Air quality – EU Legislation and EU best practices

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Why is air pollution in Europe still a problem?

Europe's air quality is slowly improving, but fine particulate matter and ground-level ozone in particular continue to cause serious impacts on health.

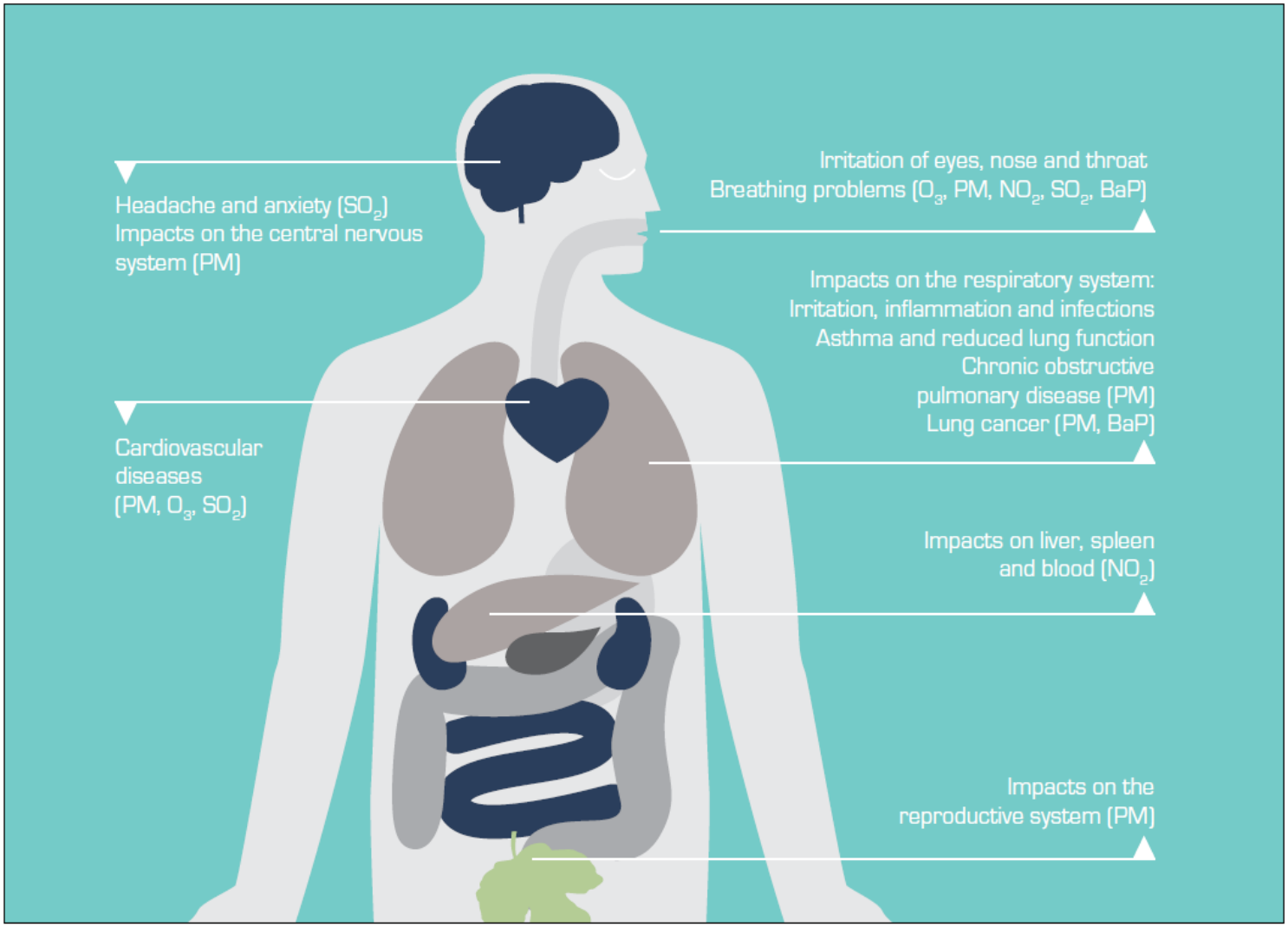
Estimates point to well above 400.000 premature deaths in EU-28 each year due to particulate matter; more than 70.000 due to nitrogen dioxide.

3 out of 10 of the urban population citizens are exposed to particulate matter above EU standards; with 9 out of 10 exposed above WHO guidelines.

Air pollutants

Pollutant	Effects on human health
Sulphur dioxide (SO_2)	Can cause respiratory problems, leading to chronic bronchitis, can cause narrowing of the airways and can affect asthmatics.
Carbon monoxide (CO)	Interferes with blood's capacity to absorb and circulate oxygen. Worsens emphysema, chronic bronchitis and other lung disease. Can affect those suffering from heart disease and can have impacts on the central nervous system.
Nitrogen dioxide (NO_2)	Can cause respiratory disorders such as altered lung function, lung tissue damage, increased prevalence of acute respiratory illness. Young children and asthmatics are most at risk.
Ozone (O_3)	Can aggravate chronic respiratory diseases and can cause permanent lung damage. Can affect the eyes, nose and throat, as well as causing chest discomfort, coughing and headaches.
Benzene (C_6H_6)	Can cause cancer, anemia and injury to bone marrow.
Lead (Pb)	Can cause mental retardation, drowsiness and problems with the kidneys and reproduction system. Long term exposure interferes with normal development and functioning of the brain.
Particulate Matter (PM)	Can cause acute respiratory disorders and decrements in lung function and can lead to premature death.
Volatile organic compounds (VOCs)	Health effects are dependent upon the specific VOC, however a number of VOCs are known or suspected to cause cancer.

