 516 125	19.6	12 030	17.1	330
Denmark	5 602 628	9.6	2 890	13.0	60
Estonia	1 320 174	7.8	690	10.8	< 5
Finland	5 426 674	5.9	1 730	9.4	< 5
France	63 697 865	14.5	45 120	18.7	8 230
Germany	80 523 746	14.2	73 400	20.4	10 610
Greece	11 003 615	19.7	13 730	14.6	1 490
Hungary	9 908 798	18.2	12 890	16.8	390
Ireland	4 591 087	9.2	1 520	11.6	30
Italy	59 685 227	18.2	66 630	24.5	21 040
Latvia	2 023 825	12.8	2 080	13.7	110
Lithuania	2 971 905	13.9	3 170	11.5	< 5
Luxembourg	537 039	14.3	280	23.4	80
Malta	421 364	12.5	230	12.0	< 5
Netherlands	16 779 575	14.3	11 530	21.3	1 820
Poland	38 062 535	22.8	48 270	16.1	1 610
Portugal	9 918 548	10.0	6 070	14.0	150
Romania	20 020 074	18.5	25 330	17.9	1 900
Slovakia	5 410 836	20.1	5 620	16.0	< 5
Slovenia	2 058 821	17.4	1 960	17.6	150
Spain	44 454 505	11.0	23 940	18.0	4 280
Sweden	9 555 893	6.0	3 020	11.5	< 5
United Kingdom	63 905 297	11.8	37 930	22.8	11 940
Albania	2 874 545	20.3	2 010	15.9	10
Andorra	76 246	11.9	40	14.3	< 5
Bosnia and Herzegovina	3 839 265	16.0	3 620	15.7	80
former Yugoslav Republic of Macedonia	2 062 294	30.4	3 360	20.8	210
Iceland	321 857	6.5	80	14.3	< 5
Kosovo (*)	1 815 606	28.0	3 530	19.3	230
Liechtenstein	36 838	11.4	20	22.7	10
Monaco	36 136	13.8	20	23.2	10
Montenegro	620 893	17.1	600	17.2	30
Norway	5 051 275	7.1	1 590	14.4	170
San Marino	33 562	15.1	30	15.4	< 5
Serbia	7 181 505	21.1	10 730	20.2	1 340
Switzerland	8 039 060	13.9	4 980	22.4	1 140
Total (*)			467 000		71 000
EU-28 (*)			436 000		68 000



2. National emission inventory reporting requirements

For air pollutants, there are two key instruments requiring reporting of *official national emission inventory data* from European countries:



1. UNECE Convention on Long-Range Transboundary Air Pollution (CLRTAP) and its protocols

(covers 51 UNECE parties including the European Union, U.S. and Canada)



2. EU National Emission Ceilings (NEC) Directive
(covers the 28 EU Member States. Annual reporting of GHG emissions is performed under separate legislation)

A revised NEC Directive was agreed in December 2016, which now aligns EU reporting requirements with those of the CLRTAP

2. National emission inventory reporting requirements

A. Emission inventories

Reporting frequency: annual, all anthropogenic sectors

Years: 1990 to year X-2

Format: Nomenclature for Reporting (NFR) (ca. 100 source categories)

Pollutants: i. main pollutants: NO_x , NMVOCs, SO_x , NH_3 , CO;
 ii. particulate matter: $\text{PM}_{2.5}$, PM_{10} and, if available, BC and TSP;
 iii. heavy metals: Cd, Pb, Hg, & if available As, Cr, Cu, Ni, Se & Zn;
 iv. POPs: 4 PAHs, dioxins and furans, PCBs and HCB.

B. Emission projections

Reporting frequency: NEC Directive every 2 years, CLRTAP every 4 years;

Years: 2020, 2025, 2030 and if available 2040, 2050;

Pollutants: NO_x , NMVOCs, SO_x , NH_3 and if available, BC.

C. Spatially-disaggregated gridded emissions

Reporting frequency: every four years from 2017.

