European Network on New Sensing Technologies for Air Pollution Control and Environmental Sustainability - *EuNetAir*

COST Action TD1105

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Air Quality Current Status in Europe

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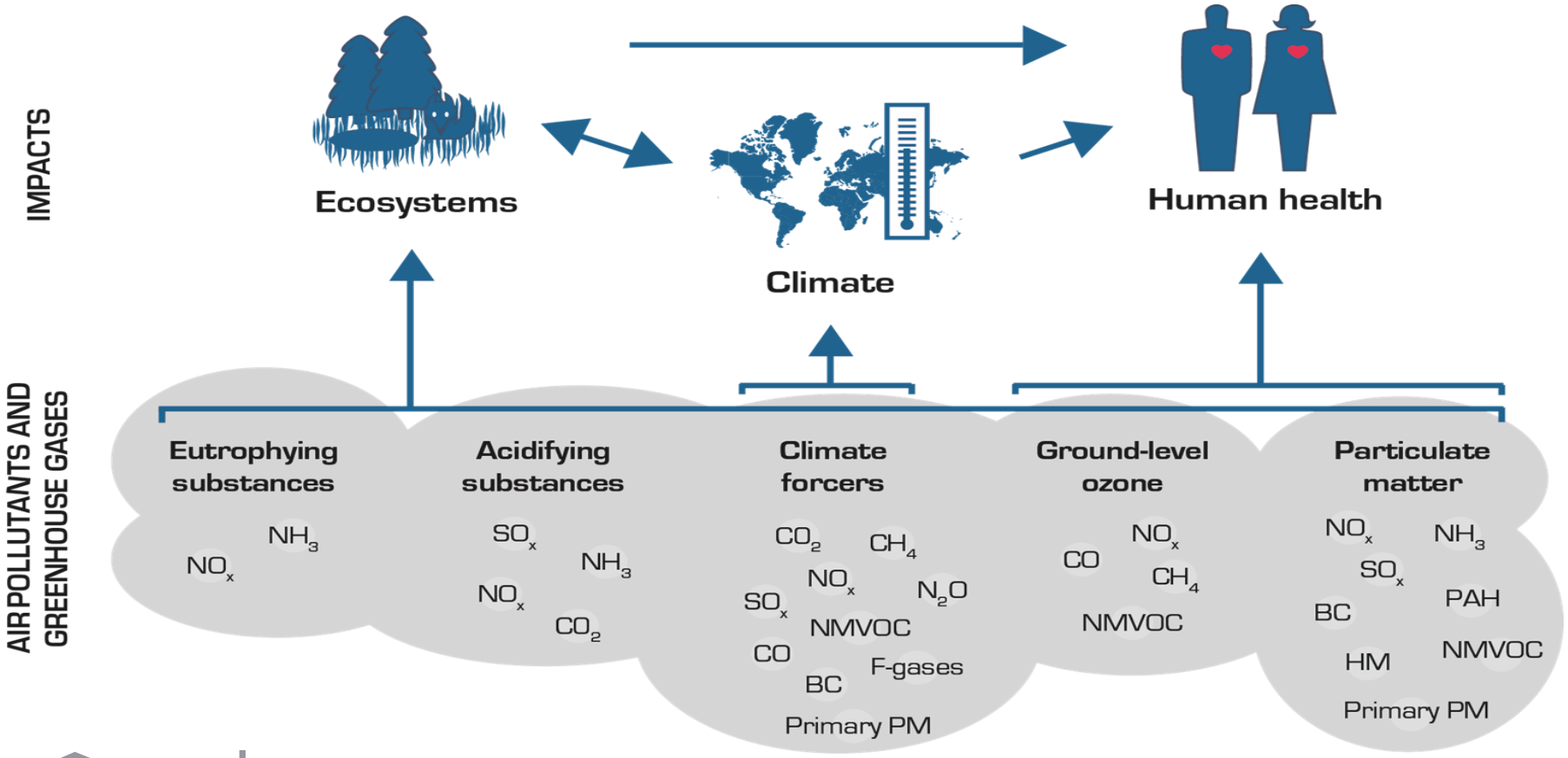
Outline of presentation

- Effects of air pollution
- Urban population exposure
- Status:
  - ✓ PM_{10} & $PM_{2.5}$,
  - ✓ O_3,
  - ✓ NO_2,
  - ✓ Benzo(a)pyrene
  - ✓ SO_2,
  - ✓ CO, Benzene, Metals
- Health impacts
- Emission trends
- Conclusions

Air pollutants and impacts



Urban population exposure

Percentage of urban population exposed to concentrations above EU/WHO values

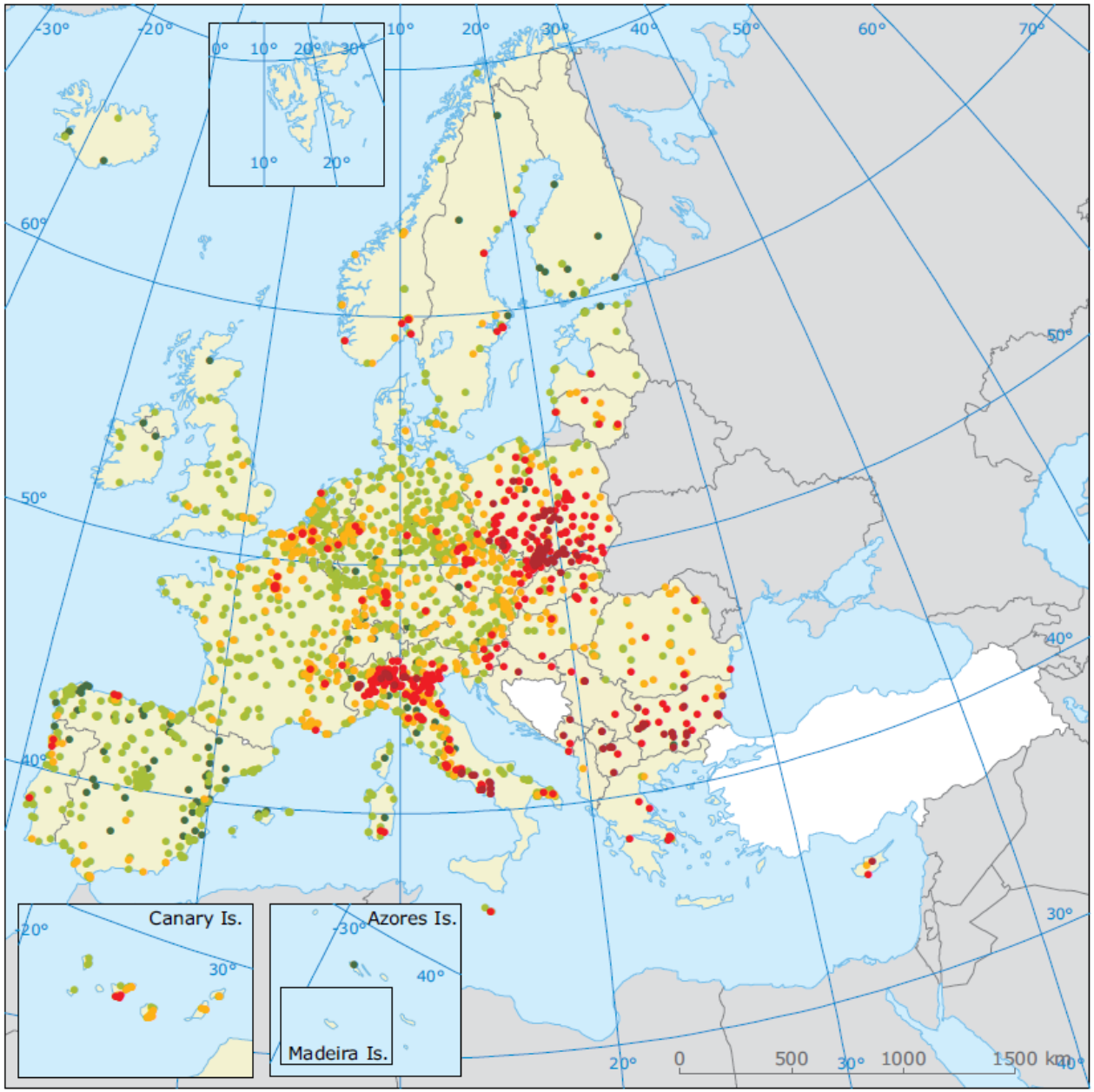
Pollutant	EU reference value	Exposure estimate	WHO AQG	Exposure estimate
$PM_{2.5}$	Year (25)	9–14	Year (10)	87–93
PM_{10}	Day (50)	17–30	Year (20)	61–83
O_3	8-hour (120)	14–15	8-hour (100)	97–98
NO_2	Year (40)	8–12	Year (40)	8–12
BaP	Year (1 ng/m³)	25–28	Year (RL, 0.12 ng/m³)	85–91
SO_2	Day (125)	<1	Day (20)	36–37