Health impact of air pollution



Health impact of air pollution

Table 10.1 Premature deaths attributable to $PM_{2.5}$, NO_2 and O_3 exposure in 41 European countries and the EU-28, 2016

		$PM_{2.5}$		NO_2		O_3	
Country	Population (1 000)	Annual mean (a)	Premature deaths (b)	Annual mean (a)	Premature deaths (b)	SOMO35 (a)	Premature deaths (b)
Austria	8 700	12.0	5 300	18.9	1 000	4 522	270
Belgium	11 311	12.7	7 600	21.7	1 600	2 203	180
Bulgaria	7 154	22.3	13 100	18.8	1 100	3 347	280
Croatia	4 191	19.4	5 300	15.2	260	4 996	190
Cyprus	1 184	13.7	580	24.0	240	5 612	30
Czechia	10 554	16.6	9 600	15.2	240	4 353	350
Denmark	5 707	9.2	2 700	10.4	80	2 293	90
Estonia	1 316	5.9	500	7.8	< 1	1 949	20
Finland	5 487	5.1	1 500	8.0	< 1	1 510	60
France	64 977	10.9	33 200	17.3	7 500	3 420	1 400
Germany	82 176	11.6	59 600	20.2	11 900	3 368	2 400
Greece	10 784	19.6	12 900	19.6	2 900	6 871	640
Hungary	9 830	17.5	12 100	16.6	770	3 952	380
Ireland	4 726	6.8	1 100	11.0	50	1 323	30
Italy	60 666	16.6	58 600	22.1	14 600	6 058	3 000
Latvia	1 969	10.9	1 700	12.0	60	2 773	60
Lithuania	2 889	11.8	2 600	11.7	20	2 456	70
Luxembourg	576	11.4	230	20.7	50	2 211	10
Malta	450	11.1	210	14.9	< 1	5 985	20
Netherlands	16 979	11.3	9 200	20.5	1 500	2 428	270
Poland	37 967	20.6	43 100	15.2	1 500	3 699	1 100
Portugal	9 809	8.3	4 900	15.3	610	4 074	320
Romania	19 761	16.8	23 400	17.6	2 600	2 485	490
Slovakia	5 426	17.6	4 800	13.5	20	4 232	160
Slovenia	2 064	16.0	1 700	15.4	70	5 007	70
Spain	44 145	11.1	24 100	20.0	7 700	5 212	1 500
Sweden	9 851	5.7	2 900	10.7	30	1 819	120
United Kingdom	65 379	9.5	31 800	21.8	11 800	1 161	530
Albania	2 876	22.3	5 100	13.7	70	5 475	180
Andorra	73	12.1	40	18.2	< 1	4 423	< 5
Bosnia and Herzegovina	3 516	28.7	5 400	13.2	20	4 409	120
Iceland	333	4.8	60	10.1	< 1	499	< 5
Kosovo	1 772	27.1	3 800	14.4	20	4 769	100
Liechtenstein	38	10.3	20	17.8	< 1	4 945	< 5
Monaco	38	14.3	30	26.8	10	7 186	< 5
Montenegro	622	20.3	630	11.9	< 1	5 269	20
North Macedonia	2 071	34.6	3 400	17.4	110	4 434	70
Norway	5 211	5.9	1 300	12.4	130	1 502	50
San Marino	33	14.3	30	16.3	< 1	5 667	< 5
Serbia	7 076	24.6	13 700	19.4	1 500	3 508	280
Switzerland	8 327	10.1	3 700	19.7	620	4 843	240
EU-28	**506 028**	**12.9**	**374 000**	**16.3**	**68 000**	**3 547**	**14 000**
Total	**538 014**	**14.4**	**412 000**	**16.3**	**71 000**	**3 811**	**15 100**

Figure 2.1 **Trends in EU-28 emissions, 2000-2017 (% of 2000 levels): (a) SO_X, NO_X, NH_3, PM_{10}, $PM_{2.5}$, NMVOCs, CO, CH_4 and BC. Also shown for comparison is EU-28 gross domestic product (GDP, expressed in chain-linked volumes (2010), % of 2000 level); (b) As, Cd, Ni, Pb, Hg and BaP**