D. Large point source (LPS) emissions

Reporting frequency: Annual (EU). Every 4 years CLRTAP



Emission inventory data portals

1. CLRTAP: Centre on Emission Inventories and Projections (www.ceip.at)

- officially reported data
- gap-filled data (expert estimates)

2. NEC Directive: EEA (eea.europa.eu/air)

- officially reported data

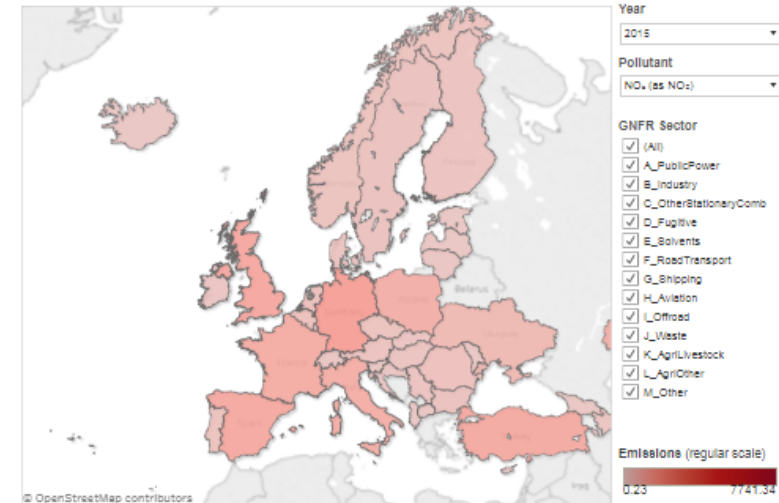
3. Non-official data sets

European Commission EDGAR database: Global gridded emissions of GHGs and air pollutants edgar.jrc.ec.europa.eu.

GAINS GHG and air emissions model: Exploration of cost-effective emission control strategies (IIASA) gains.iiasa.ac.at/

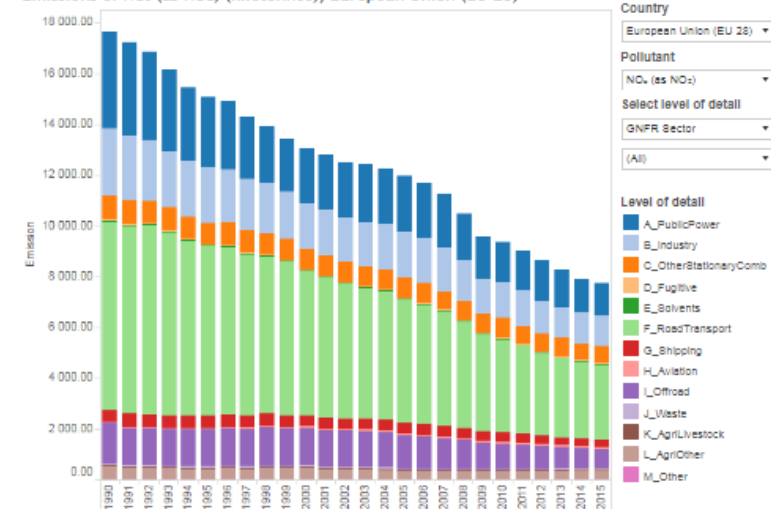
Copernicus Atmosphere Monitoring Programme: European and global emissions atmosphere.copernicus.eu/

Emissions of NO_x (as NO₂) (kilotonnes)



The data presented in this data viewer uses the GNFR14 nomenclature and is the officially reported data submitted up to 20 June 2017.

Emissions of NO_x (as NO₂) (kilotonnes), European Union (EU 28)



3. National emission reduction commitments



CLRTAP Gothenburg Protocol (2012 amendment)

- Emission ceilings 2010-2019: NO_x , NMVOCs, SO_x , NH_3
- 2020 and beyond: Emission reduction commitments for the same 4 pollutants and $\text{PM}_{2.5}$
- Only relevant for Parties who have ratified the protocol.
- Canada and U.S. are not subject to formal reduction commitments.

