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COMMISSION STAFF WORKING DOCUMENT

FITNESS CHECK
of the

Ambient Air Quality Directives

Directive 2004/107/EC relating to arsenic, cadmium, mercury, nickel and polycyclic aromatic hydrocarbons in ambient air

and

Directive 2008/50/EC on ambient air quality and cleaner air for Europe

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GLOSSARY

<i>Term or acronym</i>	<i>Meaning or definition</i>
Policies	
AAQ Directives	Ambient Air Quality Directives (Directive 2008/50/EC and Directive 2004/107/EC as amended by Commission Directive (EU) 2015/1480)
NEC Directive	Directive on the reduction of national emissions of certain atmospheric pollutants (Directive (EU) 2016/2284)
IED Directive	Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial emissions (integrated pollution prevention and control)
CAP	EU common agricultural policy
Air Convention (CLRTAP)	UNECE Air Convention (Convention on Long-Range Transboundary Air Pollution)
MARPOL	International Convention for the Prevention of Pollution from Ships
Pollutants	
SO ₂	Sulphur dioxide
NO ₂	Nitrogen dioxide
NO _x	Nitrogen oxides (i.e. sum of NO and NO ₂)
PM ₁₀	Particulate matter, aerodynamic diameter < 10 µm
PM _{2.5}	Fine particulate matter, aerodynamic diameter < 2.5 µm
O ₃	Ozone
C ₆ H ₆	Benzene
Pb	Lead
CO	Carbon monoxide
As	Arsenic
Cd	Cadmium
Ni	Nickel
BaP	Benzo(a)pyrene

Units	
mg/m ³	Milligram(s) per cubic metre (= 1 000 µg/m ³)
µg/m ³	Microgram(s) per cubic metre (= 1 000 ng/m ³)
ng/m ³	Nanogram(s) per cubic metre
EUR	Euro
USD	US Dollar
Abbreviations	
ECA	European Court of Auditors
EEA	European Environment Agency
EUROSAI	European Organisation of Supreme Audit Institutions
GAINS	Greenhouse gas – Air pollution Interactions and Synergies Model of IIASA
IIASA	International Institute for Applied Systems Analysis
JRC	European Commission Joint Research Centre
NGO	Non-governmental organisation
OECD	Organisation for Economic Co-operation and Development
UNECE	United Nations Economic Commission for Europe
WHO	World Health Organization

1. INTRODUCTION: PURPOSE AND SCOPE

Air pollution has decreased across Europe over the past decades, as emissions of many pollutants have been curbed successfully thanks to joint efforts by the EU and national, regional and local authorities. As a result, since 2000, emissions of the main air pollutants decreased by 10% to 70% depending on the pollutant.¹ Yet, in most Member States, the quality of life of EU citizens remains hampered, as air quality standards, especially for particulate matter and nitrogen dioxide, are still not being met.

Poor air quality is a cause of chronic and serious diseases such as asthma, respiratory and cardiovascular problems, or lung cancer. According to the latest data by the World Health Organization, air pollution levels remain dangerously high in many parts of the world, with 9 out of 10 people breathing air containing high levels of pollutants.² Air pollution continues to be the number one environmental health problem in the EU, with estimates reliably pointing to more than 400 000 premature deaths per year.³

To address this, the EU has set, by means of legislation adopted by the Council and the European Parliament, the goal to achieve levels of air quality that do not give rise to negative impacts on, and risks to, human health and the environment.⁴ This comprises a three-pronged EU Clean Air policy framework, which (i) sets air quality standards as regards concentration levels of pollutants in the ambient air,⁵ (ii) establishes national emission reduction commitments for key pollutants,⁶ and (iii) comprises emissions standards for key sources of pollution.⁷ (See Figure 1)

This fitness check focuses on a subset of this framework: it assesses the performance of the two complementary EU Ambient Air Quality (AAQ) Directives (2008/50/EC and 2004/107/EC, as augmented by Commission Directive (EU) 2015/1480). These Directives set air quality standards not to be exceeded throughout the EU, and requirements to ensure that Member States adequately monitor and/or assess air quality in a harmonised and comparable manner. They are complemented by an Implementing Decision laying down the rules for reciprocal exchange of information and reporting on ambient air quality.⁸

¹ COM(2018)330. 'A Europe that protects: Clean air for all'.

² WHO: [https://www.who.int/news-room/fact-sheets/detail/ambient-\(outdoor\)-air-quality-and-health](https://www.who.int/news-room/fact-sheets/detail/ambient-(outdoor)-air-quality-and-health) (accessed on 24 May 2019).

³ EEA Report 10/2019. 'Air quality in Europe – 2019 report'.

⁴ Decision 1600/2002/EC.

⁵ Directives 2004/107/EC and 2008/50/EC, as amended by Commission Directive (EU) 2015/1480.

⁶ Directive 2016/2284/EU.

⁷ Including Directives 2010/75/EU (on industrial emissions), 2015/2193/EU (on medium combustion plants), 97/70/EC (on fuel quality), 2016/802/EU (on sulphur content in liquid fuels), 2009/125/EC (on ecodesign), as well as EC Regulations 443/2009 and 510/2011 (on emission standards for vehicles), Regulations (EU) 2016/427, (EU) 2016/646, and (EU) 2017/1154 (on real driving emissions), and Regulation (EU) 2016/1628 (on non-road mobile machinery).

⁸ Implementing Decision 2011/850/EU.

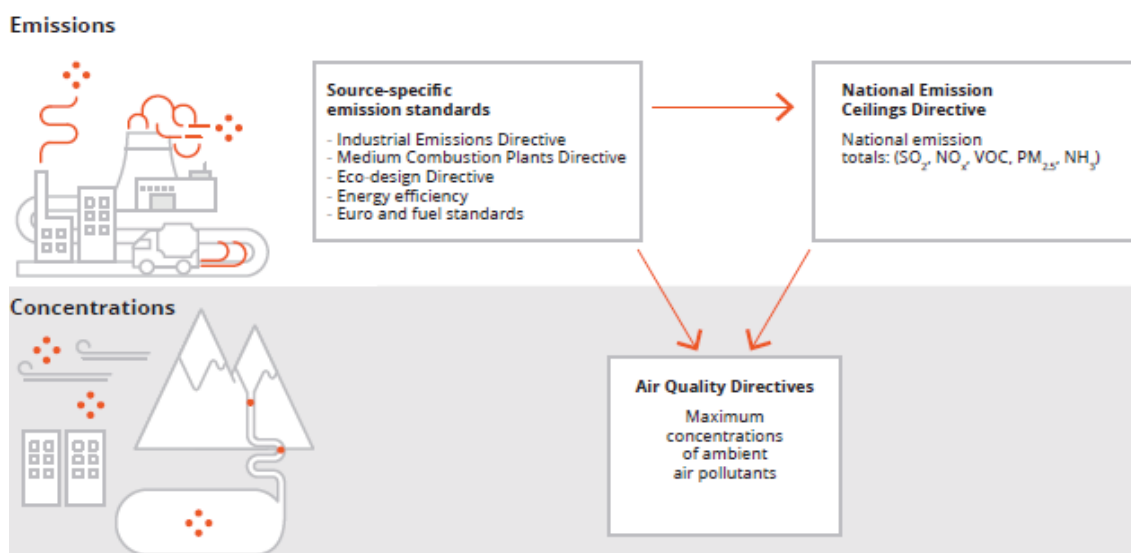


Figure 1 – The EU Clean Air Policy framework

In line with the principles of Better Regulation, this fitness check assesses whether the EU actions enshrined in these pieces of legislation have achieved their objectives without entailing disproportionate costs and continue to be justified. The AAQ Directives themselves do not include a formal requirement for a comprehensive evaluation at a specific moment. However, an evaluation is timely for several reasons:

- (1) Despite decreases in emissions of air pollutants over the last decades and improved air quality, still more than one-in-six inhabitants of urban areas in the EU are exposed to air pollution concentrations above EU air quality standards.⁹ The ‘Clean Air Programme for Europe’¹⁰ in 2013 put forward a strategic ambition to achieve full compliance with existing air quality standards across the EU as soon as possible, and by 2020 at the latest. In 2018, a Communication on ‘Clean Air for All’¹¹ outlined possible additional measures. Yet, as of 2019, significant compliance gaps remain.
- (2) The air quality standards set in the AAQ Directives have been in place for almost two decades, as most of them were ‘inherited’ from predecessor legislation (see Annex 4 to this SWD), and were last reviewed in 2005 in the context of the Thematic Strategy on Air Pollution.¹² Since their original conception, the evidence base regarding health and environmental impacts has evolved: the Air Quality Guidelines of the World Health Organization are, in most instances, more stringent than EU air quality standards (it is to be noted that the Guidelines are currently being updated by the World Health Organization). Also knowledge about the impacts of air pollution on ecosystems, and vice-versa, has increased.¹³

⁹ EEA Report 10/2019. ‘Air quality in Europe – 2019 report’.

¹⁰ COM(2013)918. ‘A Clean Air Programme for Europe’.

¹¹ COM(2018)330. ‘A Europe that protects: Clean air for all’.

¹² COM(2005)446. ‘Thematic Strategy on air pollution’.

¹³ Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES).

- (3) Over the past decade, both the policy context and the technical feasibility of effective air quality measures have evolved. Relevant policy developments on emission sources include the policy packages on Energy Union, Low Emission Mobility and climate objectives, as well as the implementation of specific new tools and instruments to utilise the full potential of existing source control legislation (i.a. by reducing sulphur emissions of certain marine fuels, and improving the effectiveness of vehicle emission standards, including through Real Driving Emission testing).
- (4) Public interest and concern about air pollution continues to be pronounced and has increased over the period covered by this fitness check. In 2013, a majority (56%) of Europeans held the opinion that air quality had deteriorated over the preceding 10 years.¹⁴ Also, in 2017, a relative majority (47%) of Europeans held this opinion – and, just behind climate change, air pollution is the environmental issue that is considered the most important.¹⁵ This is also reflected in the high media coverage air pollution receives in most Member States, and especially in those that have been reporting exceedances of EU air quality standards.

This fitness check draws on experience in, and data from, all Member States, focusing on the period from 2008 to 2018 as this is the period when both Directives were in force. The analysis covers all articles and provisions of the two AAQ Directives, looking at the role they have played in meeting the objectives. Thereby, this fitness check complements and builds on the extensive analysis developed as part of the 2013 air policy review, which informed the Clean Air Programme for Europe and the national emission reduction commitments established under Directive 2016/2284/EU (note: the date of transposition for this Directive was 1 July 2018, and it has not been included in this fitness check).

In particular, this fitness check addresses the following four overarching topics:

- *The extent to which the AAQ Directives have successfully defined methods to monitor and assess air quality, to ensure that representative and high quality assessment regimes are in place in all Member States.*
- *The extent to which the AAQ Directives have established clear and actionable air quality standards that are in accordance with scientific advice to minimise harmful effects on human health and ecosystems.*
- *The extent to which the AAQ Directives have helped ensure that reliable, objective and comparable information on air quality and the attainment of air quality standards is made public and reported to the Commission.*
- *The extent to which the AAQ Directives have facilitated action to avoid, prevent or reduce the adverse effects of poor air quality, and triggered air quality plans that have led to measurable improvements of air quality.*

¹⁴ European Commission (2013). Flash Eurobarometer 360: ‘Attitudes of Europeans towards air quality’.

¹⁵ European Commission (2017). Special Eurobarometer 468: ‘Attitudes of European citizens towards the environment’.

The findings of this fitness check will be used to inform further reflections on whether the AAQ Directives continue to provide the appropriate legislative framework to ensure protection from adverse impacts on, and risks to, human health and the environment.