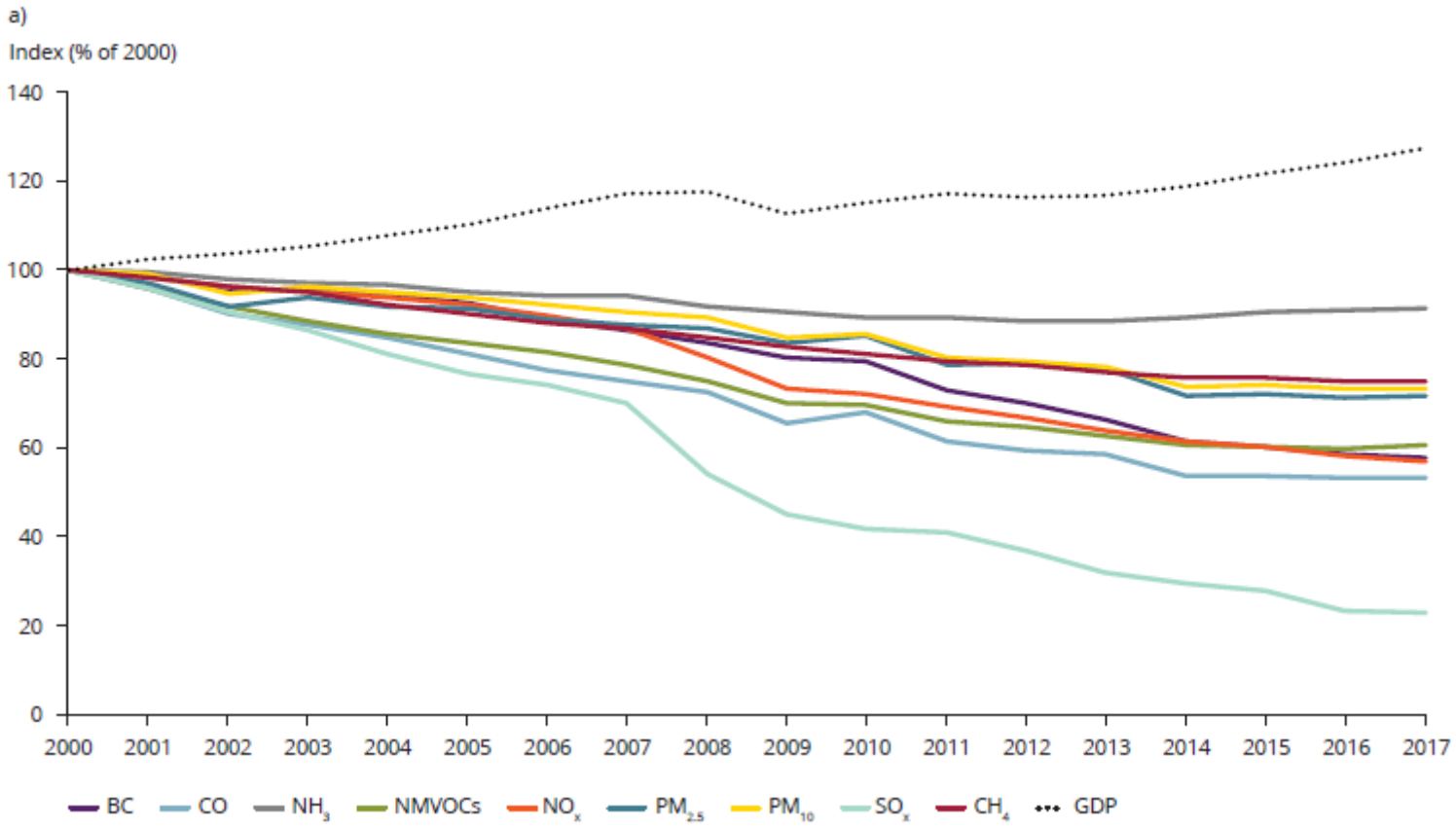
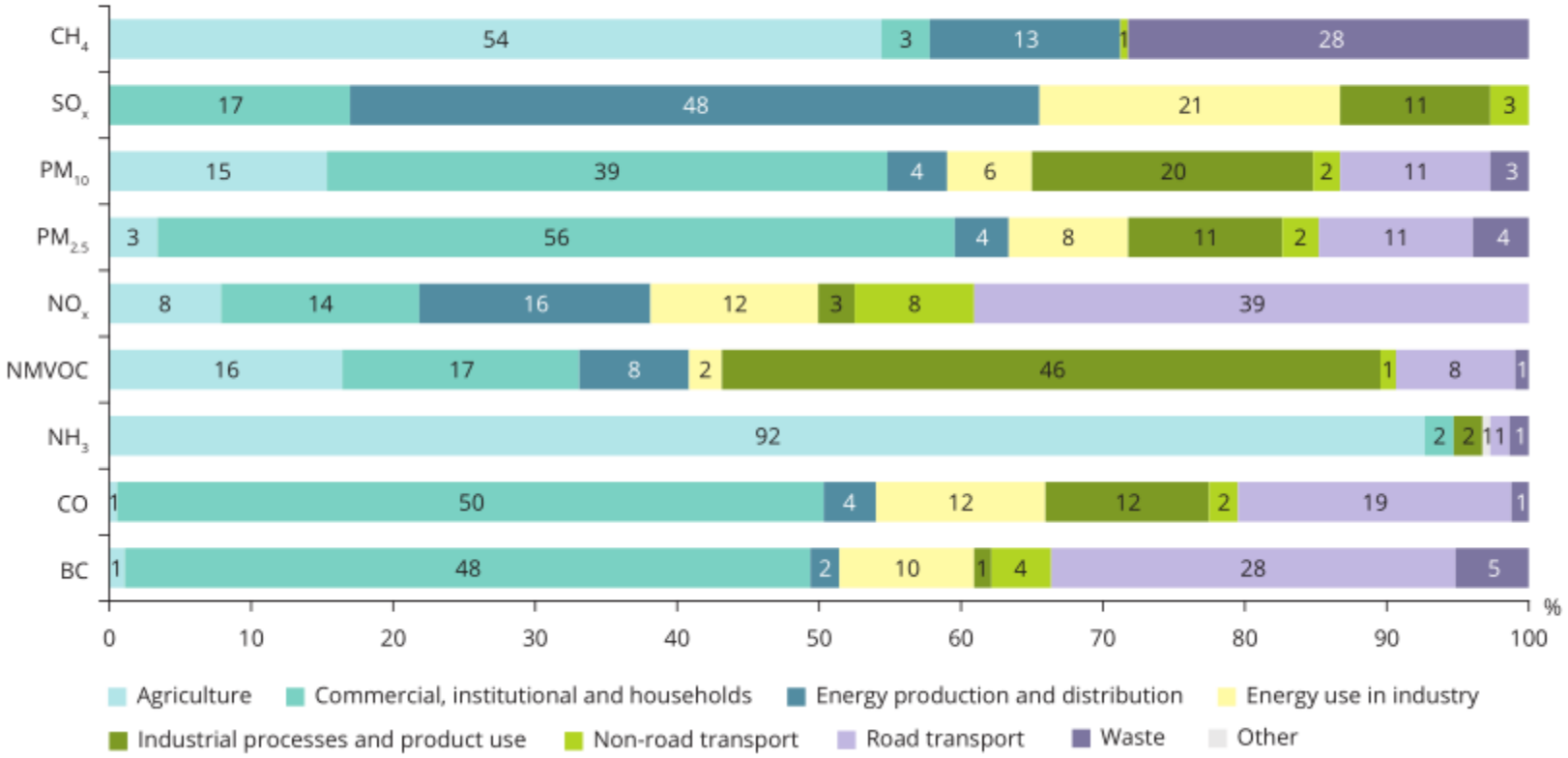


Figure 2.4 **Contribution to EU-28 emissions from the main source sectors in 2017 of SO_x, NO_x, primary PM_{10}, primary $PM_{2.5}$, NH_3, NMVOCs, CO, BC and CH_4**



Clean Air Policies in Europe – An Overview

The main European Union air policy instruments

- Ambient Air Quality Directives (AAQD): Maximum concentrations to be attained across the EU (SO2, NO2, PM10, benzene, lead, CO, O3, arsenic, cadmium, nickel, PM2.5 and BaP)