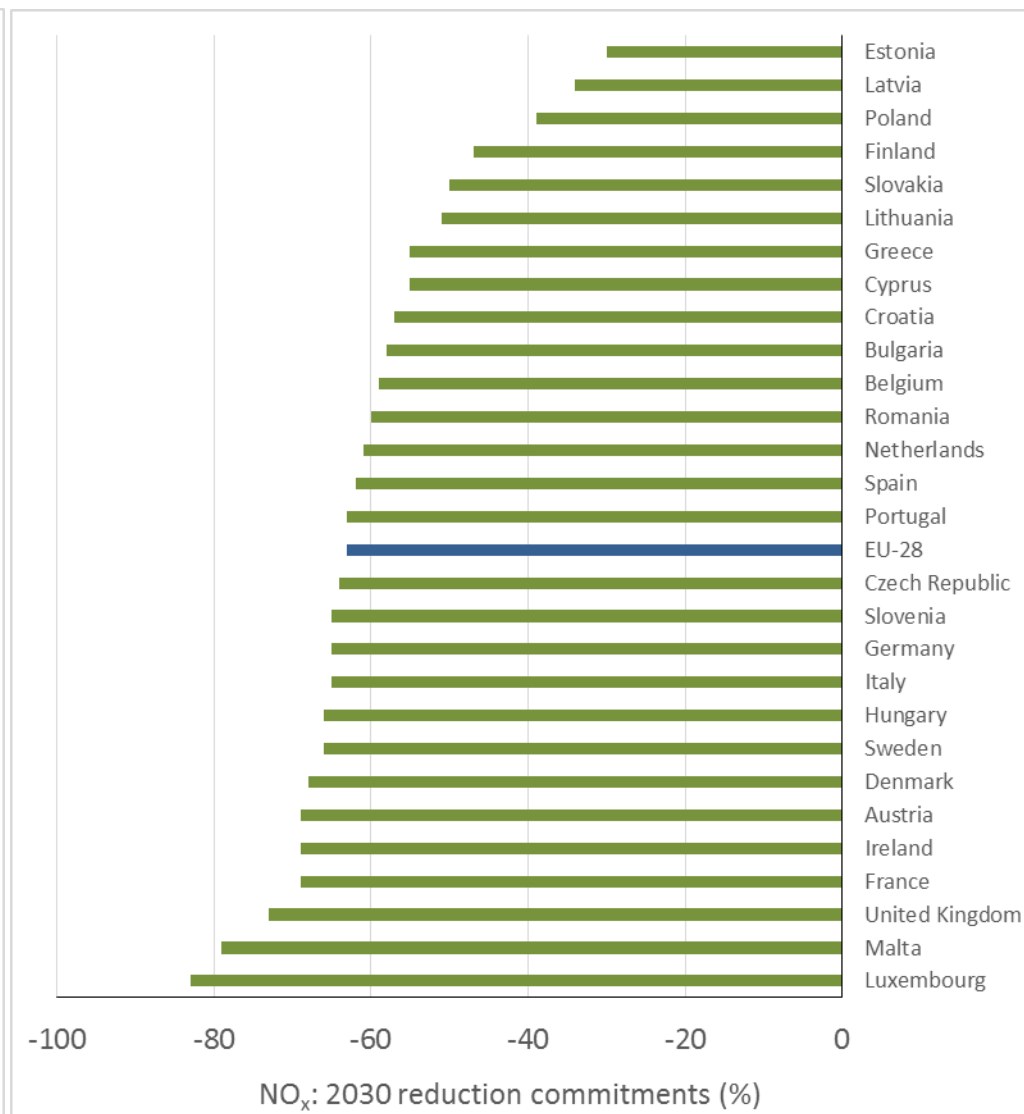