Key: < 5% | 5–50% | 50–75% | > 75%

Estimate for 2011 – 2013, except for SO_2: 2011–2012

The reference concentrations in brackets are in μg/m³, except for BaP in ng/m³

Particulate matter: PM10



90.4 percentile of PM_{10} daily concentrations in 2013

µg/m³

- ≤ 20
- 20–40
- 40–50
- 50–75
- > 75

No data

Countries/regions not included in the data exchange process

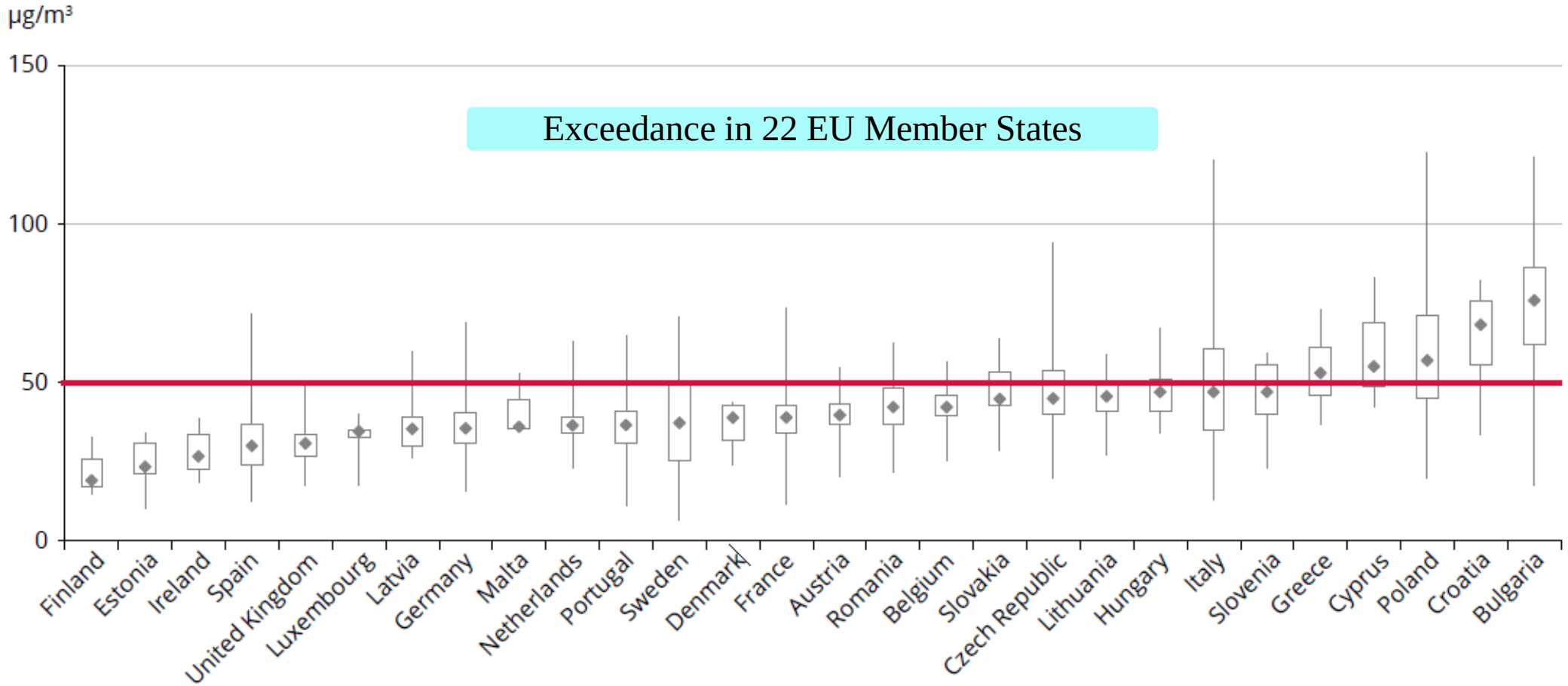
EU daily limit value = 50 µg/m³ (35 days allowed) ⇔ P90.4

EU annual limit value = 40 µg/m³

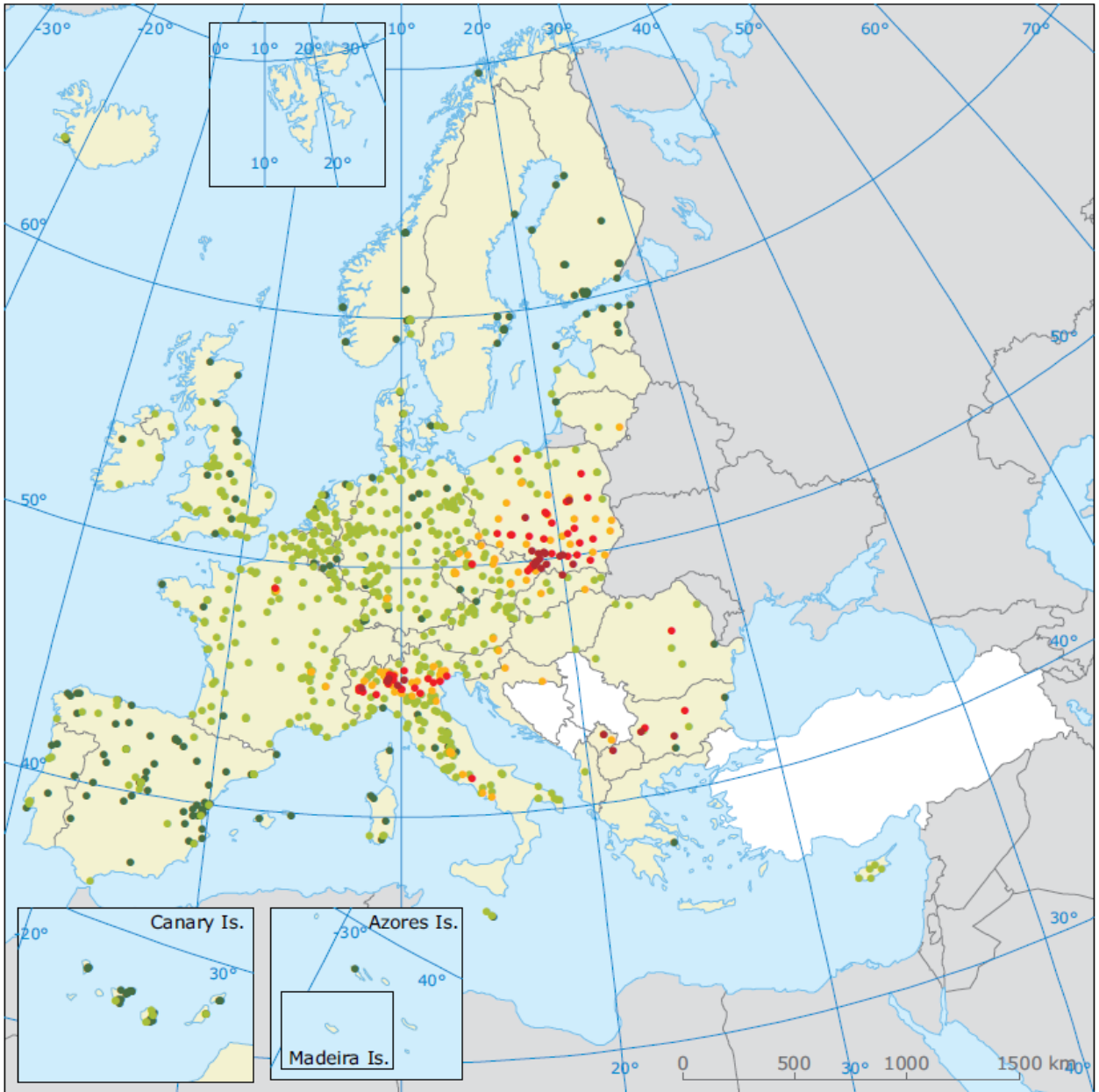
WHO daily guideline = 50 µg/m³ (3 days allowed)