►B DIRECTIVE 2008/50/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL
of 21 May 2008
on ambient air quality and cleaner air for Europe
(OJ L 152, 11.6.2008, p. 1)

►B DIRECTIVE 2004/107/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL
of 15 December 2004
relating to arsenic, cadmium, mercury, nickel and polycyclic aromatic hydrocarbons in ambient air
(OJ L 23, 26.1.2005, p. 3)

- National Emission Ceilings Directive (NECD): National emission inventories and caps to limit transboundary pollution (SOx, NOx, NMVOC, and NH3)

DIRECTIVE (EU) 2016/2284 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL
of 14 December 2016
on the reduction of national emissions of certain atmospheric pollutants, amending Directive 2003/35/EC and repealing Directive 2001/81/EC
(Text with EEA relevance)

The main Member States air policy instruments

- Air Quality Plans & Programmes (AAQD)
- National Emission Inventories, Projections, and Measures, NAPCP (NECD)

Clean Air Policies in Europe – An Overview

Table 1.1 **Air quality standards for the protection of health, as given in the EU Ambient Air Quality Directives**

Pollutant	Averaging period	Legal nature and concentration	Comments
PM_{10}	1 day	Limit value: 50 µg/m³	Not to be exceeded on more than 35 days per year
	Calendar year	Limit value: 40 µg/m³	
$PM_{2.5}$	Calendar year	Limit value: 25 µg/m³	
		Exposure concentration obligation: 20 µg/m³	Average exposure indicator (AEI) (a) in 2015 (2013-2015 average)
		National exposure reduction target: 0-20 % reduction in exposure	AEI (a) in 2020, the percentage reduction depends on the initial AEI
O_3	Maximum daily 8-hour mean	Target value: 120 µg/m³	Not to be exceeded on more than 25 days/year, averaged over 3 years (b)
		Long-term objective: 120 µg/m³	
	1 hour	Information threshold: 180 µg/m³	
		Alert threshold: 240 µg/m³	
NO_2	1 hour	Limit value: 200 µg/m³	Not to be exceeded on more than 18 hours per year
		Alert threshold: 400 µg/m³	To be measured over 3 consecutive hours over 100 km² or an entire zone
	Calendar year	Limit value: 40 µg/m³	
BaP	Calendar year	Target value: 1 ng/m³	Measured as content in PM_{10}
SO_2	1 hour	Limit value: 350 µg/m³	Not to be exceeded on more than 24 hours per year
		Alert threshold: 500 µg/m³	To be measured over 3 consecutive hours over 100 km² or an entire zone
	1 day	Limit value: 125 µg/m³	Not to be exceeded on more than 3 days per year
CO	Maximum daily 8-hour mean	Limit value: 10 mg/m³	
C_6H_6	Calendar year	Limit value: 5 µg/m³	
Pb	Calendar year	Limit value: 0.5 µg/m³	Measured as content in PM_{10}
As	Calendar year	Target value: 6 ng/m³	Measured as content in PM_{10}
Cd	Calendar year	Target value: 5 ng/m³	Measured as content in PM_{10}
Ni	Calendar year	Target value: 20 ng/m³	Measured as content in PM_{10}

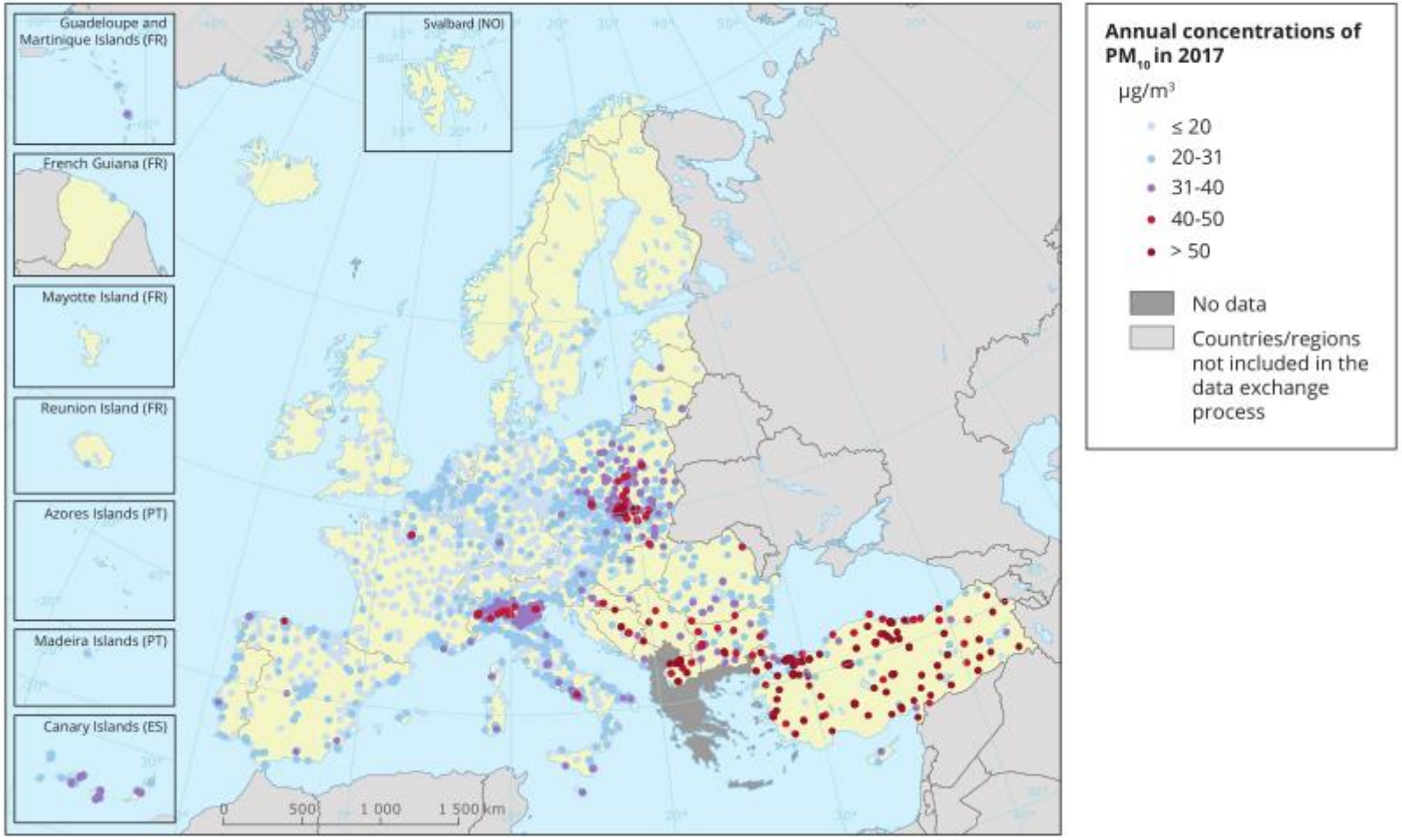
Clean Air Policies in Europe – An Overview