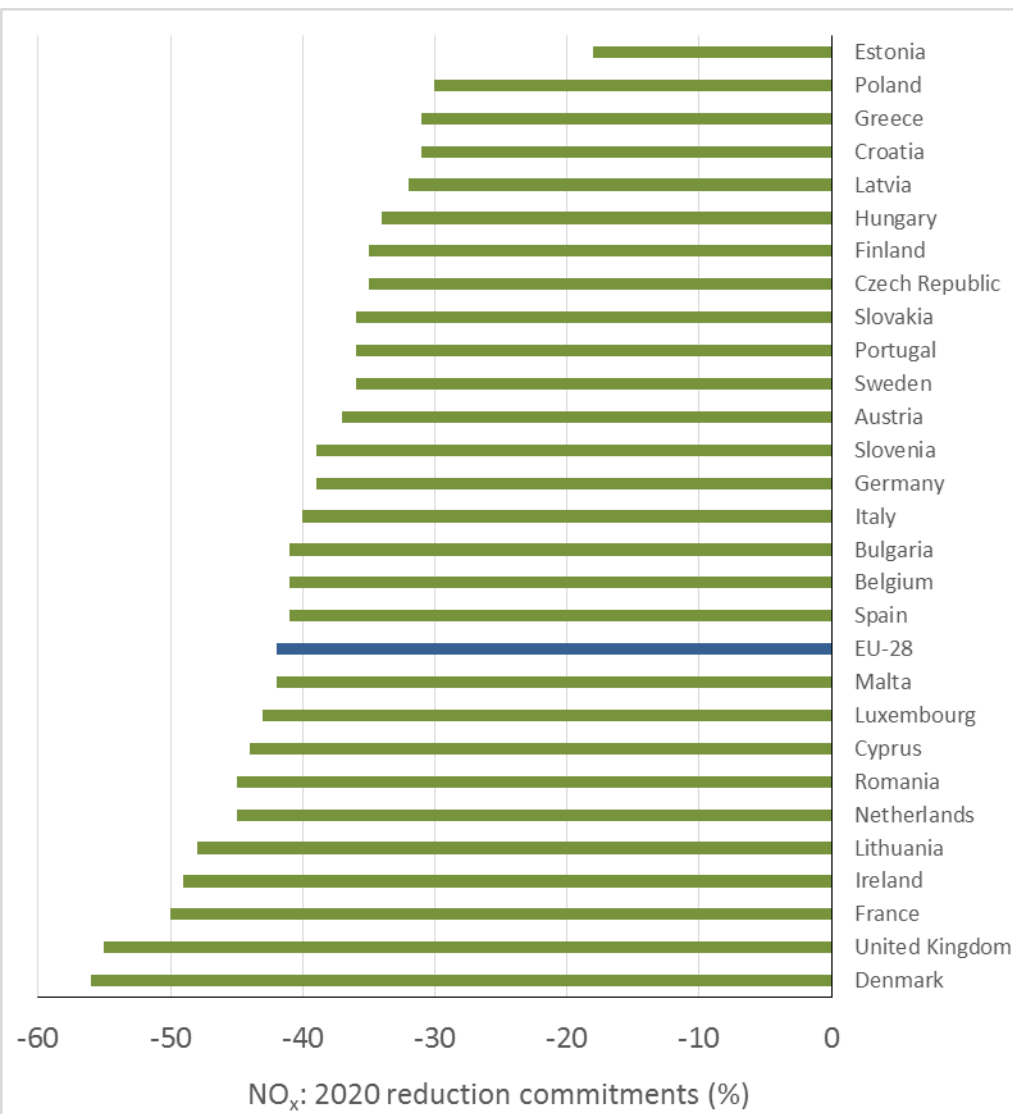