WHO annual guideline = 20 µg/m³

Attainment of daily PM10 LV, 2013



Particulate matter: PM2.5



Annual mean $PM_{2.5}$ concentrations in 2013

µg/m³

- ≤ 10
- 10–20
- 20–25
- 25–30
- > 30

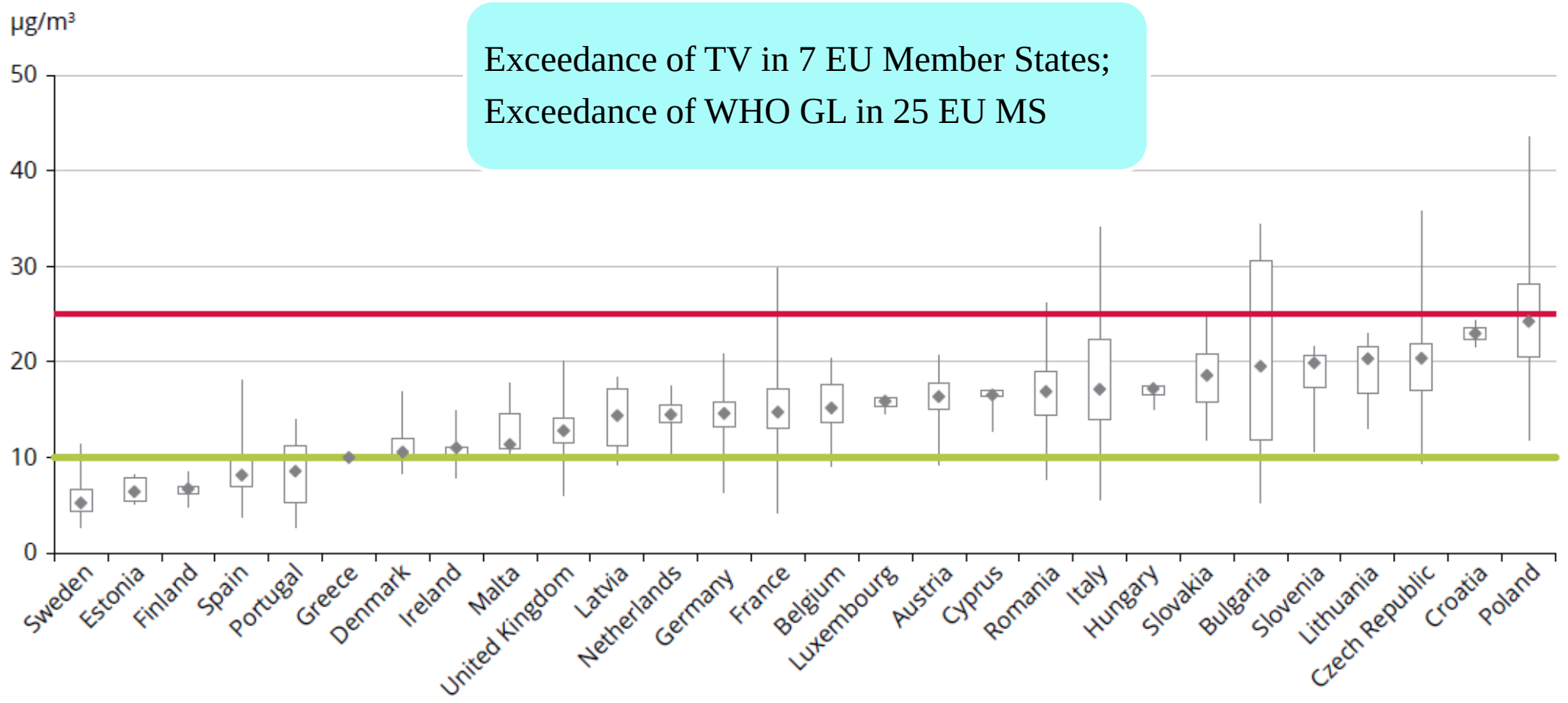
No data

Countries/regions not included in the data exchange process

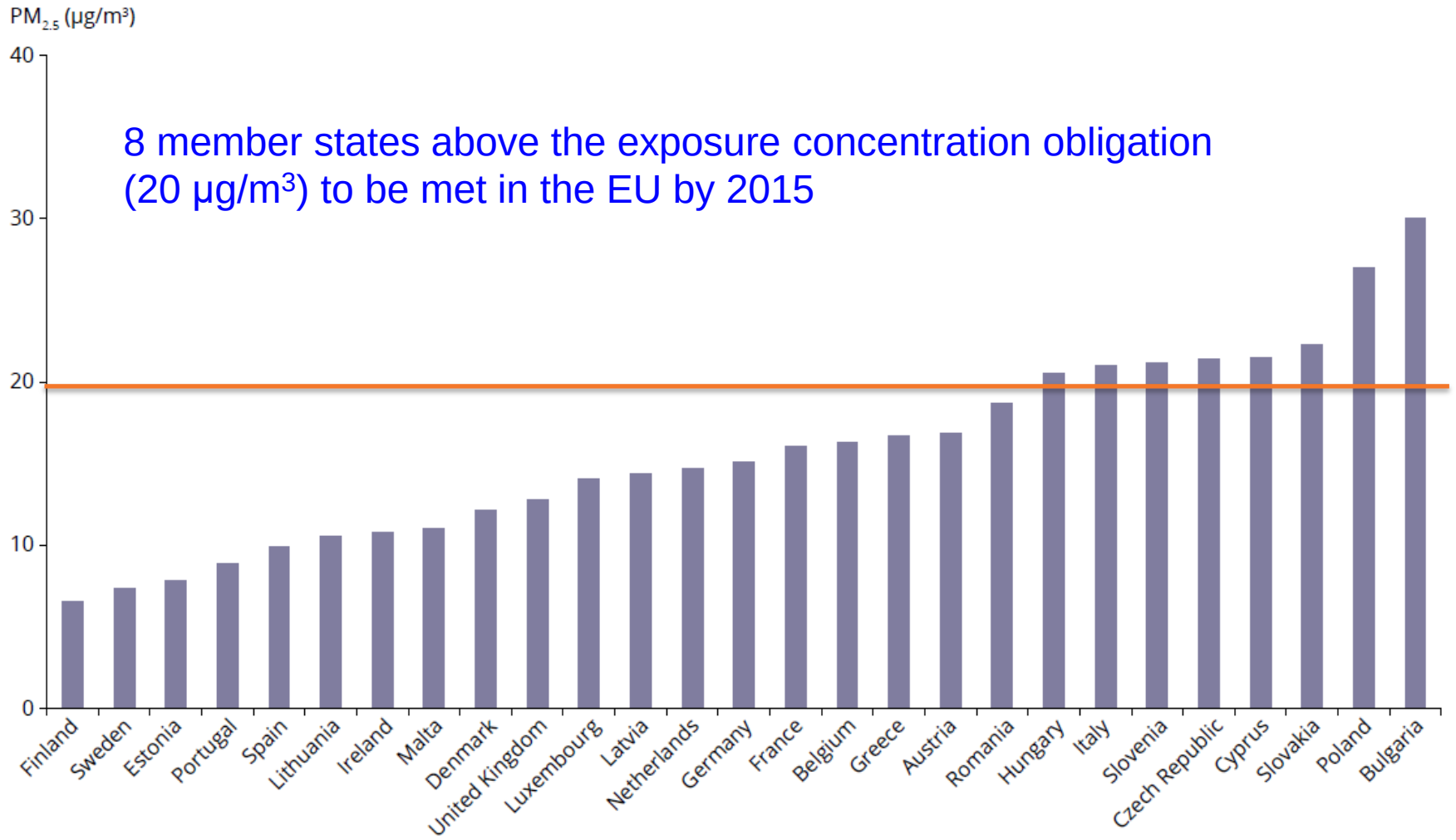