Table 1.3 **World Health Organization (WHO) air quality guidelines (AQGs) and estimated reference levels (RLs) ([a])**

Pollutant	Averaging period	AQG	RL	Comments
PM_{10}	1 day	50 µg/m³		99th percentile (3 days per year)
	Calendar year	20 µg/m³		
$PM_{2.5}$	1 day	25 µg/m³		99th percentile (3 days per year)
	Calendar year	10 µg/m³		
O_3	Maximum daily 8-hour mean	100 µg/m³		
NO_2	1 hour	200 µg/m³		
	Calendar year	40 µg/m³		
BaP	Calendar year		0.12 ng/m³	
SO_2	10 minutes	500 µg/m³		
	1 day	20 µg/m³		
CO	1 hour	30 mg/m³		
	Maximum daily 8-hour mean	10 mg/m³		
C_6H_6	Calendar year		1.7 µg/m³	
Pb	Calendar year	0.5 µg/m³		
As	Calendar year		6.6 ng/m³	
Cd	Calendar year	5 ng/m³ ([b])		
Ni	Calendar year		25 ng/m³	

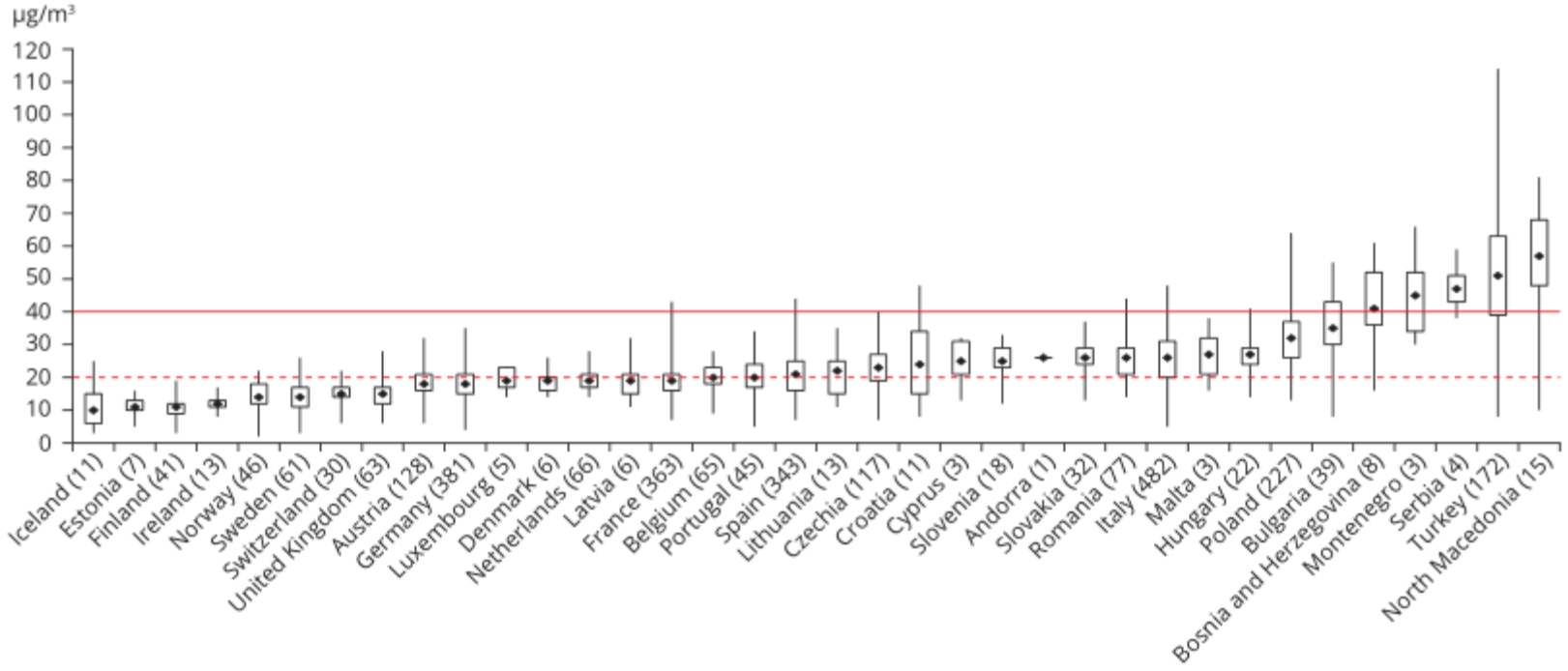
Where is air pollution a problem?