NEC Directive (revision in Dec. 2016)

Emission ceilings 2010-2019: NO_x , NMVOCs, SO_2 , NH_3

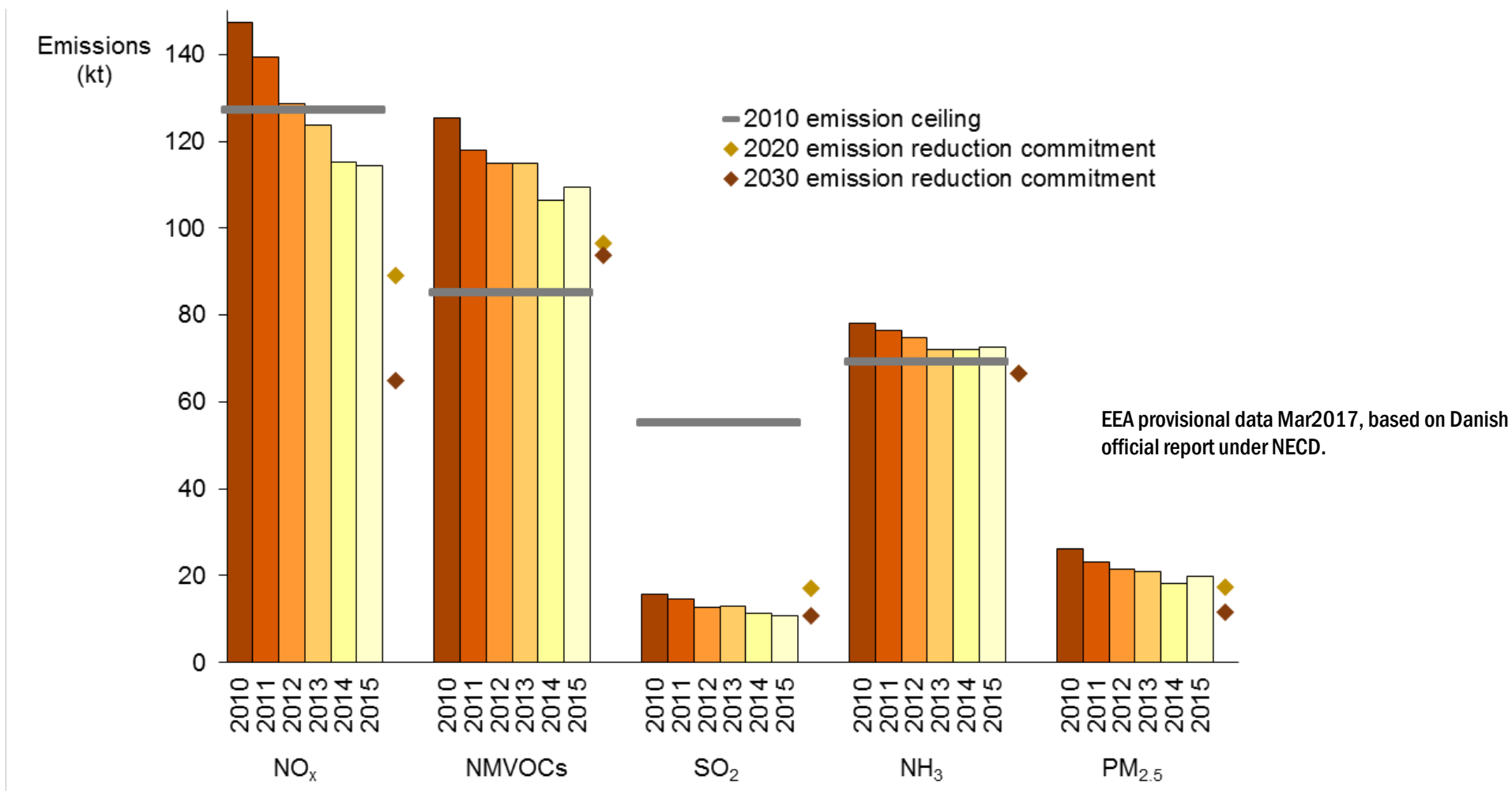
- For around half the countries, the 2010 ceilings are more ambitious than CLRTAP
- 2020-2029: Emission reduction commitments for the same 4 pollutants and $\text{PM}_{2.5}$ (ambition level same as for CLRTAP)
- 2030: More ambitious reduction commitments to cut the health impacts of air pollution in the EU by around half compared with 2005

EU-28: NECD future emission reduction commitments - NO_x



% reductions compared to a 2005 base-year

Denmark: NECD current & future emission reduction commitments



EEA provisional data Mar2017, based on Danish official report under NECD.