EU target value = 25 µg/m³

WHO guideline = 10 µg/m³

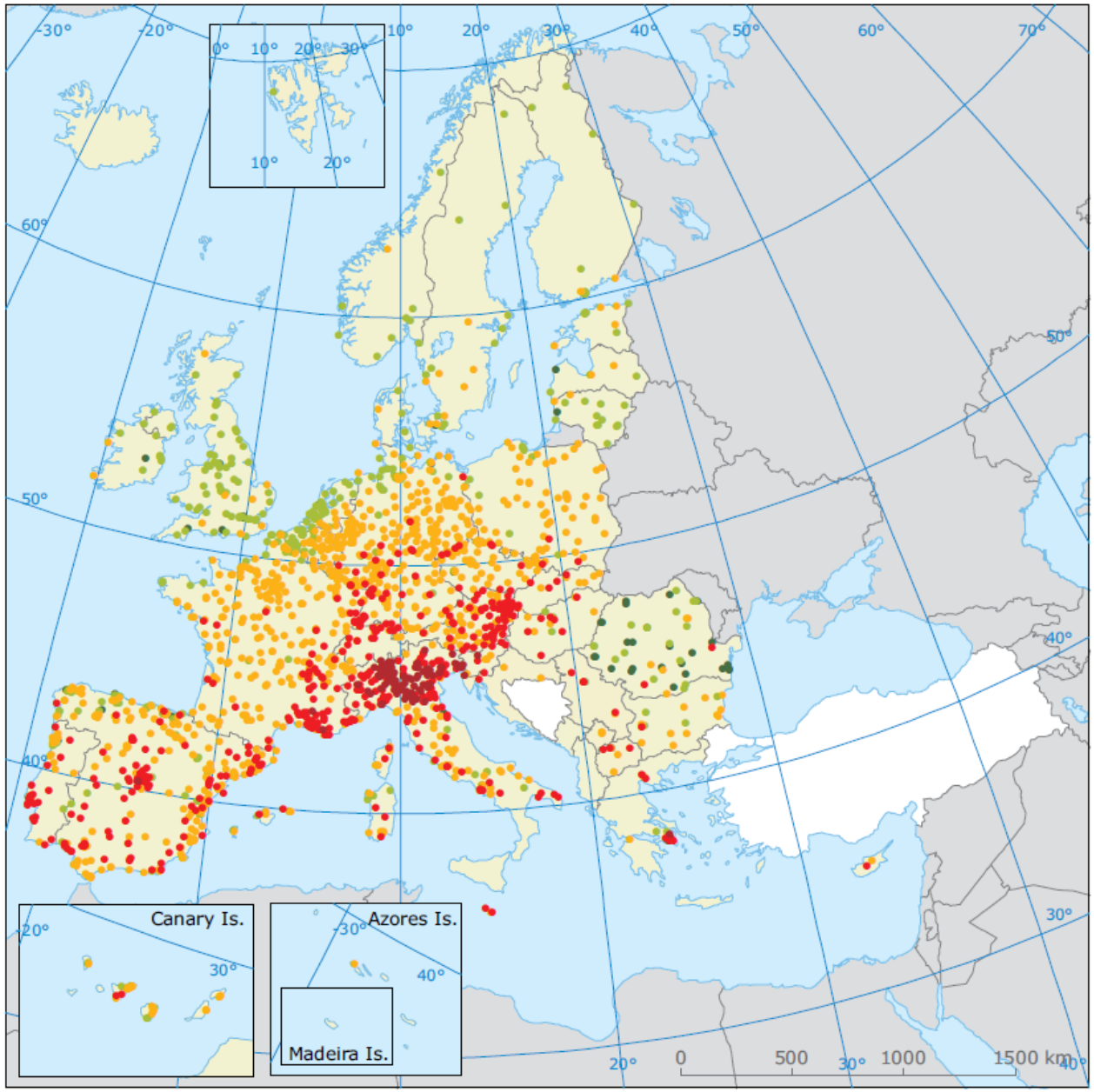
Attainment of annual PM2.5 TV and WHO GL in 2013



Average Exposure Indicator (PM2.5)



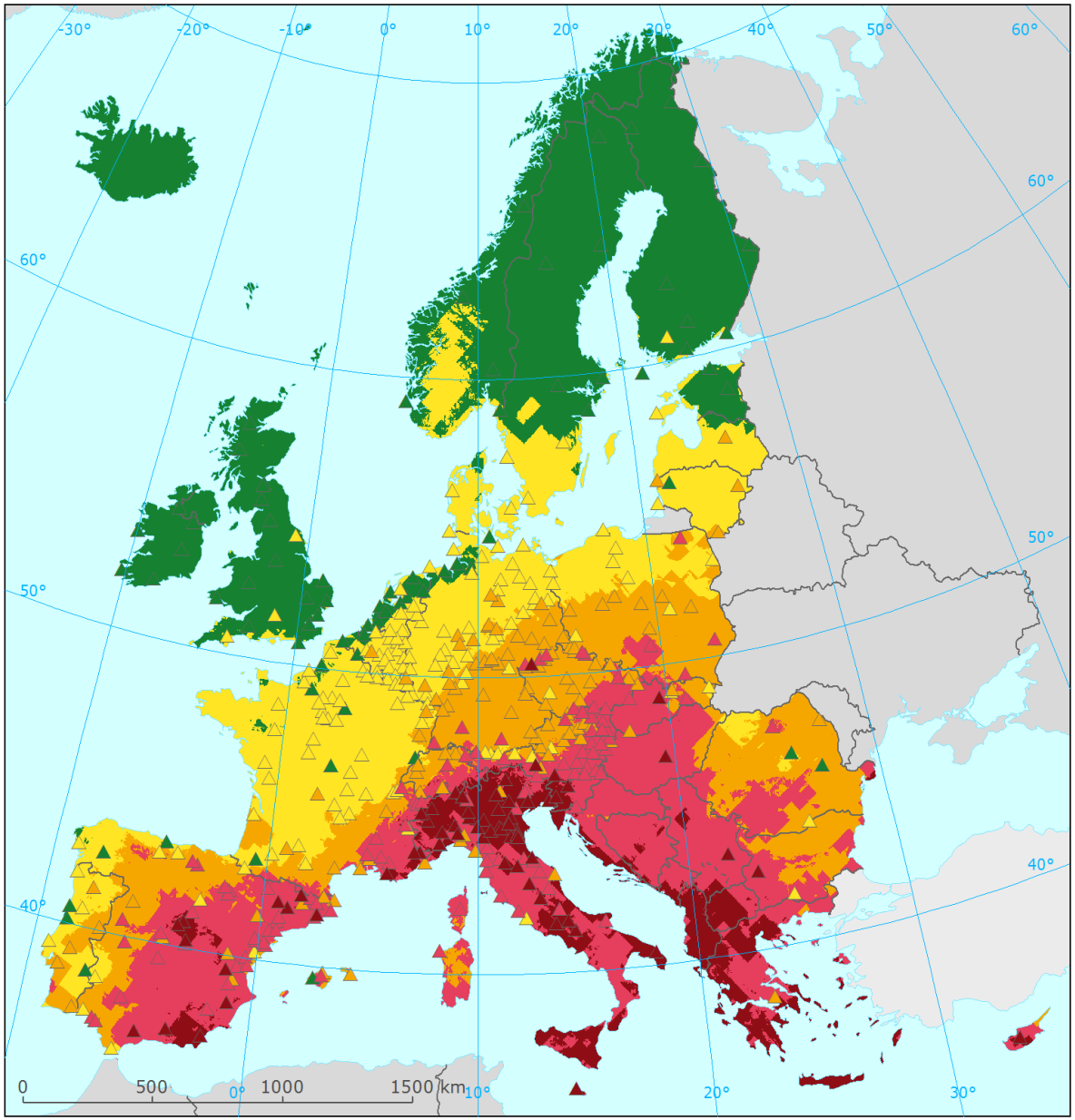
Ozone – human health



EU limit value = 120 µg/m³
(25 days allowed ⇔ P93.2)