2. BACKGROUND TO THE INTERVENTION

2.1. Description of the intervention and its objectives

The EU Ambient Air Quality (AAQ) Directives are guided by the overarching need to reduce air pollution to levels which minimise harmful effects on human health, the environment as a whole and the economy, taking into account relevant guidelines i.a. by the World Health Organization. A basis for effective air pollution reduction is proper monitoring and assessment of air quality, whereas providing information to the public can support the minimisation of harmful health effects and help raise awareness.

Figure 2 provides an overview of how the overarching needs for health, environment and economy translate into the AAQ Directives' key objectives, and how they require input and activities both at EU and at Member State level. This intervention logic can be summarised along four main strands.

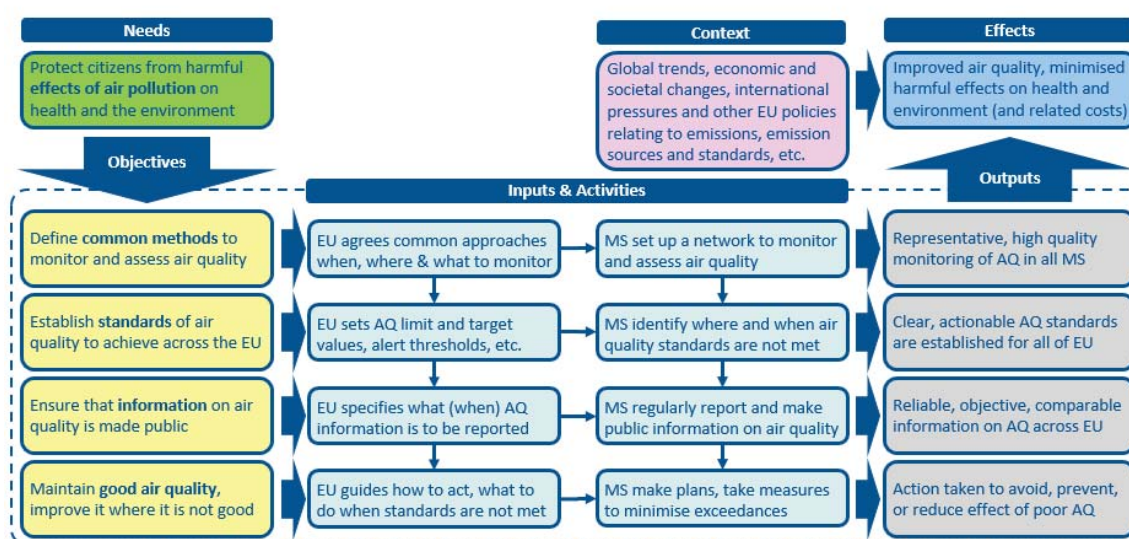


Figure 2 – Intervention logic of the EU Ambient Air Quality (AAQ) Directives

First, the AAQ Directives set common methods and criteria to assess air quality in all Member States in a comparable and reliable manner: Member States must designate zones and agglomerations¹⁶ throughout their territory, classify them according to prescribed assessment thresholds, and provide air quality assessments underpinned by measurement, modelling and/or objective estimation, or a combination of these.

Second, the AAQ Directives define and establish objectives and standards for ambient air quality for 13 air pollutants to be attained by all Member States across their territories against timelines laid out in the Directives. These are: sulphur dioxide (SO₂), nitrogen dioxide (NO₂) and nitrogen oxides (NO_x), particulate matter (PM₁₀ and PM_{2.5}), ozone (O₃), benzene, lead, carbon monoxide, arsenic, cadmium, nickel, and benzo(a)pyrene.

¹⁶ According to Directive 2008/50/EC a 'zone' shall mean part of the territory of a Member State, as delimited by that Member State for the purposes of air quality assessment and management; 'agglomeration' shall mean a zone that is a conurbation with a population in excess of 250 000 inhabitants or above a given population density per km² to be established by the Member States.

Third, the Directives require Member States to monitor air quality in their territory. Member States need to report to the Commission as well as to the general public, the results of air quality assessment on an annual basis, ‘up-to-date’ air quality measurements, as well as information on the plans and programmes they establish. It is the responsibility of Member States to approve the measurement systems required and ensure the accuracy of measurements.

Fourth, where the established standards for ambient air quality are not met, the Directives require Member States to prepare and implement air quality plans and measures (for these pollutants exceeding the standards). These air quality plans need to identify the main emission sources responsible for pollution, detail the factors responsible for exceedances, and spell out abatement measures adopted to reduce pollution. Abatement measures can include, for example, measures to reduce emissions from stationary sources (such as industrial installations or power plants, as well as medium and small size combustion sources, including those using biomass) or from mobile sources and vehicles (including through retrofitting with emission control equipment), measures to limit transport emissions through traffic planning or encouraging shifts towards less polluting modes (including congestion pricing or low emission zones), promoting the use of low emission fuels, or using economic and fiscal instruments to discourage activities that generate high emissions.

Guided by the principle of subsidiarity, the AAQ Directives leave the choice of means to achieve their air quality standards to the Member States, but explicitly require that exceedance periods are kept as short as possible.

2.2. Air quality policy context prior to 2008

Air quality has been understood as a key environmental challenge for several decades. EU level policy interventions started already in the 1980s and expanded in the late 1990s and 2000s. Most of the provisions found in the currently applicable versions of the AAQ Directives were originally established either via the Air Quality Framework Directive in 1996 or in one of the four Daughter Directives adopted between 1999 and 2004.¹⁷

Previous policy interventions already led to the establishment of most of the EU air quality standards applicable today as well as of a comprehensive monitoring network. By 2005, Member States were monitoring air quality at around 3 000 locations and routinely disseminated this information to the public and the Commission (albeit not using a system of electronic reporting based on a shared information system yet).¹⁸

In 2005, the Thematic Strategy on Air Pollution presented a detailed assessment of the situation at the time as basis for a revision of EU Clean Air Policy. It concluded that “*air pollution continues to diminish the health and quality of life of EU citizens as well as the*

¹⁷ Air Quality Framework Directive (96/62/EC), and its First (1999/30/EC on limit values for sulphur dioxide, nitrogen dioxide and oxides of nitrogen, particulate matter and lead in ambient air), Second (2000/69/EC on limit values for benzene and carbon monoxide in ambient air) and Third (2002/3/EC on ozone in ambient air) Daughter Directives. The current Directive 2004/107/EC was originally conceived as the Fourth Daughter Directive. See also Annex 4.

¹⁸ SEC(2005)1132. ‘Thematic Strategy on air pollution’.

natural environment. The magnitude of these effects is too large to ignore and doing nothing more beyond implementing existing legislation is not a sensible option."¹⁹

As regards the AAQ Directives specifically, the Thematic Strategy included a legislative proposal to combine the Air Quality Framework Directive and first three Daughter Directives, while suggesting that the fourth Daughter Directive (see Annex 4 to this SWD) would be *'merged later through a simplified "codification" process'*.²⁰ The strategy foresaw three main actions to be implemented in a revised AAQ Directive:

- *Addressing specific implementation problems:* Experience had shown that there were zones suffering from acute and exceptional problems. Therefore, as part of the proposal, it was suggested to allow Member States to request an extension to the deadline for compliance in affected zones if they could demonstrate that they had taken all reasonable measures and put in place plans to move towards compliance.²¹
- *Modernising monitoring and reporting:* It was proposed to move to a system of electronic reporting based on a shared information system.²² Furthermore the Impact Assessment assumed that the proposed regulation would require an additional 800 to 1 200 sampling points for PM_{2.5} (and, at the same time, noted scope to reduce the overcapacity of some 500 SO₂ sampling points identified).
- *Control of human exposure to PM_{2.5} in ambient air:* The Thematic Strategy found, that in addition to the existing controls on PM₁₀, there was a need to cap unduly high risks from exposure to PM_{2.5} and to reduce the general exposure of citizens everywhere. A cap of 25 µg/m³ was proposed which was deemed unlikely to impose additional burdens except in the most polluted areas of the EU.

The impact assessment of the Thematic Strategy assumed that both the AAQ Directives and previous NEC Directive²³ would be revised concurrently, to ensure simultaneous reduction of emissions and background concentrations of several air pollutants: nitrogen oxides (NO_x), sulphur dioxide (SO₂), volatile organic compounds (VOC), ammonia (NH₃) and fine particulate matter (PM_{2.5}). It was estimated that this would decrease the total number of years of life lost by 42% by the year 2020 compared to 2000.

This impact assessment also concluded that the Commission's proposal to reduce PM_{2.5} background concentrations between 2010 and 2020 would render monetized benefits of at least EUR 37 billion (and up to EU 119 billion) per year by the year 2020, while the costs of implementation were estimated at between EUR 5 and 8 billion per year.²⁴

It should be stressed that these estimates were explicitly based on the assumption that emissions of air pollutants would be reduced via a revised NEC Directive in immediate

¹⁹ SEC(2005)1132. 'Thematic Strategy on air pollution'.

²⁰ SEC(2005)1133. 'Thematic Strategy on air pollution: Impact Assessment'.

²¹ Note that this relates to Article 22 of Directive 2008/50/EC, which introduced postponement of attainment under specific conditions. Any related exemptions, however, have since expired.

²² Note that this was established by Implementing Decision 2011/850/EU.

²³ Directive 2001/81/EC.

²⁴ SEC(2005)1133. 'Thematic Strategy on air pollution: Impact Assessment'.

follow-up to the Thematic Strategy.²⁵ Accordingly, no bespoke assessment for the costs and benefits of the AAQ Directives alone was carried out at the time.²⁶

2.3. Points of comparison and baseline

The AAQ Directives and its predecessor legislation have established clear EU air quality standards in the form of limit values and target values (see Table 1).²⁷ These EU air quality standards provide a benchmark and point of comparison against which to assess improvements in air quality over the past ten years. Section 3.2 and Annex 7 provide further points of comparison in the form of key air quality indicators.

Table 1 – Air quality standards for different pollutants according to the AAQ Directives

Pollutant	Concentration	Averaging period	Legal nature	Date entering into force	Permitted exceedances each year
Sulphur dioxide (SO ₂)	350 µg/m ³	1 hour	Limit value	1.1.2005	24
	125 µg/m ³	24 hours	Limit value	1.1.2005	3
Particulate matter (PM ₁₀)	50 µg/m ³	24 hours	Limit value	1.1.2005 **	35
	40 µg/m ³	1 year	Limit value	1.1.2005 **	n/a
Fine particulate matter (PM _{2.5})	25 µg/m ³	1 year	Target value	1.1.2010	n/a
			Limit value	1.1.2015	n/a
Nitrogen dioxide (NO ₂)	200 µg/m ³	1 hour	Limit value	1.1.2010 *	18
	40 µg/m ³	1 year	Limit value	1.1.2010 *	n/a
Lead (Pb)	0.5 µg/m ³	1 year	Limit value	1.1.2005 ***	n/a
Carbon monoxide (CO)	10 mg/m ³	Max daily 8 hour mean	Limit value	1.1.2005	n/a
Ozone	120 µg/m ³	Max daily 8 hour mean	Target value	1.1.2010	25 days averaged over 3 years
Benzene	5 µg/m ³	1 year	Limit value	1.1.2010 **	n/a
Arsenic (As)	6 ng/m ³	1 year	Target value	31.12.2012	n/a
Cadmium (Cd)	5 ng/m ³	1 year	Target value	31.12.2012	n/a
Nickel (Ni)	20 ng/m ³	1 year	Target value	31.12.2012	n/a
Benzo(a)pyrene (BaP)	1 ng/m ³	1 year	Target value	31.12.2012	n/a
*Under Directive 2008/50/EU, the Member States could apply for a postponement of a maximum of five years (i.e. maximum up to 2015) in specific zones; subject to an assessment by the Commission.					
**Under Directive 2008/50/EU, Member States were able to apply for an exemption to apply these limit until 11 June 2011 in specific zones; subject to assessment by the Commission.					
*** Or 1.1.2010 in the immediate vicinity of specific, notified industrial sources; and a 1.0 µg/m ³ limit value applied from 1.1.2005 to 31.12.2009.					