- Note that Denmark has formally applied to 'adjust' some of its reported emissions downwards for compliance purposes in accordance with the flexibility provisions of the new NECD. This application has not yet been reviewed or approved by the European Commission. If approved, the number of exceedances illustrated will decrease.

New: emission inventory adjustment procedures

New: A new inventory 'adjustment' procedure is now being used under CLRTAP and NECD when compliance is assessed.

Countries can apply to 'adjust' downwards their reported emissions for compliance assessment with the national ceiling limits under specific circumstances:

1. There are **new emission sources** that were not accounted for when the emission reduction commitments were set.
2. Latest **emission factors are significantly different** to those used at the time the emission reduction commitments were set.
3. There are **new methods** used to determine emissions from specific source categories.

Adjustments are reviewed by an Expert Review Team (ERT) comprising experts from CLRTAP's Task Force on Emission Inventories and Projections (TFEIP).

Emission inventory adjustment procedures (*cont.*)

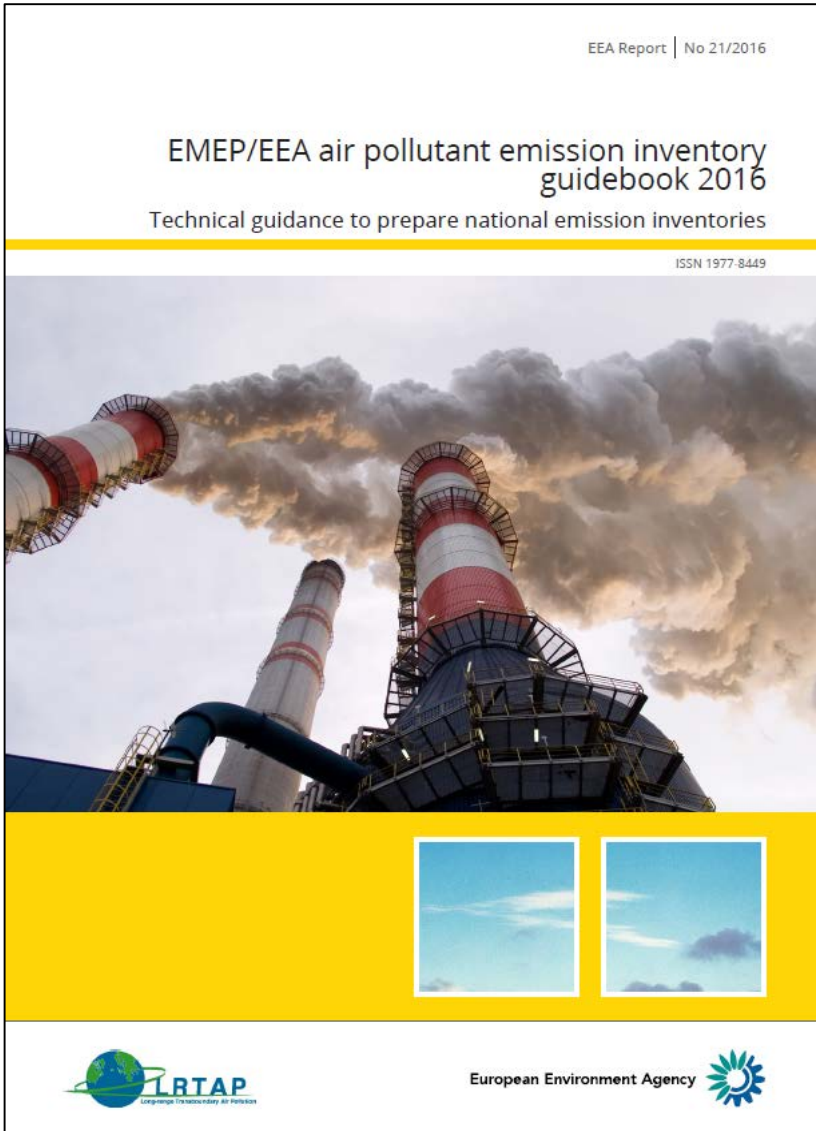


To date, adjustment applications under CLRTAP have been approved for Belgium, Denmark, Finland, France, Germany, Luxembourg and Spain.

The approved adjustments include:

- NO_x from road transport – 5 countries
- NO_x from manure management and agricultural soils – 3 countries
- NMVOCs from manure management and agricultural soils – 4 countries
- NH_3 from agricultural soils – 2 countries

4. Ensuring inventory quality – Guidance



The EMEP/EEA Guidebook provides national emission inventory compilers with guidance and ‘default’ emission factors for NFR sources

Includes:

- general guidance & good practice requirements
- specific guidance for each NFR source;
- methodological choices (decision trees)
- tier-based emission methods and emission factors.

Countries must follow the Guidebook for reporting under the LRTAP Convention and NEC Directive.

Updated every 3-4 years to help drive inventory improvement, and reflect new scientific & methodological insights.

Rather analogous to EPA AP-42 guidance

4. Ensuring inventory quality - Networks

TFEIP

TASK FORCE ON EMISSION
INVENTORIES & PROJECTIONS

The Task Force on Emission Inventories and Projections (TFEIP) is a group established under the LRTAP Convention:

- supporting Parties in the reporting of official data under the Convention and NEC Directive .