Map 3.2 **Concentrations of PM_{10}, 2017 — annual limit value**



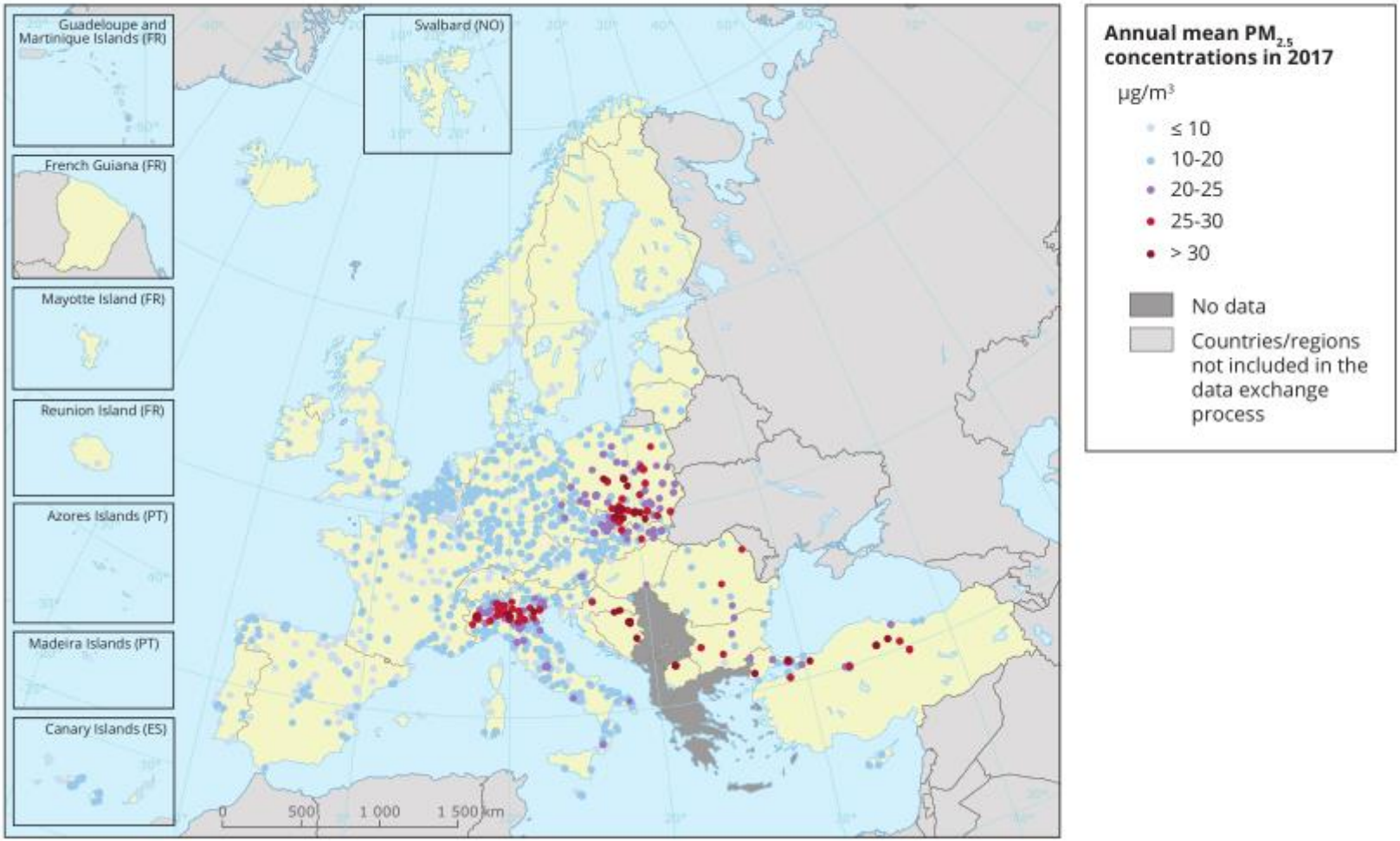
Where is air pollution a problem?

Figure 3.2 PM_{10} concentrations in relation to the annual limit value in 2017 and number of stations considered for each country



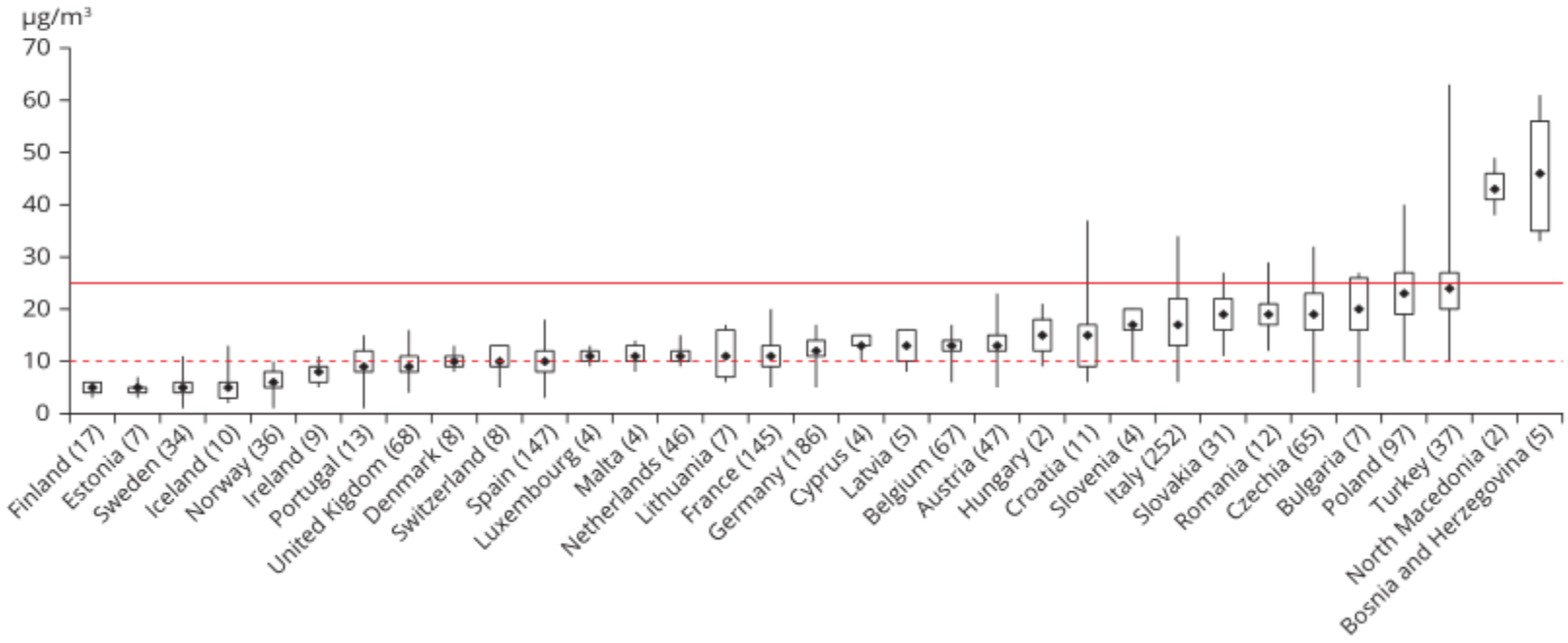
Where is air pollution a problem?