WHO guideline = 100 µg/m³

Ozone – Crops



Ozone
AOT40 for crops

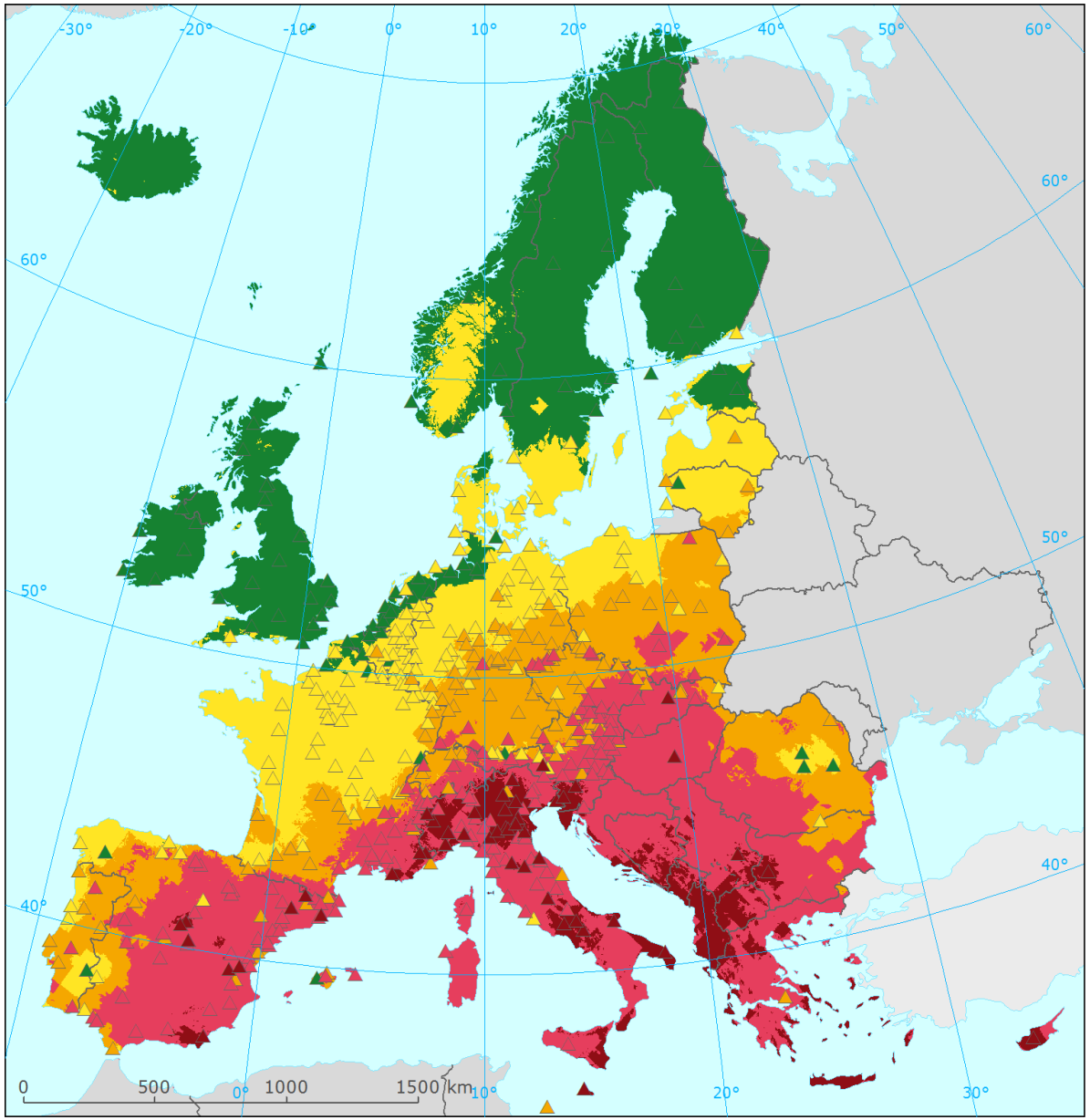
Reference Year: 2012
Rural Map
Resolution: 2x2 km

- ≤ 6 000 µg.m^{-3}.h
- 6 000 - 12 000 µg.m^{-3}.h (6 000 = LTO)
- 12 000 - 18 000 µg.m^{-3}.h
- 18 000 - 27 000 µg.m^{-3}.h (18 000 = TV)
- > 27 000 µg.m^{-3}.h
- outside data coverage
- poor data coverage
- △ rural background station

AOT40 is an accumulated ozone exposure: Sum of hourly O_3 conc above 80 µg/m^3 from 8 to 20 hr accumulated from 1 May to 31 July.

Source: ETC/ACM TP 2014/4

Ozone – Forests



Ozone
AOT40 for forests

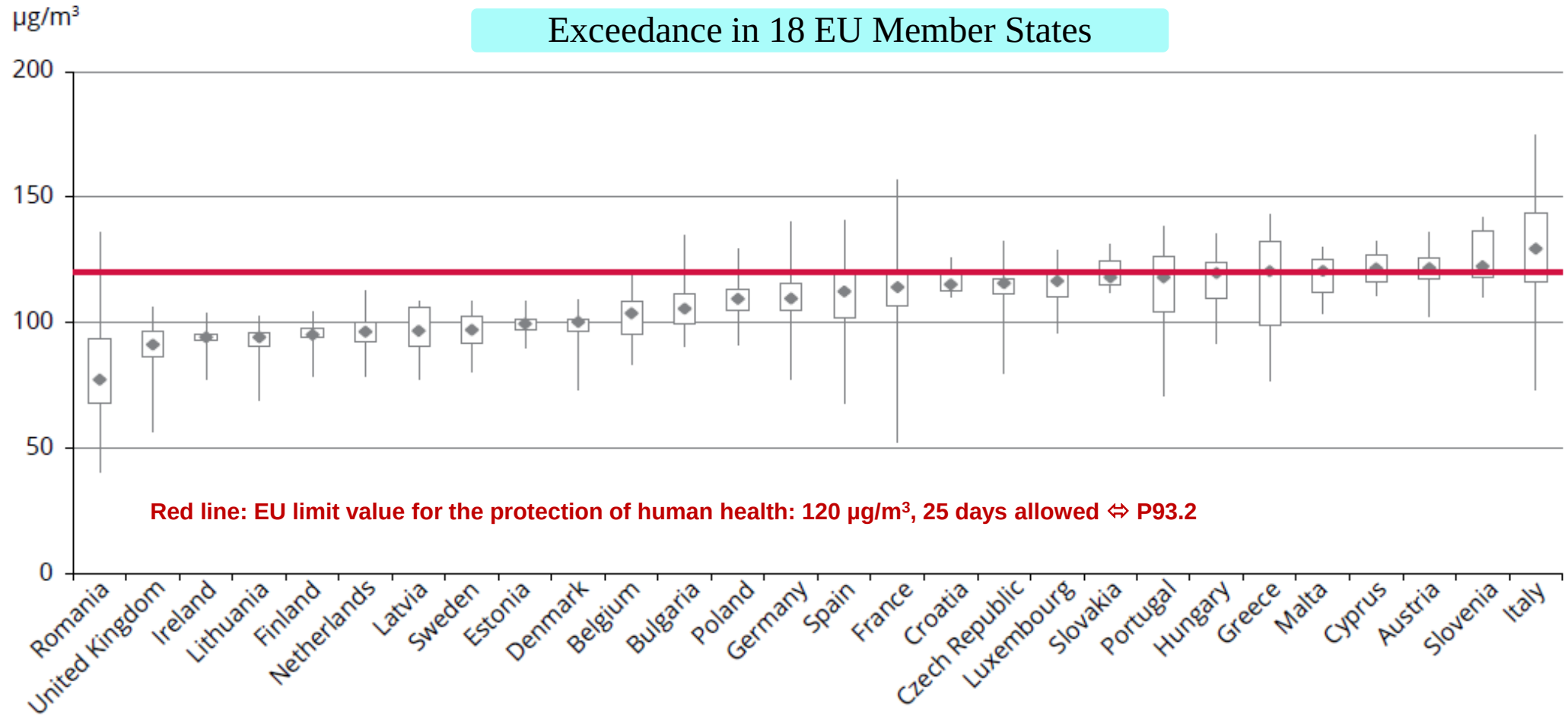
Reference Year: 2012
Rural Map
Resolution: 2x2 km

- ≤ 10 000 µg.m^{-3}.h
- 10 000 - 20 000 µg.m^{-3}.h (10 000 = CL)
- 20 000 - 30 000 µg.m^{-3}.h
- 30 000 - 50 000 µg.m^{-3}.h
- > 50 000 µg.m^{-3}.h
- outside data coverage
- poor data coverage
- △ rural background station