- providing a technical forum and expert network to discuss policy-relevant science, emission factors, and new methods for estimating emissions
- offering capacity building and support to countries still developing their emission inventories - e.g. EECCA countries.

Meets once per year (May) with an attendance of around 130 participants.

<http://tfeip-secretariat.org/>



4. Ensuring inventory quality – Inventory Reviews

Inventories reported by countries are subject to an expert review process:

- Stage 1: initial checks of timeliness, format and completeness;
- Stage 2: checks of additional aspects of inventory ‘quality’ - consistency and comparability of data, document the scope of recalculations etc;
- Stage 3: in-depth reviews of selected national inventories performed by a team of emission experts.

The reviews are designed to have a strong capacity-building element

New in 2017: ‘technical corrections’ are provided by the review teams if underestimations or missing sources are found in the reported inventories for key categories.

Review reports are made publicly available:

- CLRTAP – www.ceip.at
- NEC Directive: European Commission webpage (later in 2017)

5. Improving the scientific knowledge base – on-going needs

1. Black carbon

- In 2017, 37 countries reported BC emissions (on a voluntary basis) under CLRTAP.
- EMEP/EEA Guidebook 2016 contains EFs for BC (% of PM_{2.5} emissions per NFR source category)
- Major uncertainties: domestic wood burning, shipping, agricultural burning, forest fires etc.

2. Reporting of condensable PM emissions, especially from domestic wood burning

- Essential for consistency of compliance assessments and AQ modelling inputs

3. Requests from AQ modellers for better information on time-resolved emissions, NMVOC speciation, PM fractionation (elemental, organic, BC etc.)

4. Coherence between national air pollutant and GHG emission inventories



Air pollution – toward the future



1. **Policies are working: Air quality is improving as a direct result of current policies & on-going technological improvements.**
2. **However, air pollution remains responsible for more than 400 000 premature deaths in Europe each year. It continues to damage vegetation and ecosystems.**
3. **Effective air quality policies require action and cooperation at different scales: international and pan-European, national and local/city levels.**
4. **Systemic solutions must increasingly be found to move toward air quality consistent with the WHO AQ guidelines, and achieve the EU’s 2050 vision of “living well within the limits of the planet”.**





Thank you

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