Map 3.3 **Concentrations of $PM_{2.5}$, 2017 — annual limit value**



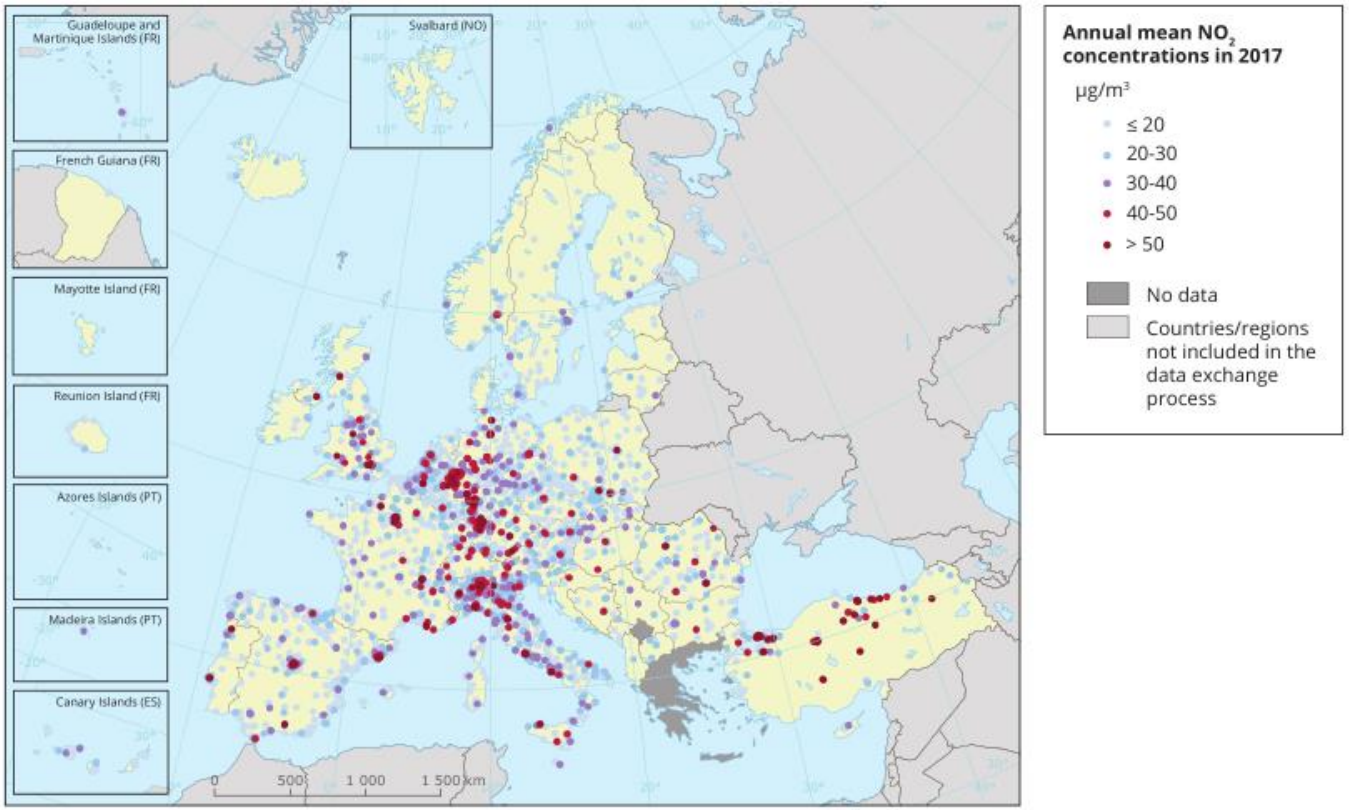
Where is air pollution a problem?

Figure 3.3 **$PM_{2.5}$ concentrations in relation to the annual limit value in 2017 and number of stations considered for each country**



Where is air pollution a problem?