²⁵ Note that the NEC Directive, i.e. Directive 2001/81/EC, was not revised at the time. It was, however, subsequently revised in 2016; see Directive (EU) 2016/2284. This should now help delivering a sustained downward trend in air pollutant emissions in a 2030 and beyond perspective, and reduce the negative health impacts of air pollution by more than 50% by the year 2030 compared to 2005.

²⁶ SEC(2005)1133. ‘Thematic Strategy on air pollution: Impact Assessment’.

²⁷ In addition to limit values and target values, other types of air quality standards have been established in the form of critical levels, long-term objectives, alert thresholds and information thresholds, depending on the pollutant. The differences between these types of air quality standards are described in further detail below, see Table 1 and Box 1

Box 1 – A typology of EU Air Quality Standards

The AAQ Directives deploy a number of different types of air quality standards for the different pollutants they cover. All of these standards have been set on the basis of scientific knowledge, with the aim of avoiding, preventing or reducing harmful effects on human health and/or the environment as a whole, but their formats and purposes differ. These differences are motivated in part by different levels to which Member States can address the respective air pollutants and their underlying emissions on their own territories.

Limit values are to be attained within a given period and not to be exceeded once attained – set for particulate matter, sulphur dioxide, nitrogen dioxide, benzene, carbon monoxide, and lead.

Target values are to be attained *where possible* over a given period by taking all necessary measures *not entailing disproportionate costs* – set for ozone, benzo(a)pyrene, arsenic, cadmium, nickel (also for fine particulate matter standards were initially established as target values before becoming limit values). One reason for setting target values rather than limit values is to take account of the specific formation mechanisms, for example in the case of ozone (also due to a strong role of transboundary sources and annual variations in meteorology for this air pollutants).

Critical Levels refer to concentrations, above which direct adverse effects may occur on some receptors, such as trees, other plants or natural ecosystems but not on humans – set for sulphur oxides and for oxides of nitrogen.

Long-Term Objectives are set to be attained in the long term, save where not achievable through proportionate measures – set for ozone only.

Alert thresholds are levels beyond which there is a risk to human health from brief exposure for the population as a whole and at which immediate steps are to be taken by the Member States – set for sulphur dioxide, nitrogen dioxide, and ozone. And for ozone only, *information thresholds* set a level lower than the alert threshold beyond which there is a risk for particularly sensitive persons and appropriate information is needed.

In addition, the *Average Exposure Indicator* provides an average level determined on the basis of measurements at urban background locations which reflects population exposure. It is used to calculate national exposure reduction targets (in percent) for each Member State. This has been established only for fine particulate matter (PM_{2.5}).

An assessment of the state of air quality in 2008,²⁸ provides a pollutant by pollutant baseline of the number and magnitude of exceedances at the time (see also Section 3.2 and Annex 7):

- ***Sulphur dioxide (SO₂)*** showed an ongoing decreasing trend in ambient concentrations, and exceedances of the health related limit values were observed at a limited number of stations only.
- ***Particulate matter (PM₁₀ and PM_{2.5})*** concentrations were decreasing slowly. In particular, the PM₁₀ limit value for daily concentration measurements was exceeded frequently at urban background and traffic stations. Also the target value for PM_{2.5} (which was to enter into force in 2010) was being exceeded for about 10% of the sampling points. (See Figure 3)

²⁸ ETC/ACC Technical paper 2010/1. ‘The state of the air quality in 2008’.

- **Nitrogen dioxide (NO_2)** concentrations were decreasing in most parts of Europe: more than half of the traffic stations showed a decline. Still, compliance with the air quality standards for annual mean values was seen as a serious problem in many urban and traffic areas. (See Figure 3)
- **Ozone (O_3)** concentrations showed, more than for any of the other pollutants, a pronounced year-to-year variability which made it difficult to identify a trend. In 2008, both the health and the ecosystem related target values were exceeded frequently and widely across Europe.
- **Carbon monoxide (CO)** levels were generally below the limit value even if some incidental exceedances were observed, as concentrations had already decreased during the previous decade. Similarly, **benzene (C_6H_6)** concentrations were in compliance with the limit values except for a limited number of traffic hotspot situations.
- **Lead (Pb)** air pollution exceedances were observed in a limited number of Member States, but appeared to be local issues only. Similarly, **arsenic (As)**, **cadmium (Cd)**, and **nickel (Ni)** air pollution was generally low: at a majority of the sampling points the concentrations were below the lower assessment threshold. Still, limited exceedances at between 2% and 7% of the stations were reported.
- **Benzo(a)pyrene (BaP)** target values were exceeded at more than one third of the sampling points, mainly those located at (sub)urban background stations.

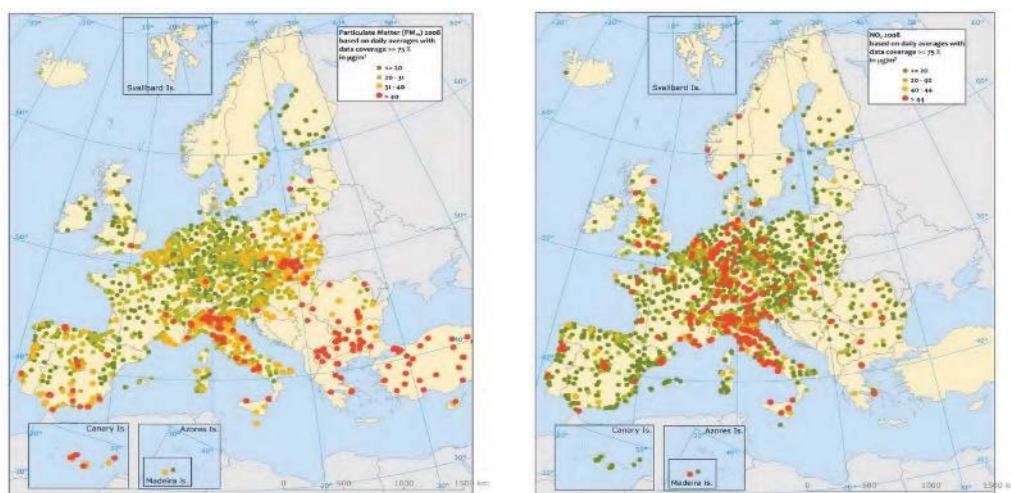


Figure 3 – Annual mean concentration map of PM_{10} (left), NO_2 (right) in 2008

3. IMPLEMENTATION / STATE OF PLAY

3.1. Air quality monitoring

Across the EU, Member States have established more than 4 000 monitoring stations, with more than 16 000 sampling points to measure specific pollutants, see Table 2.

Table 2 – Number of sampling points per pollutant, and total monitoring stations (which may contain multiple sampling points), as reported by Member States for the year 2017²⁹,

Monitoring Stations per Member State	Sampling points per pollutant												
	PM ₁₀	PM _{2,5}	SO ₂	NO ₂	O ₃	CO	Benzene	Pb in PM ₁₀	As in PM ₁₀	BaP in PM ₁₀	Cd in PM ₁₀	Ni in PM ₁₀	
AT	187	156	55	69	148	111	26	21	13	13	30	14	13
BE	218	66	70	37	119	38	18	32	28	28	19	28	28
BG	43	40	9	30	25	20	18	20	9	4	13	10	5
CY	5	3	4	3	3	3	3	1	2	2	1	2	2
CZ	149	121	70	46	68	60	15	34	42	42	39	42	42
DE	606	502	219	130	559	275	93	130	99	103	114	103	103
DK	13	8	10	3	13	8	5	3	3	3	2	3	3
EE	9	11	7	9	9	9	7	4	5	5	5	5	5
EL	26	27	14	11	23	20	12	7	2	2	2	2	2
ES	610	464	242	423	497	435	194	108	122	123	89	123	122
FI	61	41	17	12	31	17	1	2	1	4	8	4	4
FR	651	391	157	164	443	345	28	71	59	54	53	54	51
HR	22	13	10	8	13	15	4	3	2	2	3	2	2
HU	36	25	12	24	24	17	21	11	-	7	19	5	2
IE	30	16	9	12	14	12	4	2	4	4	4	4	4
IT	663	509	265	247	582	327	211	226	126	129	146	128	125
LT	18	15	7	14	17	14	9	3	5	5	5	5	5
LU	8	6	7	3	7	5	3	1	1	1	1	1	1
LV	12	6	5	6	8	7	1	6	5	5	5	5	5
MT	4	3	4	3	4	4	2	2	3	3	1	3	3
NL	82	68	47	14	73	46	10	10	1	1	3	1	1
PL	278	288	111	141	141	119	83	49	83	81	135	81	80
PT	65	59	18	29	52	47	14	3	-	-	-	-	-
RO	144	92	17	141	115	94	106	65	55	32	-	54	47
SE	141	75	40	33	114	45	12	22	4	4	-	4	4
SI	21	18	4	7	9	12	4	2	5	5	3	5	5
SK	38	32	32	14	25	16	13	11	4	4	4	4	4
UK	192	75	81	27	153	76	7	38	24	24	32	24	24
Total	4 332	3.130	1.543	1.660	3.289	2.197	924	887	707	690	736	716	692

For comparison, number of total sampling points per pollutant for which data was reported for the year 2008:³⁰

2694	540	2144	3 140	2 166	1313	707	624	637	637	637	637
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This monitoring network provides reliable, credible and comparable information on air quality. It increasingly does so in real time, with more than 2 500 monitoring stations providing the European Environment Agency with ‘up-to-date’ data. More and more of this information is made available also online, including on hand-held devices, for example via the European Air Quality Index.³¹

As regards the placement of monitoring stations and sampling points, the AAQ Directives give the competent authorities in the Member States a certain margin to adapt the placement of sampling points to local circumstances, but only within the limits set by the AAQ Directives. Section 5.3 discusses the effectiveness and efficiency of the monitoring network in further detail.

²⁹ https://tableau.discomap.eea.europa.eu/t/Aironline/views/Content_stats-refreshed/SPO-1year-npollutants

³⁰ ETC/ACC Technical paper 2010/1. ‘The state of the air quality in 2008’.

³¹ <http://airindex.eea.europa.eu/>

3.2. Air quality standards

The AAQ Directives have established a set of EU air quality standards, which have entered into force in 2005, 2010, 2012 and 2015 respectively. The latest available data as published by the European Environment Agency via its annual air quality report for Europe shows that widespread exceedances of EU air quality standards of key pollutants continue to have significant impacts on the health of EU citizens.³²

For particulate matter (PM₁₀), in 2017, 23% of all reporting sampling points and 17 Member States reported exceedances of the daily limit values established by EU legislation: this translates into leaving 17% of the urban population exposed to exceedances for PM₁₀ (note that when compared against WHO Air Quality Guidelines, this number increases to approximately 44% of the urban population), see Figure 4a.

For fine particulate matter (PM_{2.5}), in 2017, 7 Member States reported exceedances above the EU annual limit value. The share of the urban population exposed to exceedances above the annual limit value is 8% compared to EU air quality standards, but 77% compared to WHO Air Quality Guidelines, see Figure 4b.

For nitrogen dioxide (NO₂), in 2017, around 10% of all reporting sampling points and 16 Member States, reported exceedances above EU air quality standards: including in more than 130 cities across the EU. This leaves approximately 7% of the urban population exposed to annual concentrations above the limit value, see Figure 4c.