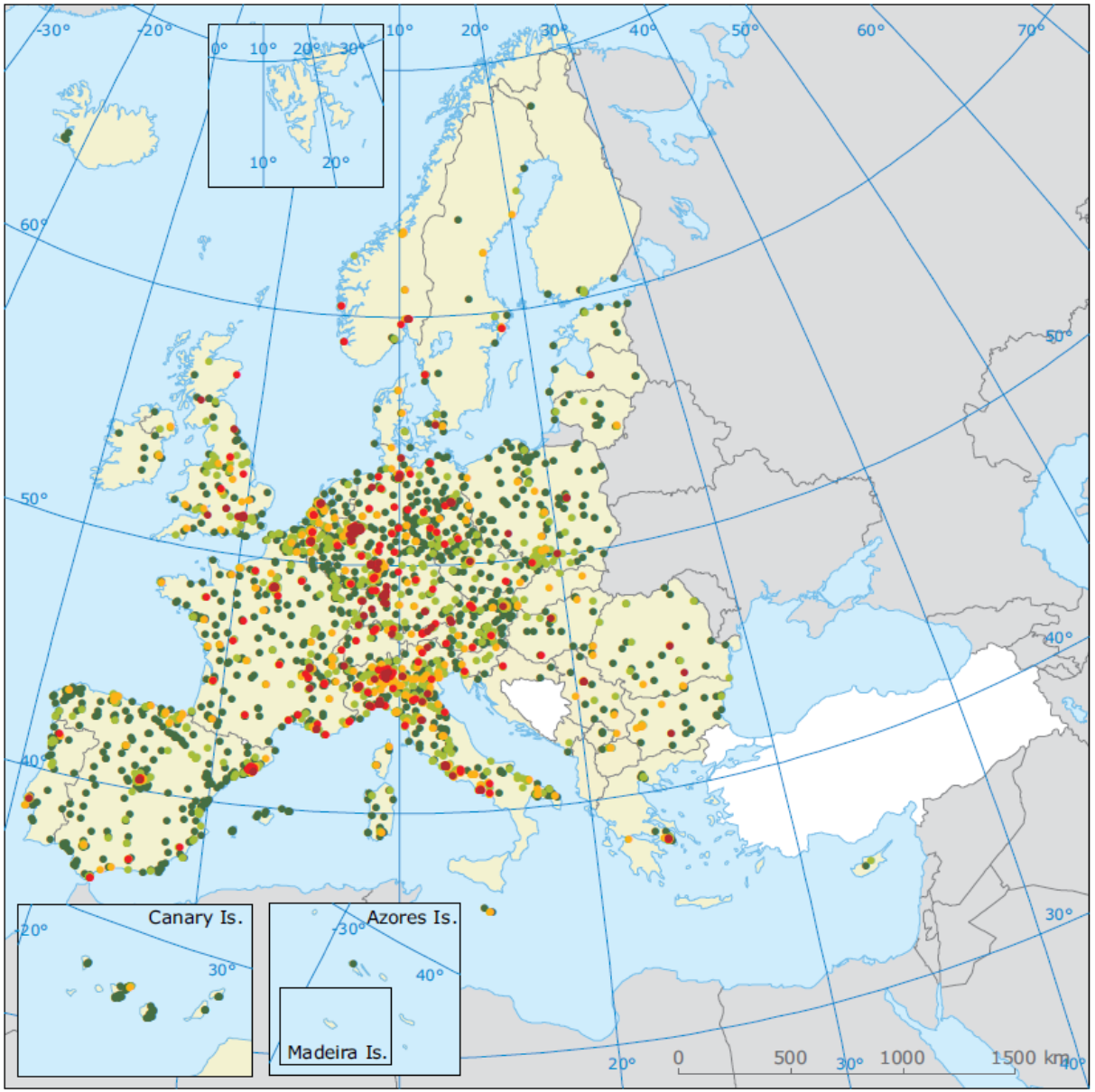
AOT40 is an accumulated ozone exposure: Sum of hourly O_3 conc above 80 µg/m^3 from 8 to 20 hr accumulated from 1 April to 30 September.

Source: ETC/ACM TP 2014/4

Attainment of ozone LV, 2013



NO_2



Annual mean NO_2 concentrations in 2013

µg/m³

- ≤ 20
- 20–30
- 30–40
- 40–50
- > 50

No data

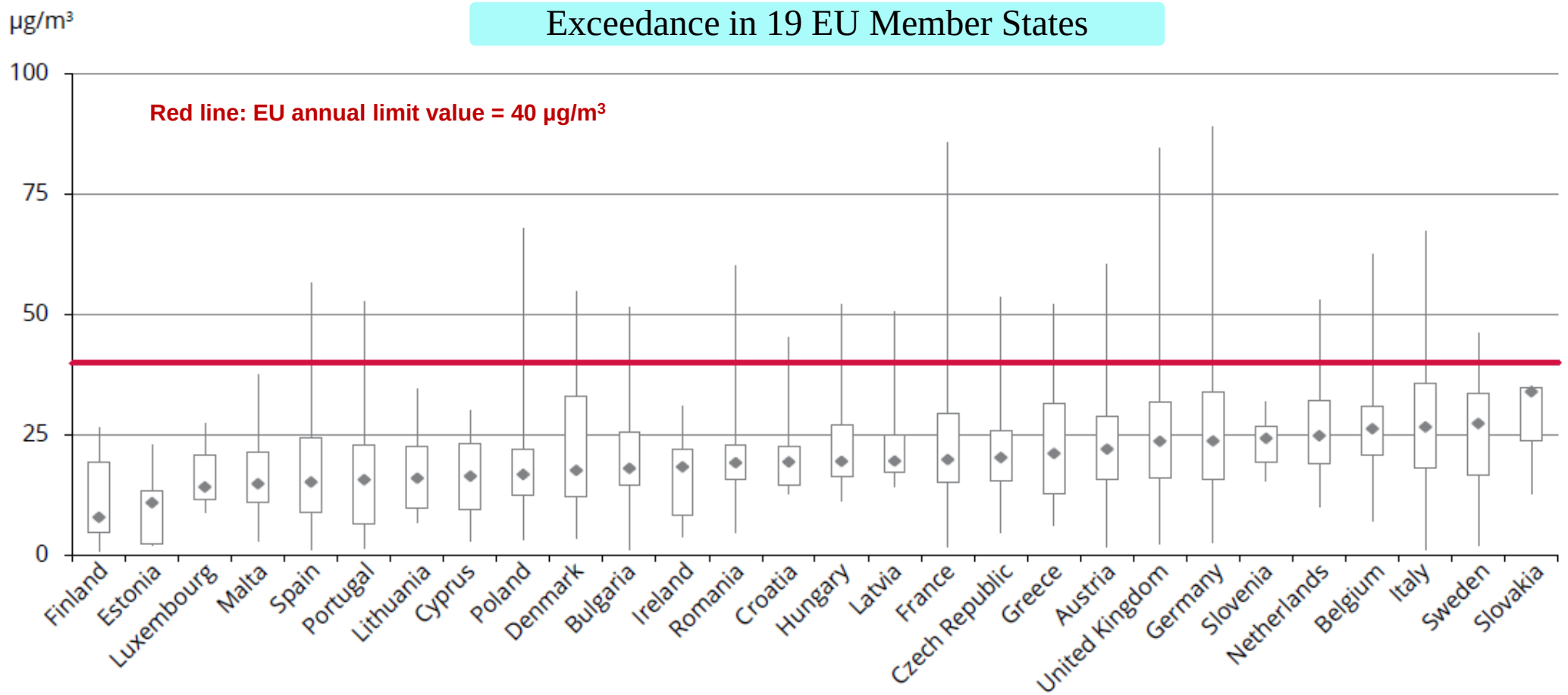
Countries/regions not included in the data exchange process