Map 5.1 Concentrations of NO_2, 2017

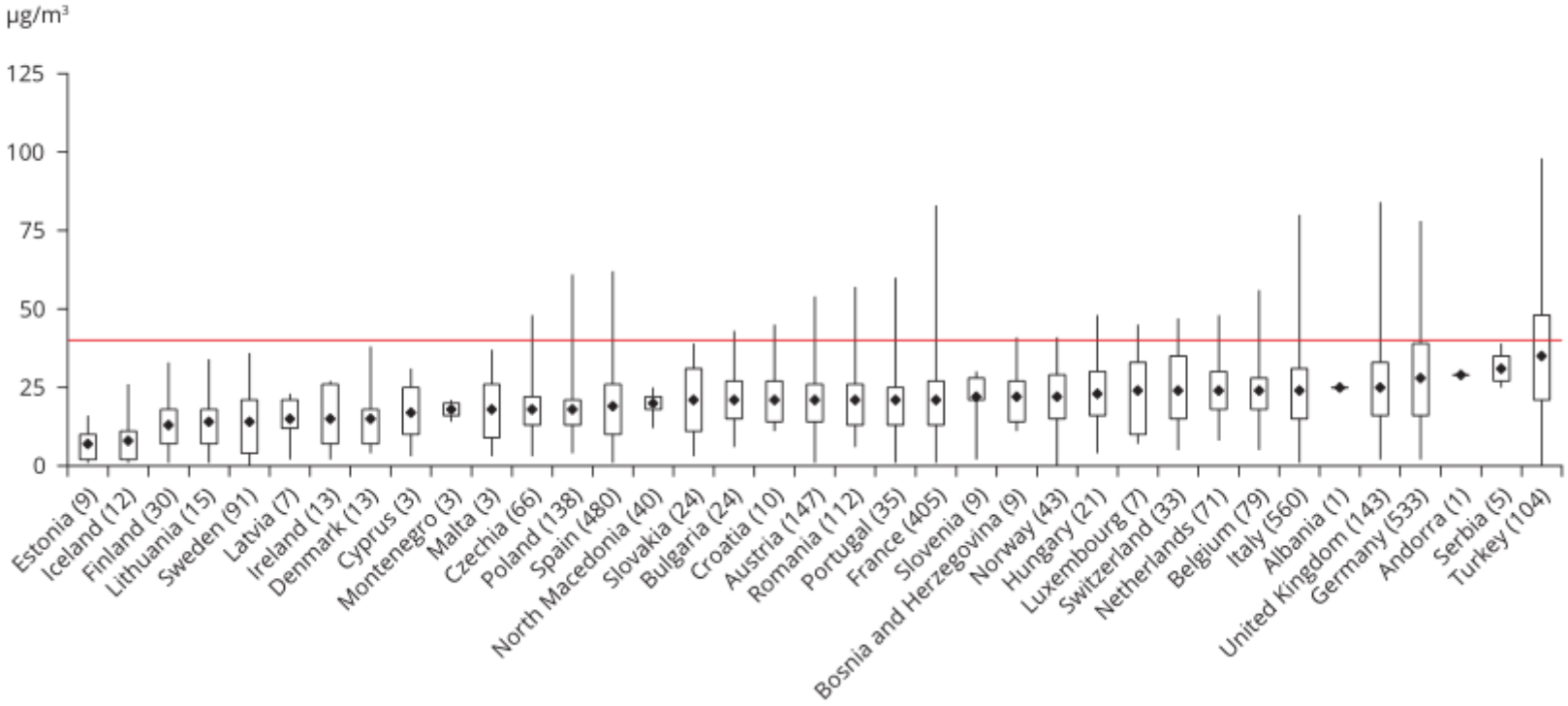


Note: Observed concentrations of NO_2 in 2017. Dots in the last two colour categories correspond to values above the EU annual limit value and the identical WHO AQG (40 µg/m³). Only stations with more than 75 % of valid data have been included in the map.

Source: EEA, 2019c.

Where is air pollution a problem?

Figure 5.1 NO_2 concentrations in relation to the annual limit value in 2017 and number of stations considered for each country



Urban population exposure

Table ES.1 **Percentage of the urban population in the EU-28 exposed to air pollutant concentrations above certain EU and WHO reference concentrations (minimum and maximum observed between 2015 and 2017)**

Pollutant	EU reference value (a)	Urban population exposure (%)	WHO AQG (a)	Exposure estimate (%)
PM_{10}	Day (50)	13-19	Year (20)	42-52
$PM_{2.5}$	Year (25)	6-8	Year (10)	74-81
O_3	8-hour (120)	12-29	8-hour (100)	95-98
NO_2	Year (40)	7-8	Year (40)	7-8
BaP	Year (1)	17-20	Year (0.12) RL	83-90
SO_2	Day (125)	< 1	Day (20)	21-31

Key	< 5 %	5-50 %	50-75 %	> 75 %

Clean air for all… there are effective measures

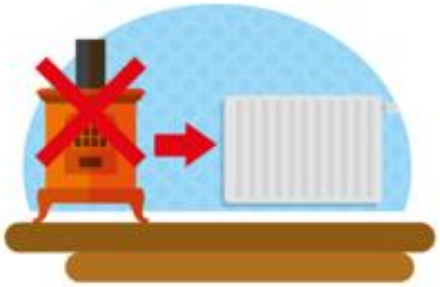
Examples for PM_{10}

Boosting **energy efficiency** by refurbishing buildings

Implementing **cleaner industrial processes**

Reliable, affordable and clean **public transport** such as electric buses and trams and new Euro VI

City or district heating, using heat from existing industry or renewable energy sources



Promoting substitution of old, dirty **stoves and boilers** with clean models, and banning **dirty fuels for household heating/cooking**

Clean air for all… there are effective measures

Examples for NO_2

Reliable, affordable and clean **public transport** such as electric buses and trams and new Euro VI

Extensive and safe **cycling networks**, abundant bike-parking facilities with easy access to public transport

Traffic restrictions such as low-emission zones, reduced speed limits and congestion charges

Implementing **cleaner industrial processes**

Cleaner transport such as electric cars or buses and **retrofitted dirty vehicles and ships**

Clean air for all… there are effective measures

Health benefits of cleaner air

Reducing **particulate matter**, **nitrogen dioxide** and **ozone** would have the biggest health benefits

Breathing problems and **heart disease** are less common when there are fewer small particles in the air

Cleaner transport reduces car exhaust fumes, which irritate the **eyes**, **nose and throat** and **can cause lung cancer**

Less ozone pollution is better for our **lungs and heart**

Less **nitrogen dioxide** in the air we breathe benefits our **liver**, **spleen** and **red blood cells**

Renewable energy and city or district heating significantly reduce **local air** pollution

THANKS

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Clean Air Policies in Europe – An Overview

Table 1.2 **Air quality standards, for the protection of vegetation, as given in the EU Ambient Air Quality Directive and the Convention on Long-range Transboundary Air Pollution (CLRTAP)**

Pollutant	Averaging period	Legal nature and concentration	Comments
O_3	AOT40 ([a]) accumulated over May to July	Target value, 18 000 µg/m³·hours	Averaged over 5 years ([b])
		Long-term objective, 6 000 µg/m³·hours	
	AOT40 ([a]) accumulated over April to September	Critical level for the protection of forests: 10 000 µg/m³·hours	Defined by the CLRTAP
NO_X	Calendar year	Vegetation critical level: 30 µg/m³	
SO_2	Winter	Vegetation critical level: 20 µg/m³	1 October to 31 March
	Calendar year	Vegetation critical level: 20 µg/m³	