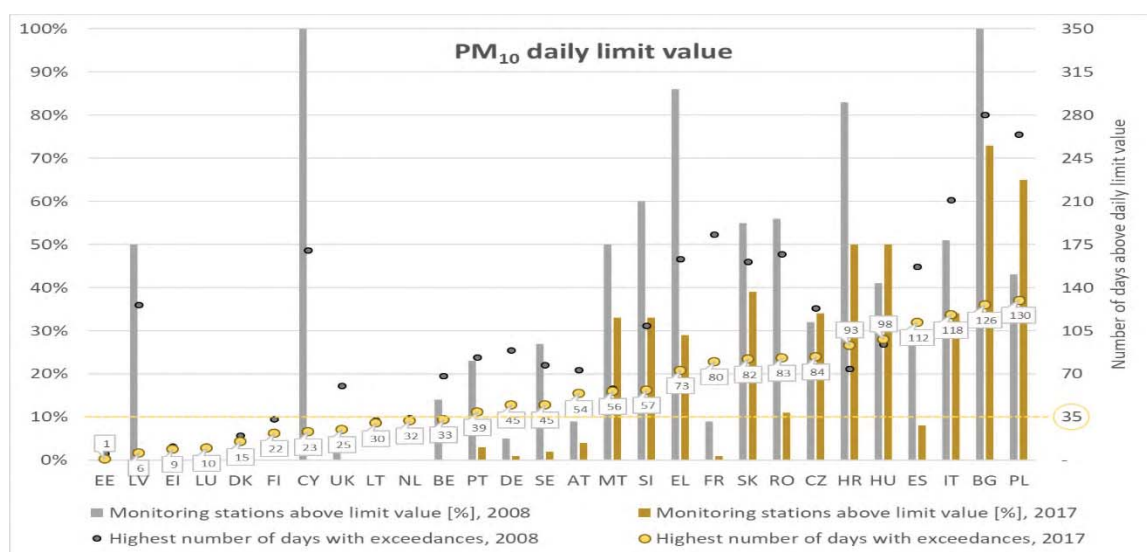


Figure 4a – Percentage of monitoring stations for particulate matter, PM₁₀, with exceedances above the daily limit value (columns, left axis), and highest number of days with exceedances (points, right axis shows number of days above the daily limit value), as reported for each Member State for 2008 and 2017.³³

³² EEA Report 10/2019. ‘Air quality in Europe – 2019 report’.

³³ Data for Croatia shows 2013 (i.e. not 2008) and 2017. Data for Malta shows 2009 (i.e. not 2008) and 2017. Note that for some Member States, for example Poland, this figure also reflects significant changes in the air quality network, in particular adding of new stations in areas of exceedances (thus increasing the number of stations above the limit value between 2008 and 2017). The dashed line depicts the number of days for which exceedances of the daily limit value are permissible under the AAQ Directives. Member States are sorted according to maximum number of days reported in 2017.

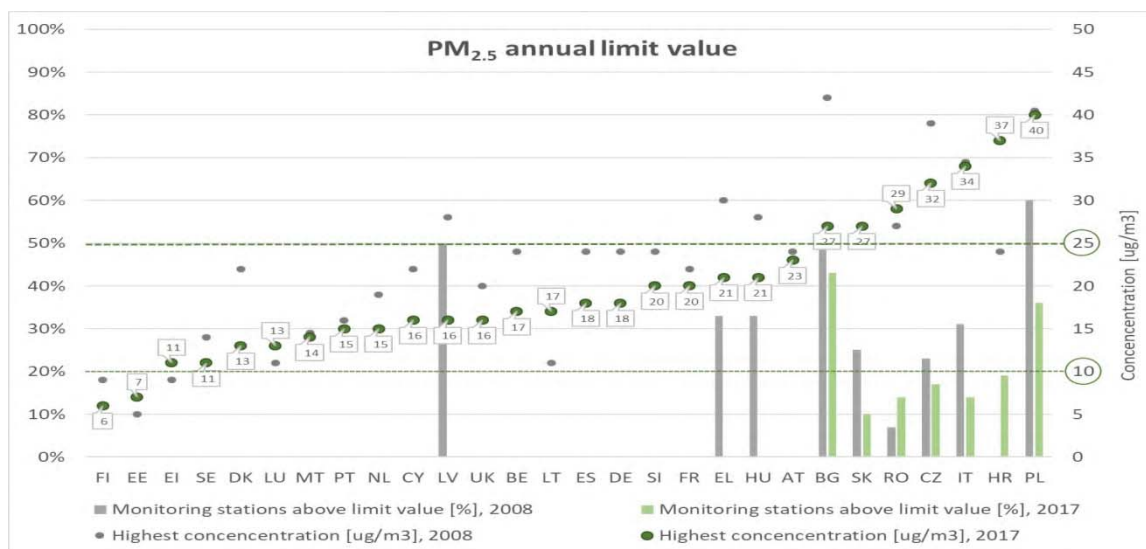


Figure 4b – Percentage of monitoring stations for fine particulate matter, PM_{2.5}, with exceedances above the annual limit value (columns, left axis), and highest concentration (points, right axis shows µg/m³), as reported for each Member State for 2008 and 2017.³⁴

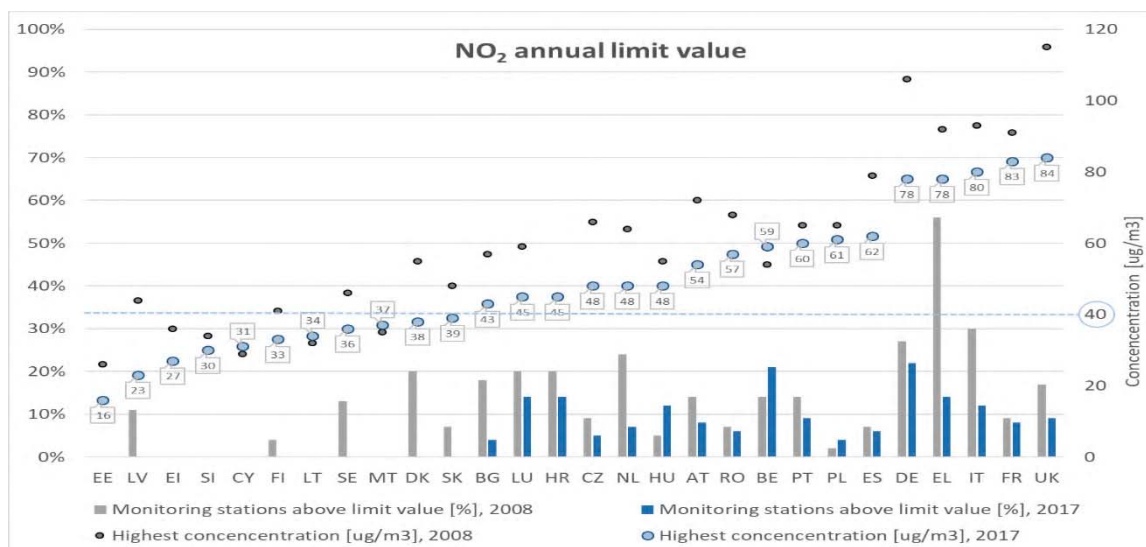


Figure 4c – Percentage of monitoring stations for nitrogen dioxide, NO₂, with exceedances above the annual limit value (columns, left axis), and highest concentration (points, right axis shows µg/m³), as reported for each Member State for 2008 and 2017.³⁵

Note that this does not take into account the possible subtraction due to natural sources or winter sanding/salting.

³⁴ Data for Croatia shows 2013 (i.e. not 2008) and 2017. Data for Romania shows 2010 (i.e. not 2008) and 2017. Note that for some Member States, for example Poland, this figure also reflects significant changes in the air quality network, in particular adding of new stations in areas of exceedances (thus increasing the number of stations above the limit value between 2008 and 2017). Note that this does not take into account the possible subtraction due to natural sources or winter sanding/salting. The upper dashed line depicts the annual limit value (40 µg/m³); the lower dashed line depicts the WHO Guidelines (20 µg/m³). Member States are sorted according to highest exceedance reported in 2017.

³⁵ Data for Croatia shows 2013 (i.e. not 2008) and 2017. Data for Cyprus and Malta shows 2009 (i.e. not 2008) and 2017. The dashed line depicts the annual limit value (which is identical to levels

Also, exceedances above the ozone target value and the long-term objective continue to be widespread and persistent. In 2017, 20% of all reporting sampling points and 17 Member States reported exceedances above the target values. It is also worth noting that exceedances reported for ozone vary significantly from year to year, as this pollutant is particularly sensitive to changes in meteorological conditions. The share of the urban population exposed to exceedances above the annual target value is 14% when compared to EU air quality standards, but 97% when compared to WHO Air Quality Guidelines.

For several other pollutants, exceedances occur only in isolated instances. In 2017, exceedances were reported for only two sampling points for sulphur dioxide (in Bulgaria), for one sampling point for carbon monoxide (in Sweden), for three sampling points for benzene (in Belgium, Romania and Spain), and none for lead. In the same year, only a limited number of exceedances were reported for arsenic (six sampling points), cadmium (two sampling points), and nickel (five sampling points).

Air pollution also damages vegetation and affects the ecosystems' ability to function and grow. The most harmful air pollutants in terms of damage to ecosystems are ozone, ammonia, nitrogen dioxide and sulphur dioxide. In particular, air emissions of sulphur dioxide, ammonia and nitrogen dioxide affect water, vegetation and soils through acidification and eutrophication, with adverse effects on flora and fauna, leading to reduced capacity of ecosystems to provide fundamental services such as nutrient cycling, carbon cycling and water provision, on which the ecosystems and human life depend. 73% of EU-28 ecosystem area remains exposed to air pollution above eutrophication limits.³⁶ Increased ground-level ozone causes damage to plants, leading to reduced agricultural yields, ecosystems damages and, ultimately, reduced air filtering capacity of the vegetation overall.³⁷

3.3. Air quality reporting and information

Member States send validated data to the Commission once a year, and continuously transmit up-to-date (near real-time) air quality data. Reporting obligations include monitoring data and information about sampling points and assessment methods, exceedance situations and alerts, about contributions from natural sources, road sanding and salting, about air quality plans and measures.

Since 2013, the requirements for the reciprocal exchange of information and reporting on ambient air quality are governed by Implementing Decision 2011/850/EU.³⁸ Accordingly, data is by now submitted via e-reporting through the Reporting Obligation Database

recommended in the WHO Guidelines. Member States are sorted according to highest exceedance reported in 2017.

³⁶ EEA Report 10/2019. 'Air quality in Europe – 2019 report'.

³⁷ UNECE Air Convention (Convention on Long-Range Transboundary Air pollution), Geneva, 1979.

³⁸ Implementing Decision 2011/850/EU laying down rules as regards the reciprocal exchange of information and reporting on ambient air quality applies since 1 January 2014 (i.e. for data observed in 2013).

(Central Data Repository) of the European Environment Information and Observation Network (EIONET), hosted by the European Environment Agency.

In this manner, all Member States report information on zones and agglomerations ('Dataflow B'), on assessment regimes ('Dataflow C'), on assessment methods ('Dataflow D'), on primary validated assessment data ('Dataflow E1a'), and on the attainment of environmental objectives ('Dataflow G').³⁹ 26 Member States (status in May 2019) report primary up-to-date assessment data ('Dataflow E2a'). For 2017, 12 Member States reported also modelled data ('Dataflow E1b') – see section 5.3.

Where and when applicable, Member States also report information on air quality plans ('Dataflow H'), on source apportionment ('Dataflow I'), on the scenario for the attainment year ('Dataflow J') and on measures ('Dataflow K').

Based on the data reported by Member States, the European Environment Agency provides online access to all reported air quality data, statistics and maps, and publishes an annual air quality report summarising key findings. It also provides access to this data via online information services such as the European Air Quality Index (see Figure 5).