93% of exceedances occur at traffic stations

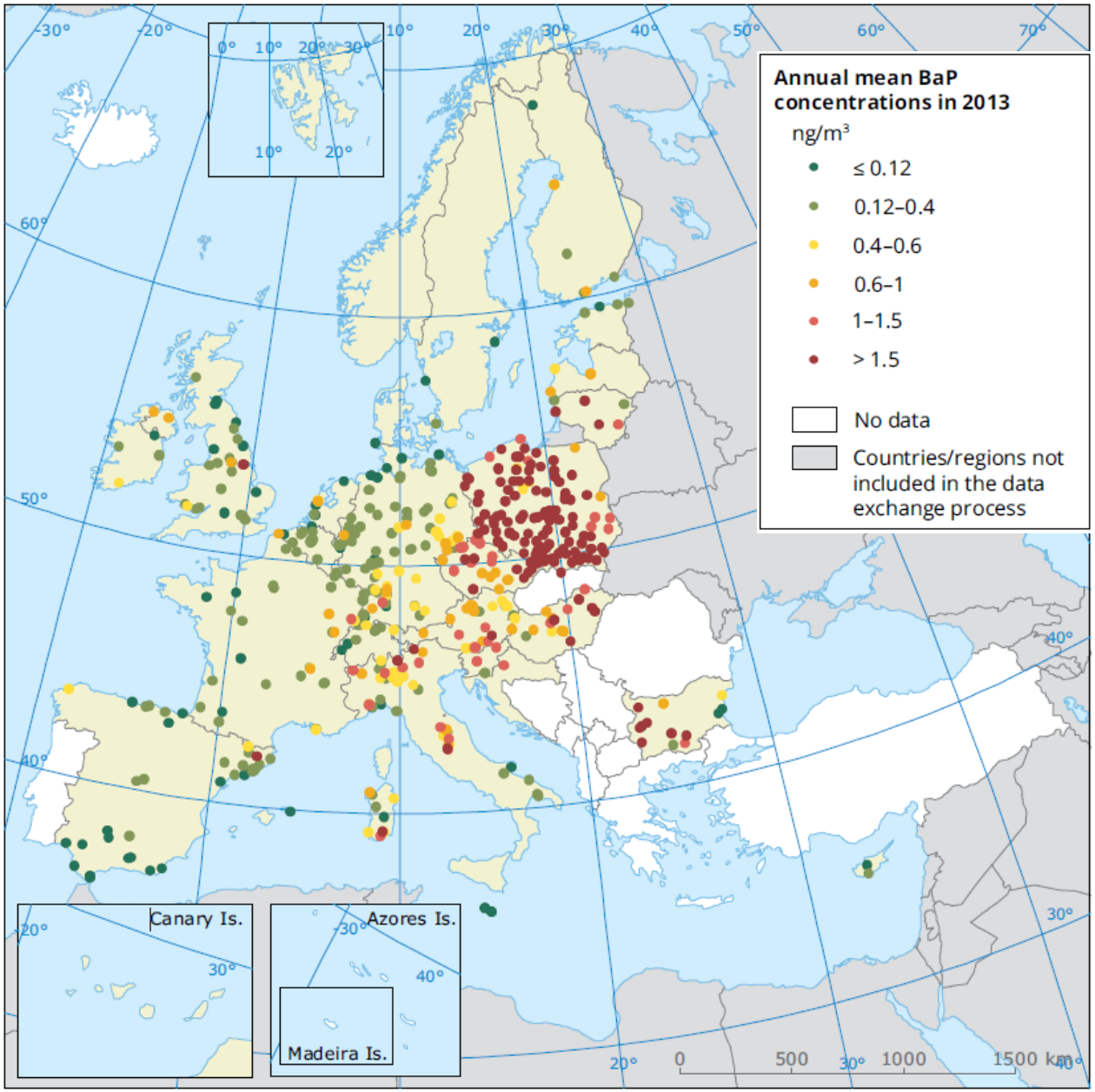
EU annual limit value & WHO guideline = 40 µg/m³

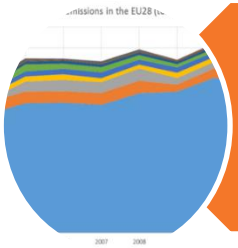
In red and dark red: above EU limit value

Attainment of NO_2 LV, 2013



Benzo(a)Pyrene

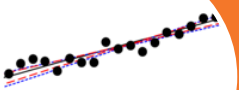




BaP emissions increased by 21% 2003-2012 in EU

Main sector:

Commercial, institutional and household fuel combustion: 85% of BaP emissions

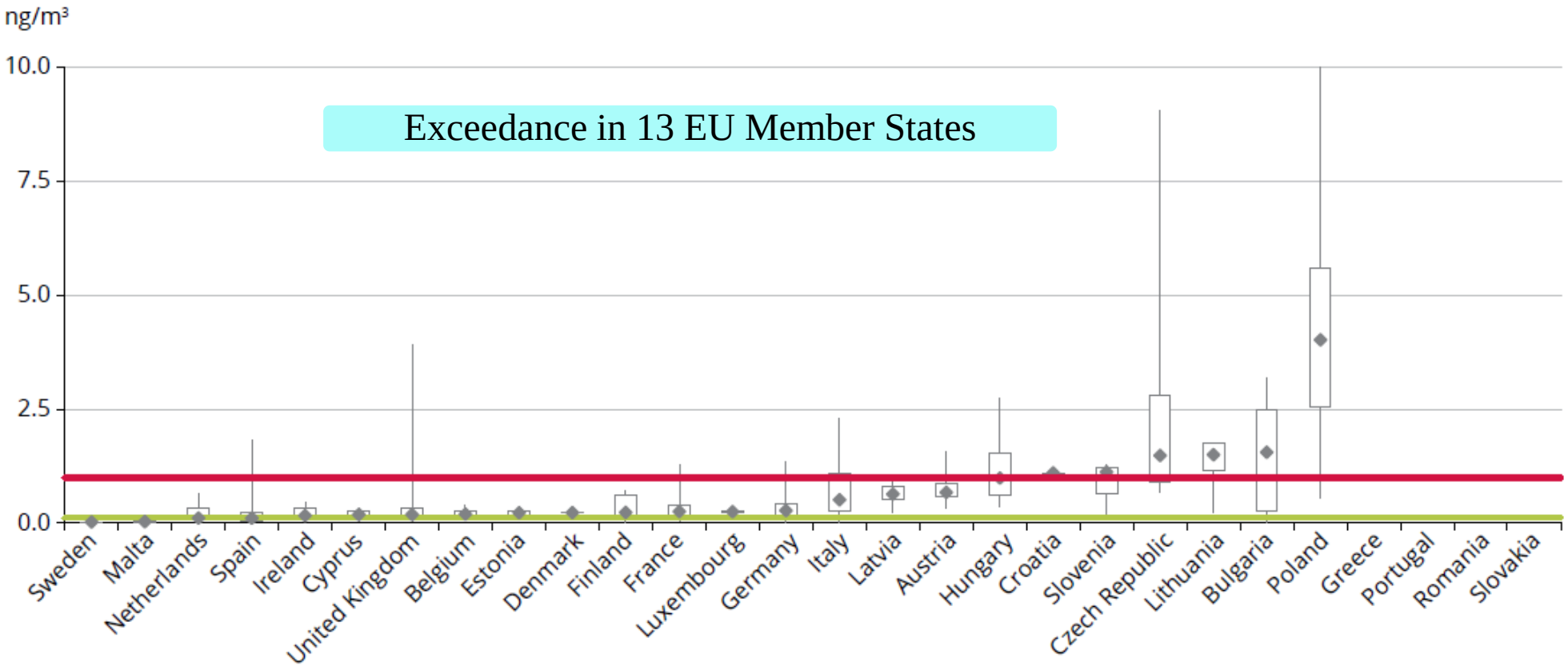


Increased by 24% in 2003-2012

EU target value : 1 ng/m³

Reference value : 0.12 ng/m³

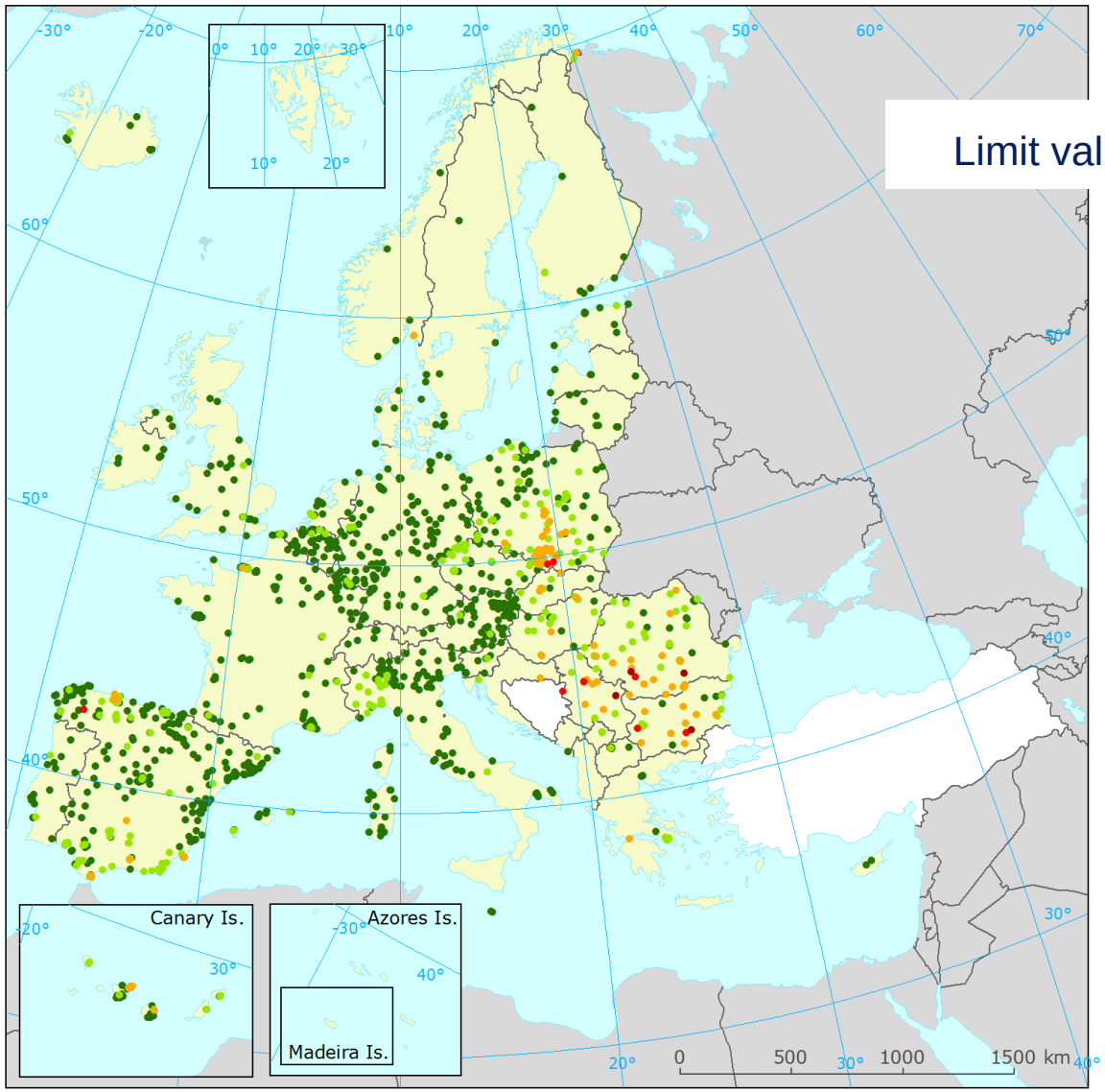
Attainment of B(a)P TV in 2012



EU annual target value = 1 ng/m³

Reference value = 0.12 ng/m³

Sulphur dioxide (SO_2)



Limit value for the protection of vegetation 20 µg/m^3

SO2_mean_2013_pct_valid_above_75
statistic average group is "hour" or "day"
<= 5
5 - 10
10 - 20
20 - 25
> 25
SO2_nodata_2013
Outside coverage

SO_2 concentrations are generally well below the limit values for *health protection*:

- **The hourly and daily LVs were exceeded in 2013 at 2 urban stations in the EU (Bulgaria) of >1300 stations.**

CO, benzene and metals

Human exposure to CO, benzene, Pb, As, Cd and Ni ambient air concentrations above the EU standards is a local problem.

Atmospheric deposition of heavy metals contributes to the exposure of ecosystems and organisms and bioaccumulation of heavy metals.

Most countries have exceedance of critical loads for Cd in <1 % of their national ecosystem area.

Atmospheric deposition of Pb exceeds the critical loads in over 12 % of the EU ecosystem area.

More than half of all EEA-33 countries have exceedances of critical loads for Hg across nearly 90 % or more of their ecosystem area.

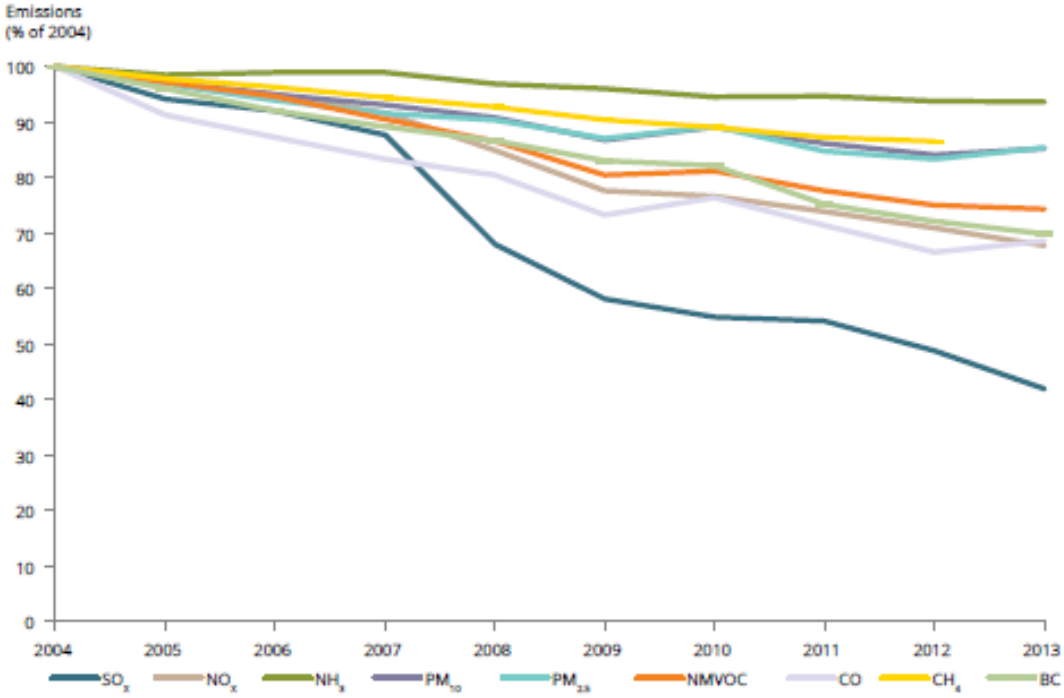
In total, atmospheric deposition of Hg exceeds the critical loads across 54 % of the EU ecosystem area.

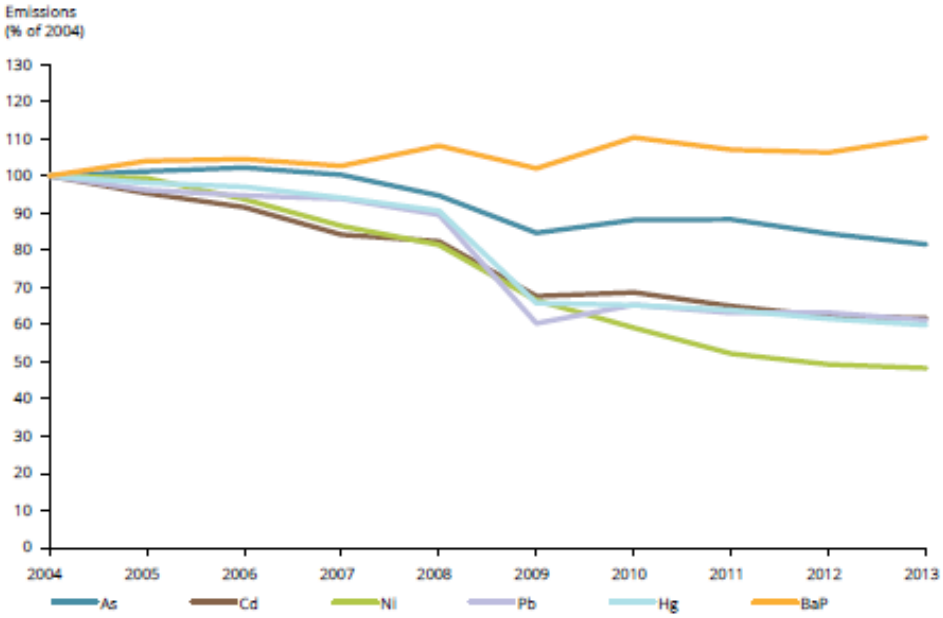
Health Impacts

		EU-28	Total Europe
PM2.5	YLL	4 494 000	4 804 000
	YLL/10^5 inhab.	898	895
	premature deaths	403 000	431 000
NO_2	YLL	800 000	828 000
	YLL/10^5 inhab.	160	154
	premature deaths	72 000	75 000
O_3	YLL	197 000	216 000
	YLL/10^5 inhab.	39	40
	premature deaths	16 000	17 000

Estimated lung cancer incidence due to BaP exposure: 550 - 600 in Europe

Most emissions have been reduced





Conclusions

- Almost one third of Europe's city dwellers are exposed to excessive concentrations of airborne particulate matter.
- Emissions of the main air pollutants in Europe declined in the period 2003–2012, resulting in some improvements in air quality. But PM and BaP emissions from household combustion have increased considerably!
- Most European countries still do not comply with one or more air quality limit or target values:

  22 MS exceeded the PM_{10} daily LV;19 MS exceeded the NO_2 annual LV; 18 MS exceeded the O_3 LV for health protection
- Exposure to $PM_{2.5}$, NO_2 and O_3 lead to respectively 431 000, 75 000, and 17 000 premature deaths in Europe (based on 2012 concentrations).
- Several air pollutants continue to lead to significant impacts on ecosystems, forests and crops.

Thank you for your attention!

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