Figure 5 – The European Environment Agency publishes annual air quality reports (left) and hosts an online European air quality index with near-real-time data (right)⁴⁰

³⁹ <http://aqportal.discomap.eea.europa.eu/products/submission-monitoring/data-monitor-all-except-e2a/>

⁴⁰ <http://airindex.eea.europa.eu/>

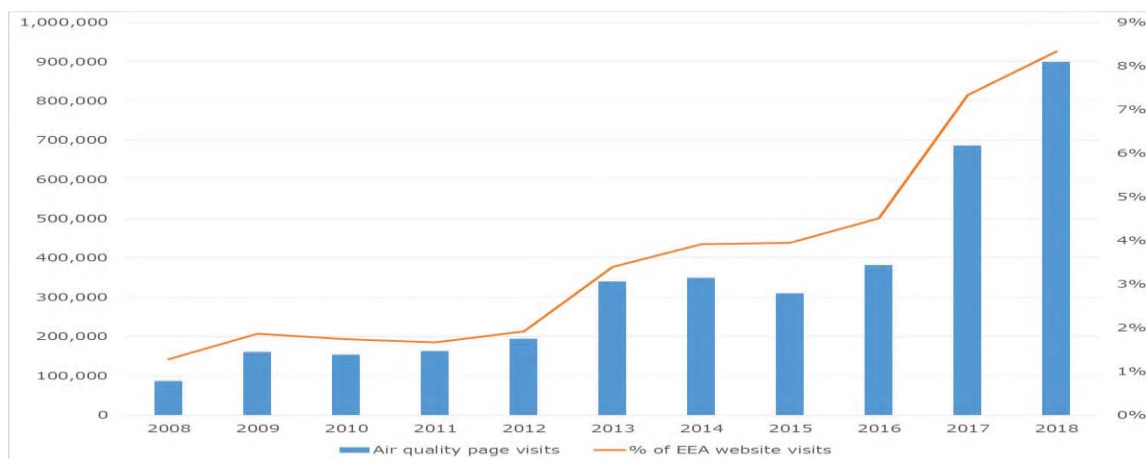


Figure 6 Visits to EEA air quality website pages 2008 to 2018. (Source: Data provided by the EEA on 9 May 2019)

This information has been increasingly made available, and accessed by a wider public. EEA website traffic monitoring data (see Figure 6) shows that the number of visits to the EEA air quality website pages has increased substantively since 2008. Nevertheless, Eurobarometer surveys consistently indicate that a majority of citizens still do not feel informed about air quality issues in their countries (see Annex 10 to this SWD).

In addition to the official air quality data and information that is made available to a wider public at EU-level and by national authorities, the availability and popularity of so-called low-cost air quality sensors has increased over the few past years. The current generation of low-cost sensors, however, tends to deliver measurements of lower data quality than monitoring carried out in accordance with the AAQ Directives.⁴¹

Recently, citizen science monitoring campaigns have successfully used low-cost sensors to increase public awareness and public engagement on air quality issues (Box 2).

Box 2 – Curieuze Neuzen

The *Curieuze Neuzen* (Curious Noses) project is an example of a citizen science project in which citizens measured air quality using NO₂ passive sampling tubes in Flanders in Belgium. The project involved 20 000 citizens who measured the air quality near their own houses in the spring of 2018. The results of this project have been visualised at <https://curieuzeneuzen.be/>

3.4. Air quality plans and Member States' measures

When and where concentrations of pollutants in ambient air exceed the relevant target values or limit values, the AAQ Directives require Member States to develop air quality plans and/or take appropriate measures (depending on the pollutant), so that the related target values or limit values are achieved in the respective zones and agglomerations, and that exceedance periods are kept as short as possible.

In line with the principle of subsidiarity, the choice of measures is left to Member States, to ensure that these are appropriate and cost-effective within the specific context of respective local and national circumstances. Generally speaking, such measures should

⁴¹ JRC 2017. 'Measuring air pollution with low-costs sensors'

be guided by the principles that guide environmental action in the EU, i.e. that action should be based on the precautionary principle and on the principles that preventive action should be taken, that environmental damage should as a priority be rectified at source and that the polluter should pay.

Air quality plans are required to clearly localise the excess pollution, provide an assessment of the pollution situation, list and quantify the main emission sources responsible for the pollution and provide details of those factors responsible for the exceedance, and detail possible measures for the improvement of air quality. Measures adopted with a view to reducing pollution need to be described, including with a timetable for implementation as well as estimates of the improvement in air quality planned.⁴²

Appropriate measures need to address the main emission sources at different geographical scales (see Annex 5 to this SWD). In general, looking at the EU as a whole, air pollutants mainly stem from transport, both road and non-road transport; the commercial, institutional and households sector, including residential heating; energy production and distribution; energy use in industry; industrial processes and product use; agriculture; and waste (see Figure 7 for details per pollutant).

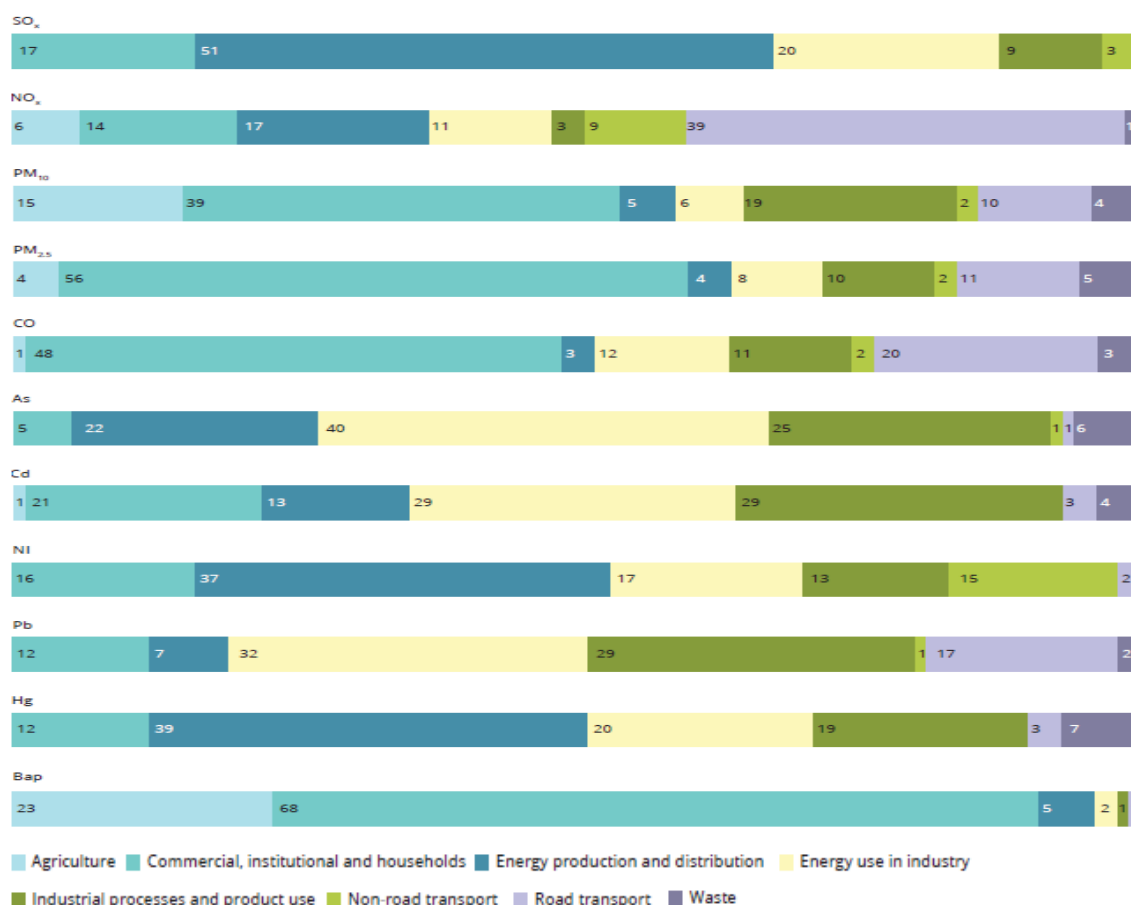


Figure 7 – Contribution to EU-28 emissions from main source sectors in 2016^{43,44}

⁴² Annex XV of Directive 2008/50/EC specifies the details to be provided in air quality plans.

⁴³ EEA Report 12/2018. ‘Air quality in Europe – 2018 report’.

Air quality plans shall be reported to the Commission no later than two years after the exceedance occurred. For the period 2013 to 2017, via the e-reporting system hosted by the EEA, almost 300 air quality plans for 20 Member States have been reported.⁴⁵ Member States also report source apportionment where exceedances occur, as well as measures adopted.⁴⁶ The Joint Research Centres hosts a *Catalogue of Air Quality Measures* to showcase a selected number of successful and less successful air quality measures to inform better implementation.⁴⁷

An analysis of the different types of measures and plans to improve air quality that were officially reported from 2014 to 2016 indicates that most of these address particulate matter and nitrogen dioxide, corresponding to the limit values most commonly exceeded.⁴⁸ The majority of individual measures taken address the transport sector, although they focus mainly on road transport compared to non-road transport.

3.5. Ongoing infringements point to implementation gaps

The European Commission has worked intensively with national authorities throughout the past years, even before limit values entered into force, to steer progress in implementation, and help deliver compliance with air quality legislation. This has been done alongside the Commission using its legal powers: where exceedances and non-compliance persist, infringement procedures have been initiated and pursued.

As of October 2019, 32 infringement procedures against 20 Member States remain pending:

- 15 cases for persistent particulate matter (PM₁₀) exceedances (Bulgaria, Czechia, Germany, Greece, Spain, France, Hungary, Italy, Latvia, Portugal, Poland, Romania, Sweden, Slovakia and Slovenia);
- 14 cases for persistent nitrogen dioxide (NO₂) exceedances (Austria, Belgium, Czechia, Germany, Denmark, France, Greece, Spain, Hungary, Italy, Luxembourg, Poland, Portugal, and the United Kingdom);
- one case for persistent sulphur dioxide (SO₂) exceedances (Bulgaria); and
- two cases for shortcomings related to air quality monitoring (Slovakia and Romania).

Of these, for eleven cases the decision has been taken to refer these to the Court of Justice of the EU. Three cases have received a recent ruling: in 2017, 2018 and 2019, respectively, the Court of Justice of the EU delivered judgements in the cases on

⁴⁴ EEA Report 6/2018. ‘European Union emission inventory report 1990-2016’ provides an explanation of the categories of emission sources (in its Appendix 4). Note that the category ‘commercial, institutional and households’ includes residential heating.

⁴⁵ Data extracted from <http://aideh.apps.eea.europa.eu>.

⁴⁶ See <http://aidei.apps.eea.europa.eu> and <http://aidek.apps.eea.europa.eu>, respectively.

⁴⁷ See <https://fairmode.jrc.ec.europa.eu/measure-catalogue/>.

⁴⁸ EEA Briefing 9/2018. ‘Improving Europe’s air quality — measures reported by countries’.

exceedances of PM₁₀ in Bulgaria and in Poland, and for NO₂ in France.⁴⁹ These judgements confirm the European Commission's view that persistent exceedances require the Member States concerned to take more effective measures.

The European Court of Auditors has recommended to accelerate enforcement by the Commission, as infringement cases have been taking between six and eight years from the initial exceedance to a referral to the Court of Justice of the EU, and have not yet ensured compliance with the AAQ Directives.⁵⁰

Furthermore, there have been numerous, often successful, proceedings before national courts brought by NGOs demanding the elaboration or implementation of appropriate air quality plans.⁵¹

⁴⁹ For an overview of closed and pending cases before the Court of Justice of the EU, see Annex 6 to this SWD. See case C-488/15 for Bulgaria, case C-336/16 for Poland and case C-636/18 for France.

⁵⁰ European Court of Auditors Special Report on Air Pollution. See section 1 of Annex 9 to this SWD.

⁵¹ See Annex 6 to this SWD for an illustrative overview of clean air cases before national courts.

4. METHOD

4.1. Process and methodology

Evaluation questions

This fitness check was guided by a *Roadmap*⁵² that outlined issues, looking in particular at the five evaluation criteria outlined in the Better Regulation agenda. This translated into five overarching evaluation questions on the criteria of relevance, effectiveness, efficiency, coherence and EU added value. A sixth evaluation question specifically looked at the effectiveness and efficiency of air quality monitoring.

- (1) Do the AAQ Directives still set appropriate objectives, address the most pressing air pollutants, and set meaningful standards to protect human health and ecosystems in accordance with evolving scientific understanding? (*Relevance*)
- (2) To what degree have the AAQ Directives acted as an incentive to implement effective measures to improve air quality, and thus reduce the adverse impacts of air pollution? (*Effectiveness*)
- (3) To what degree are the monitoring and reporting approaches mandated by the AAQ Directives (and their respective implementation) fit for purpose? (*Effectiveness and efficiency of air quality monitoring*)
- (4) To what degree do the benefits of improved air quality justify the costs of improving air quality? Are there significant differences in costs (or benefits) between Member States, and if so, what is causing them? (*Efficiency*)
- (5) Are the AAQ Directives coherent internally, with other EU Clean Air policies, with other EU legislation (e.g. on transport, energy, agriculture or nature protection), and with international commitments? (*Coherence*)
- (6) To what degree have common EU air quality standards and comparable monitoring, reporting and assessment regimes enabled Member States to take successful action beyond what would have been possible without EU action? (*EU added value*)

To inform the responses to these six evaluation questions a separate support study⁵³ analysed a total of ten more detailed evaluation (sub-) questions which were derived from the above six (i.e. one on relevance, one on effectiveness, four on efficiency, two on coherence and two on EU added value). For the responses provided in this Staff Working Document the evidence collated under these ten evaluation (sub-) questions has been summarised for each of the six questions listed above – see Annex 3 to this SWD.

⁵² https://ec.europa.eu/info/law/better-regulation/initiatives/ares-2017-3763998_en

⁵³ COWI et al. (2019). ‘Supporting the fitness check of the EU Ambient Air Quality Directives (2008/50/EC, 2004/107/EC)’ – hereafter referred to as ‘Support study informing this Fitness Check’.

Information and data gathering

The support study helped gather information and data through different channels, including several means to solicit stakeholder views.

Literature review and legal analysis: An extensive literature review was undertaken, through the support study (which analysed more than 600 sources of evidence)⁵⁴ and outside of it, analysing relevant reports and studies, academic literature, position papers published by experts, stakeholder opinions, legislation at EU and Member State levels as well as other relevant sources. The review contributed to establishing the baseline and the implementation state of play and to collecting information on all evaluation questions. It also benefited from several other institutions' reports published during the course of this fitness check, in particular reports by the European Court of Auditors⁵⁵ and the European Organisation of Supreme Audit Institutions (EUROSAI).⁵⁶

Analysis of reported data: The support study gathered relevant information from the air quality e-Reporting database managed by the European Environment Agency. The database gathers air quality information reported by Member States, such as on assessment regimes, attainment of environmental objectives, air quality plans and measures, which informed the assessment of the effectiveness and efficiency criteria (see, in particular, Appendix E to the support study).

An open public consultation of EU stakeholders was published online in 2018, open to all interested parties (citizens, companies, NGOs, research institutions, public authorities) for 12 weeks (from May to July 2018), and translated into all official EU languages. It consisted of both closed and open questions covering all evaluation questions. It also allowed for position papers to be uploaded. The open public consultation generated 489 responses, with respondents from 27 of the 28 EU Member States. The number of responses, below 500 respondents, provides an illustration of stakeholder perspectives, but by itself does not allow for a conclusive analysis (see Annex 2 to this SWD).

A targeted questionnaire was sent to representatives of public authorities' stakeholders (approximately 160 contacts at national, regional and local level); national and EU level NGOs (around 100 contacts); industry and trade representatives (around 80 contacts at national and EU levels); research institutes and universities (around 180 contacts), with more than two months for sending responses. 43 responses were received from all types of stakeholders consulted, which were used in all aspects of the evaluation (see Annex 2 to this SWD).

Two stakeholder workshops took place on 18 June 2018 and on 15 January 2019, respectively, with high-level representatives from the Commission.⁵⁷ The workshops

⁵⁴ Support study informing this Fitness Check, Appendix C.

⁵⁵ European Court of Auditors Special Report on Air Pollution. See section 1 of Annex 9 to this SWD.

⁵⁶ EUROSAI Joint Report on Air Quality. See section 4 of Annex 9 to this SWD.

⁵⁷ The agendas and summaries are available online.
18 June 2018: https://ec.europa.eu/info/events/stakeholder-workshop-support-fitness-check-eu-ambient-air-quality-directives-2018-jun-18_en
15 January 2019: https://ec.europa.eu/info/events/second-stakeholder-workshop-support-fitness-check-eu-ambient-air-quality-directives-2019-jan-15-0_en

provided the opportunity to gather feedback on the approach taken, the sources of information, and the preliminary results of the analysis. In addition, four meetings of the *Ambient Air Quality Expert Group* gathering representatives from EU Member States provided opportunities to inform and discuss the fitness check, from January 2018 to April 2019 (see Annexes 1 and 2 to this SWD).

Seven case studies were conducted in Bulgaria, Germany, Ireland, Italy, Spain, Slovakia, and Sweden, based on extensive desk research and interviews with relevant authorities and stakeholders. The case studies investigated several dimensions of the analysis, such as the impact of governance systems on air quality monitoring and assessment, good practices and implementation challenges (see Annex 11 to this SWD).

Bespoke modelling and computations: For the analysis of the efficiency criterion, and in addition to the sources of information presented above (which informed mostly the analysis of the costs), the support study undertook specific computations based on previously published methodology, in order to estimate some of the health benefits of the AAQ Directives and some of the damage costs to society in case of their insufficient implementation. The precise steps of these computations are described in Annex 3 to this SWD.

4.2. Limitations and robustness of findings

Each source of information had its own set of limitations but combining those sources has allowed to minimise the impacts of the limitations on the reliability of the analysis.

The reliability of the extensive body of *literature* that has been reviewed is high as the studies and reports used were peer-reviewed. However, it has to be noted that some evaluation questions were subject to more abundant literature than others. This limitation applies specifically to the efficiency criterion, for which it has proved difficult to find studies exactly fitted for the analysis under this fitness check (in terms of coverage, timeline etc.), hence also limiting the availability and reliability of baseline data. However, costs and benefits' estimates stemming from other related (although not similar) exercises were also considered, be they from the OECD or from previous Commission work. On the other hand, the *analysis of legal documents* has provided a high level of confidence, based on case law, infringement cases as well as secondary literature (e.g. reports or academic literature) analysing these aspects.

The information gathered through the *EEA reporting database* is deemed very reliable due to extensive quality checks both by Member States and the European Environment Agency; it allowed establishing trends and patterns of implementation across Member States, which were then complemented by more specific information from other sources.

As it is the case with any such consultation, the results from the *public and stakeholder consultations* undertaken during this exercise should not be regarded as necessarily representative of the general population. Having said that, it should be noted that views were expressed from a sufficiently large variety of stakeholders in order to provide useful and illustrative information. Limitations of representativeness were also counterbalanced, as much as possible, through the information gathered through other sources. In particular, the case studies, although representative only of specific cases, provided useful complementary information for exemplification.

Most of the limitations in the analysis relate to the *efficiency* criterion and these are clearly highlighted throughout the support study and this Staff Working Document. Despite attempts to gather information through several channels (targeted questionnaire, case studies, literature review), data availability on costs and benefits for the periods before and after the implementation of the AAQ Directives is poor. This difficulty, also recognised in the EUROSAT report,⁵⁸ can be explained by the fact that many measures affecting air quality originate from other policy areas (such as congestion reduction, acting on energy poverty) and that measures put in place in air quality plans also deliver co-benefits to other policies (such as decarbonisation). It is therefore difficult to isolate the costs and benefits that should be attributed exclusively to the measures stemming from the AAQ Directives (and this information is not available at regional or Member State level).

In addition, and although they are based on a well-established methodology, including peer-reviewed modelling approaches, the calculations undertaken in the support study to estimate the social costs and benefits have several limitations, due to the need to base the modelling on assumptions when there is uncertainty on some actual parameters (see Annex 3 to this SWD for more details on the modelling and its limitations). Therefore, the quantification of the impacts done for this fitness check should not be considered as exact numbers, nor used for direct comparisons. However, the information gathered is sufficient to draw conclusions on trends and orders of magnitude of socioeconomic costs and benefits.

Overall, and despite the limitations presented above, the analysis underpinning this fitness check is sufficient to formulate answers to the evaluation questions. As regards monetized costs and benefits of air pollution, and of measures taken to improve air quality in particular, it is unlikely that further analysis based on available data would yield considerably different results or significantly influence the overall findings.

⁵⁸ EUROSAT Joint Report on Air Quality. See section 4 of Annex 9 to this SWD.

5. ANALYSIS AND ANSWERS TO THE EVALUATION QUESTIONS

5.1. Relevance

Evaluation question: Do the AAQ Directives still set appropriate objectives, address the most pressing air pollutants, and set meaningful standards to protect human health and ecosystems in accordance with evolving scientific understanding?

Overall response: Air pollution is of high concern to citizens across the EU. The level of concern has increased and become more acute over the past decade. This translates into a clear and increasing expectation for policy to act where air quality is poor. Scientific evidence of the harmful effects of the air pollutants covered by the AAQ Directives has been further consolidated and increased (and there is robust scientific evidence that the pollutants covered have harmful effects).

All of the air pollutants covered by the Directive continue to be relevant, as their respective harmful effects are confirmed. Europeans continue to be exposed to widespread and persistent excess concentrations of particulate matter, nitrogen dioxide, benzo(a)pyrene and ozone. For other pollutants only local or occasional exceedances have been reported over the past years: in such cases the known harmful effects still make continuous monitoring relevant, also to ensure that no new exceedances occur. The AAQ Directives sets upper and lower assessment thresholds, and thus offer scope to address pollutants differently depending on their expected risk of exceedances (allowing for a proportionate approach to monitoring and to when and where measures are taken).

The air quality standards established by the AAQ Directives for some pollutants are not as stringent as recommended by the World Health Organization 'Air Quality Guidelines'. Scientific evidence points to serious adverse health effects at lower concentration levels than set by the EU air quality standards for several air pollutants, most notably for particulate matter, sulphur dioxide, benzene and benzo(a)pyrene (and to a lesser degree also for ground-level ozone).

This results in a dichotomy: on the one hand for a number of air pollutants the air quality standards as set by the AAQ Directives fall short of scientific recommendations and public expectations – while on the other hand the persistent exceedances of the current air quality for at least one pollutant in a majority of Member States point to substantial socio-economic and/or political challenges in reaching the objectives agreed a decade ago.

What is the issue?

The overarching objective of the AAQ Directives is to protect citizens from the adverse effects of air pollution and reduce it to levels which minimise harmful effects on human health, paying particular attention to sensitive populations, and the environment as a whole. Central to this is the establishing of common maximum concentration levels, or air quality standards, for harmful substances in the ambient air – taking into account the relevant guidelines and recommendations by the World Health Organization.

The AAQ Directives set air quality standards for a total of 13 air pollutants, namely for sulphur dioxide (SO₂), nitrogen dioxide (NO₂) and nitrogen oxides (NO_x), particulate matter (PM₁₀ and PM_{2.5}), ozone, benzene, lead, carbon monoxide, arsenic, cadmium, nickel, and benzo(a)pyrene, to be attained by 2005, 2010, 2012 or 2015, depending on

the pollutant. These standards take the form of limit values, target values, critical values, alert thresholds, information thresholds or long term objectives (see Table 1 and Box 1).

But do the AAQ Directives still tackle the most pressing air pollutants, and do they do so at the appropriate scale and at meaningful levels? Has scientific understanding evolved to now indicate that some pollutants are more harmful, or less harmful, than understood at the time the AAQ Directives were adopted?

What are the findings?

Air quality continues to be a major health and environmental concern to the citizens of the EU (see stakeholder views below). This perception continues to be fully in line with the available scientific evidence. There is an extensive and continuously expanding body of clinical, toxicological, and epidemiological studies that conclusively document the adverse health effects of air pollution.

The scientific evidence base available prior to the adoption of the AAQ Directives was authoritatively summarised by the World Health Organization in its Air Quality Guidelines from 2006 (See Box 3).⁵⁹ This was an important consideration in setting the standards, along with information on the technical feasibility of meeting different standards, and their costs and benefits.

Box 3 – The Air Quality Guidelines by the World Health Organization

A first edition of the Air Quality Guidelines for Europe was published by the World Health Organization in 1987. Since then, new data and developments in risk assessment methodology have informed updates and revision of these guidelines. The most recent edition of Air Quality Guidelines by the World Health Organization was published in 2006.⁶⁰

For this most recent edition, the World Health Organization established a steering group to advise and lead the guideline development process, and recommended experts in epidemiology, toxicology, air quality exposure assessment, air quality management and public policy to draft the guideline document. These were subjected to both internal and external expert review. It is worth noting that these guidelines are not conceived as standards nor legally binding criteria.

Since 2006, the evidence base for adverse health effects related to short- and long-term exposure to air pollutants such as particulate matter, nitrogen dioxide, and ozone has expanded further.⁶¹ Accordingly, in 2016, the World Health Organization initiated work towards the update of the Air Quality Guidelines. This work will conclude with the provision of up-to-date recommendations in the early 2020s.⁶²

The scientific evidence base has evolved further, and has been reviewed periodically: in 2013, for example, the World Health Organization provided an extensive review of evidence on health aspects of air pollution confirming their existing guidelines. That review highlighted in particular additional evidence on the chronic impacts of particulate

⁵⁹ World Health Organization (2006). 'Air Quality Guidelines – Global Update 2005'.

⁶⁰ World Health Organization (2006). 'Air Quality Guidelines – Global update 2005'.

⁶¹ World Health Organization (2013). 'Review of evidence on health aspects of air pollution'.

⁶² [https://www.who.int/news-room/fact-sheets/detail/ambient-\(outdoor\)-air-quality-and-health](https://www.who.int/news-room/fact-sheets/detail/ambient-(outdoor)-air-quality-and-health)

matter, nitrogen dioxide and ground-level ozone. Looking at the specific pollutants that contribute to outdoor air pollution, scientific evidence has grown on the harmful effects of the pollutants the AAQ Directives address. By contrast, no scientific evidence that any of the pollutants covered have only a limited adverse effect has been identified.⁶³

It is also worth noting that, in 2013, the International Agency for Research on Cancer classified outdoor air pollution as carcinogenic to humans.⁶⁴

As for pollutants currently not covered, there is a growing body of research suggesting the relevance of considering various components of particulate matter, such as black carbon or ultrafine particles (see Box 4). In 2013, the World Health Organization concluded that the scientific base at the time was too weak to lay down a guideline value for black carbon or ultrafine particles, but that it would need to be kept under review. To date the World Health Organization has not suggested guideline values for additional air pollutants.

Box 4 – Ultrafine Particles

There is increasing, though limited epidemiological evidence of adverse health impacts of ultrafine particles (smaller than 0.1 µm) in ambient air. Such particles have been found in several organs, and recent systematic literature reviews point to short-term association with cardiorespiratory health, including pulmonary and systemic inflammation, as well as the health of the central nervous system. For other adverse health outcomes, the evidence on health effects remains inconclusive or insufficient.⁶⁵

To establish a correlation with illnesses is difficult due to the limited availability of specific data, expressed in terms of numbers per cubic meter or as ultrafine particles (PM_{0.1}), which does not allow to conduct targeted epidemiological studies. The risk linked to such particles is however potentially growing, due to the evidence of modern combustion engines emitting large numbers of extremely small particles whose mass is extremely limited while their capacity to penetrate the circulatory and nervous systems is enhanced by their size (as small as 2.5nm).

However, available data would still be insufficient to set standards: more research efforts are needed in this area. In particular, several expert bodies have recommended to enhance the continuous monitoring of ultrafine particle concentrations in ambient air, including in the vicinity of major airports.⁶⁶

The pollutants addressed by the AAQ Directives thus have been and continue to be relevant substances for which concentration levels are to be regulated. Whether this has

⁶³ World Health Organization (2013). ‘Review of evidence on health aspects of air pollution’.

⁶⁴ https://www.iarc.fr/wp-content/uploads/2018/07/pr221_E.pdf (accessed 8 May 2019).

⁶⁵ World Health Organization (2013). ‘Review of evidence on health aspects of air pollution’. For more recent reviews, see for example, Ohlwein et al (2019). ‘Health effects of ultrafine particles: a systematic literature review update of epidemiological evidence’. *Int J Public Health* 64(4):547-559. Similarly, see for example, Umweltbundesamt (2018). ‘Health Effects of Ultrafine Particles’.

⁶⁶ See for example: Anses (2018). ‘Polluants “émergents” dans l’air ambiant : Identification, catégorisation et hiérarchisation de polluants actuellement non réglementés pour la surveillance de la qualité de l’air’. Similarly, see for example, Air Quality Expert Group to the Department for Environment, Food and Rural Affairs, Scottish Government, Welsh Government and Department of the Environment in Northern Ireland (2018). ‘Ultrafine Particles (UFP) in the UK’.

been done at the levels recommended by scientific evidence in general, or by the Air Quality Guidelines of the World Health Organization (simply referred to as the ‘WHO Guidelines’ hereafter) in particular, depends on the respective pollutant (see Table 3).

In 2018, the European Court of Auditors emphasised that some of the air quality standards established by the Directive 2008/50/EC ‘are much weaker than the WHO Guidelines. Furthermore, the standards allow limits to be exceeded frequently and do not include any short-term (i.e. daily) standard for PM_{2.5}, a very harmful air pollutant [...]. Health professionals support stricter standards in the EU [...]’.⁶⁷

Similarly, the 2019 Special Eurobarometer on air quality⁶⁸ shows that among those respondents who have heard of EU quality standards, almost two-thirds believe that they should be strengthened. A majority of the respondents also feels that air quality has deteriorated in the past decade. The latter should however be understood against the background of reported data showing that air quality has in fact improved over the last 10 years (see section 5.2). This may mean that the above public perceptions of deterioration could stem from air quality having gained more prominence in the public debate over the past decade, at least partly as a result of the implementation of the AAQ Directives (see in particular section 5.6).

It should be kept in mind that the WHO Guidelines are not conceived as standards nor legally binding criteria. They are designed to offer guidance based on expert evaluation of scientific evidence that can be used by regulatory authorities as a basis for setting standards, taking into account local socio-political and economic conditions and prevailing ambient concentrations of air pollutants.^{69,70} Scientific guidelines have to be considered also against this context.

Nevertheless, modelling analysis projects that with full implementation of the relevant acquis, and the Directive on the reduction of national emissions of certain atmospheric pollutants⁷¹ in particular, the share of EU population exposed to fine particulate matter (PM_{2.5}) concentrations over the WHO Guidelines value would decrease from 88% in 2005 to 13% by 2030 (see Clean Air Outlook, as summarised in Annex 8 of this SWD). This puts the EU on a trajectory towards reaching levels as recommended by the WHO for fine particulate matter in large parts of the EU in a ten year perspective.

However, it should be noted that this EU-level result hides disparities in pollutants concentrations, across and within Member States, leading to some regions in the EU still

⁶⁷ European Court of Auditors Special Report on Air Pollution. See section 1 of Annex 9 to this SWD. Note that the WHO Guidelines make reference to both annual mean and daily mean concentrations of PM_{2.5}; EU air quality standards set a limit value for annual mean concentration only.

⁶⁸ See Section 2 of Annex 10 to this SWD.

⁶⁹ World Health Organization Regional Office for Europe (2017). ‘Evolution of WHO air quality guidelines: past, present and future’.

⁷⁰ Note that public interventions, which aim at improving social welfare, depend not only on budgetary constraints but also on the various historical, geographical and social contexts in which they take place. Any public intervention decision necessarily reflects potential tensions between various priority interests (environment, health, but also employment, education etc.) of different societal actors.

⁷¹ Directive (EU) 2016/2284 on the reduction of national emissions of certain atmospheric pollutants.

overpassing the WHO Guidelines values in the 2030 modelling results (including Northern Italy and Southern Poland). In these cases measures are deemed technically feasible but not cost-effective under current economic and political assumptions, in turn leading to a situation where the WHO Guidelines would not be reached even in a 2030 projection without significant additional effort.

It is also worth stressing that, consistent with the principle established in Article 193 of the Treaty on the Functioning of the European Union, the AAQ Directives do not prevent Member States to set more stringent standards in national legislation – as is the case, for example, in Austria (for particulate matter (PM₁₀) and nitrogen dioxide), the United Kingdom (for ozone) or Sweden (most notably for nitrogen dioxide).

Table 3 compares EU air quality standards with the WHO Guidelines and the standards in place in other OECD countries. This shows alignment with WHO Guidelines in some cases (such as for nitrogen dioxide) and large differences in other cases (such as for sulphur dioxide). For fine particulate matter, the EU air quality standards are also above those set in other OECD countries, while for most other pollutants EU levels are within the range established in other OECD countries (i.e. higher than in some, lower than in others).

Table 3 – Comparison of EU air quality standards with WHO Guidelines and standards applicable in other OECD countries (*)

Pollutant	WHO Guidelines	EU air quality standards	‘Permitted’ exceedances	Selected standards applicable in other OECD countries (**)
PM ₁₀ (annual LV)	20 µg/m ³	40 µg/m ³	-	AU: 25; CH:20; NO:25
PM ₁₀ (daily LV)	50 µg/m ³	50 µg/m ³	(35 days a year)	AU: 50; CH: 50 (3d); NO: 30 (30d) NZ: 50 (1d); US: 150 (1d)
PM _{2.5} (annual LV)	10 µg/m ³	25 µg/m ³	-	AU: 8; CH: 10; CA: 10; JP: 15; NO: 15; US: 12
PM _{2.5} (daily LV)	25 µg/m ³	-	-	AU: 25; CA: 28; JP: 35 (2%); US: 35 (2%)
NO ₂ (annual LV)	40 µg/m ³	40 µg/m ³	-	AU: 57; CA: 32; CH: 30; NO: 40; US: 101
NO ₂ (hourly LV)	200 µg/m ³	200 µg/m ³	(18 hours a year)	AU: 230; CA: 115; NO: 200 (18h); NZ: 200 (9h); US: 191 (2%)
SO ₂ (daily LV)	20 µg/m ³	125 µg/m ³	(3 days a year)	AU: 213 (1d); CH:100 (1d); JP: 107 NO: 125 (3d)
SO ₂ (hourly LV)	500 µg/m ³ (for 10 min)	350 µg/m ³	(24 hours a year)	AU: 532 (1d); JP: 266; NO: 350 (24h); NZ: 350 (9h); US: 200 (1%)
O ₃ (8-hour TV)	100 µg/m ³	120 µg/m ³	(75 days in 3 years)	CA: 126; US: 140

(*) Cells shaded in grey and using red font highlight where EU air quality standards diverge from WHO Guidelines.

Acronyms used in this table: LV (limit value), TV (target value). Note: where standards applicable in selected other OECD countries have been established as ‘ppb (parts per billion)’, this has been converted to µg/m³ for this table

(**) Values in parentheses in this column denote the number of ‘permitted’ exceedances above the noted standard:

AU (Australia): Standards and Goal established under National Environment Protection (Ambient Air Quality) Measure, status of 25 February 2016, see <https://www.legislation.gov.au/Details/F2016C00215>

CA (Canada): Canadian Ambient Air Quality Standards (CAAQS) established under the Canadian Environmental Protection Act, see <http://airquality-qualitedelair.ceme.ca/en/>

CH (Switzerland): ‚Luftreinhalte-Verordnung (vom 16 Dezember 1985, inklusive Änderung vom 11. April 2018)’, see <https://www.admin.ch/opc/de/classified-compilation/19850321/index.html>

JP (Japan): Environmental Quality Standards in Japan – Air Quality. <http://www.env.go.jp/en/air/aaq/aaq.html>

NO (Norway): ‘Grenseverdier for tiltak’, as established in ‘forskrift om begrensning av forurensning’ see <https://lovdata.no/dokument/SF/forskrift/2004-06-01-931> (see Del 3)

NZ (New Zealand): Ambient air quality standards for contaminants under Resource Management (National

Pollutant	WHO Guidelines	EU air quality standards	'Permitted' exceedances	Selected standards applicable in other OECD countries (**)
Environmental	Standards for Air Quality)	Regulations	2004 (SR 2004/309), see http://www.legislation.govt.nz/regulation/public/2004/0309/latest/DLM287036.html	
US (United States of America): National Ambient Air Quality Standards (NAAQS) set by the Environmental Protection Agency under the Clean Air Act, see https://www.epa.gov/criteria-air-pollutants/naaqs-table				

For **particulate matter (PM₁₀)**, the EU annual limit value is set at twice the level recommended by the WHO Guidelines (i.e. 40 µg/m³ versus 20 µg/m³). Meanwhile, for the EU daily limit value, the AAQ Directives followed the WHO Guidelines (i.e. 50 µg/m³), however allowing for up to 35 days of exceedances per year having in mind specific local geographical and/or meteorological conditions.

For **fine particulate matter (PM_{2.5})**, the scientific conclusions of the WHO Guidelines on the evidence for a causal link between PM_{2.5} and adverse health outcomes in humans have been strengthened since the adoption of the AAQ Directives. At the time, however, the AAQ Directives did not follow the WHO Guidelines as regards the annual limit value (25 µg/m³ versus 10 µg/m³). Furthermore, the AAQ Directives did not establish a daily limit value for fine particulate matter, whereas the WHO Guidelines here recommend 25 µg/m³. The AAQ Directives also established an exposure reduction target according to which Member States need to secure a relative reduction depending on their starting levels, and which calls for all appropriate measures to be taken to limit average exposure to below a maximum of 18 µg/m³ by 2020.

For **nitrogen dioxide (NO₂)**,⁷² the limit values set by the AAQ Directives align with the WHO Guidelines (even though the hourly limit value may be exceeded in up to 18 hours per year). In 2013, an extensive World Health Organization review noted that *'more studies have now been published, showing associations between long-term exposure to NO₂ and mortality and morbidity'* and that *'both short- and long-term studies have found these associations with adverse effects at concentrations that were at or below the current EU limit values'*. While this review noted that there is scientific debate as to the degree to which adverse effects are due to nitrogen dioxide per se (as the adverse effects may be indicative of other traffic-related pollutants) it explicitly *'suggests that consideration should be given to lowering the WHO Guideline'*.⁷³

For **ground-level ozone (O₃)**,⁷⁴ the EU air quality standards for maximum daily 8-hour mean concentrations is close to the WHO Guidelines (120 µg/m³ versus 100 µg/m³), but this target value may be exceeded on no more than 25 days per year (averaged over three years). The long-term objective is to not exceed this level at all.

⁷² Nitric oxide (NO) and nitrogen dioxide (NO₂) are together referred to as nitrogen oxides (NO_x).

⁷³ World Health Organization (2013). 'Review of evidence on health aspects of air pollution'. See question C2: *'Is there any new evidence on the health effects of NO₂ that impact upon the current limit values? Are long-term or short-term limit values justified on the grounds that NO₂ affects human health directly, or is it linked to other co-emitted pollutants for which NO₂ is an indicator substance?'*

⁷⁴ Tropospheric (ground-level) ozone is a secondary pollutant, which is not directly emitted into the atmosphere, but is formed (and removed) via chemical reactions in the presence of sunlight, and natural and anthropogenic precursor gases (mainly nitrogen oxides (NO_x) from vehicle and industry emissions and volatile organic compounds (VOCs) emitted by vehicles, solvents and industry). As a result, the highest levels of ozone pollution occur during periods of sunny weather. At the continental scale, methane (CH₄) and carbon monoxide (CO) also play a role in ozone formation. See also EEA Report 12/2018, 'Air quality in Europe – 2018 report' for further details on ozone.

For **sulphur dioxide (SO₂)**, the daily limit value set by the AAQ Directives (125 µg/m³) is considerably less stringent than the WHO Guidelines (20 µg/m³). The hourly limit value established by the AAQ Directives is closer to the WHO Guidelines for 10 minute periods (500 µg/m³ versus 350 µg/m³).

For both **lead** and **cadmium**, the annual limit value, and target value respectively established by the AAQ Directives are fully aligned with the standards recommended by the WHO Guidelines, at 0.5 µg/m³ and 5 ng/m³, respectively. Also for **carbon monoxide**, the maximum daily 8-hour mean limit value of 10 mg/m³ matches the WHO Guidelines: however, at EU level there is no air quality standard for one hour, which the WHO Guidelines recommend to set at 30 mg/m³.

For several other pollutants, the World Health Organization did not put forward Air Quality Guidelines as such, but did provide estimated reference levels based on excess lifetime cancer risk of 1 in 100 000. For **arsenic** and **nickel**, the respective annual target values of 6 ng/m³ and 25 ng/m³ are close to the respective reference levels at 6.6 ng/m³ and 20 ng/m³. For **benzene**, there is a somewhat larger discrepancy, with an annual limit value at 5 µg/m³ three times higher than the reference level at 1.7 µg/m³. For **benzo(a)pyrene** this discrepancy is even larger with an annual target value at 1 ng/m³ and a reference level at 0.12 ng/m³.

Generally speaking, over the past decade, there has been a downward trend for all air pollutants for which the AAQ Directives have established environmental objectives (i.e. EU air quality standards). Nevertheless, exceedances continue to be widespread and frequent, for particulate matter, nitrogen oxides, ozone and benzo(a)pyrene. For other pollutants exceedances tend to be rare or isolated occurrences.⁷⁵

This does not mean, however, that monitoring or achieving the standards set for these pollutants is no longer relevant: the health risks remain, and when and where exceedances occur, these need to be addressed. It can be argued that it is sufficient to keep these pollutants ‘under observation’. The AAQ Directives already provide a mechanism for such a proportionate approach, whereby pollutants that are expected to be below well-defined assessment thresholds, can be covered by less extensive monitoring regimes (see, for example, Article 6 and Annex V in Directive [2008/50/EC](#)).

While the AAQ Directives provide a degree of flexibility in relation to amending non-essential elements of the Directives (which explicitly excludes the possibility to change air quality standards as such), there are no specific mechanisms in the Directives laying down an obligation to carry out a periodic review of the Directives with a view of adapting them to the latest technical and scientific progress. Additional pollutants or more stringent air quality standards can only be added by the co-legislators.

Finally, Box 5 points to a number of provisions of the AAQ Directives that have become redundant since 2008. However, none of these directly affect the implementation of the AAQ Directives in their current form.

⁷⁵ For the year 2017, reported data refers to exceedances for arsenic only at six sampling points across the EU, for cadmium at two sampling points, for nickel at four sampling points, for carbon monoxide at one sampling point, for benzene at three sampling points, and no exceedances for lead. See also EEA Report 10/2019. ‘Air quality in Europe – 2019 report’ for further details.

Box 5 - Provisions of the AAQ Directives that have become redundant

There are a number of provisions of the AAQ Directives that have become redundant over time. This is the case with the provisions that contain a temporal component, prescribing the starting or the ending date of an obligation. In the meantime, they either have been exhausted or have lost relevance:

- Article 22, in connection with Annex XV, section B, of Directive 2008/50/EC, related to the postponement of attainment deadlines by up to five years and the exception from the obligation to apply certain limit values until June 2011.
- Article 32 of Directive 2008/50/EC, obliging the Commission to review in 2013 provisions related to PM_{2.5} and, as appropriate, other pollutants. This 2013 review has occurred.
- Article 8 of Directive 2004/107/EC requiring the Commission to report by the end of 2010 on the experience with the Directive. A corresponding analysis has been prepared as part of the air policy review initiated in 2011.⁷⁶
- Several provisions of Directive 2008/50/EC refer to margins of tolerance (allowed exceedances of limit values expressed in percentages) that were applicable until a certain date (e.g. until 1 January 2010 for nitrogen dioxide).

Views of stakeholders⁷⁷

Air quality continues to be a major health and environmental concern to the citizens of the EU. Respondents to a Eurobarometer survey in 2017 (with more than 27 000 respondents) highlighted ‘air pollution’ as one of the two most important environmental issues, with 46% including this issue in their response (the other being ‘climate change’, named by 51%).⁷⁸

Similarly, a large majority of respondents to the open public consultation carried out in the context of this fitness check (489 respondents), noted that, in their view, air pollution poses a concern to public health (94%) and the environment (88%) to a large or a very large extent. And an even higher number of respondents (95%) considered defining and establishing of common EU standards to be important or very important.

The open public consultation also indicates that all the pollutants currently regulated by the AAQ Directives remain relevant. The largest agreement was on the importance of addressing nitrogen dioxide (94%) and fine particulate matter (93%). Stakeholders highlight that the evidence about the health impacts of all the pollutants addressed by the AAQ Directives has further developed over the last 10 years and, as a result, there is no reason for EU law to stop regulating any of the pollutants currently addressed. One NGO suggested that SO₂ is no longer relevant due to the implementation of stricter coal

⁷⁶ SEC(2011)342. ‘Implementation of EU Air Quality Policy and preparing for its comprehensive review’; see also underpinning analysis provided jointly by Environment Agency Austria, Ricardo-AEA, and TNO (2013) ‘Review of the Air Quality Directive and the 4th Daughter Directive’.

⁷⁷ For an overview of the stakeholder feedback, and details on views expressed by different stakeholder groups in the open consultation, please also see Annex 2 to this SWD.

⁷⁸ European Commission (2017). Special Eurobarometer 468: ‘Attitudes of European citizens towards the environment’. In nine Member States ‘air pollution’ topped the list of environmental issues named, namely in Malta, Bulgaria, Belgium, Poland, Greece, Croatia, Romania, Italy and France.

combustion standards. Another respondent noted that there is no need to monitor lead, nickel and carbon monoxide as frequently anymore.

Approximately 24% of the respondents to the open public consultation found the air quality standards of the AAQ Directives to be set at appropriate levels, while 61% found the standards either much too lenient (27%) or somewhat too lenient (34%). In contrast, only 9% found the standards too strict (8%) or far too strict (1%). The findings of the targeted questionnaire paint a similar picture.

A large share of stakeholders interviewed highlighted the need to reflect the most recent scientific evidence on the harmful effects of air pollution and sharpen the current standards at least to the levels recommended by the WHO Guidelines. In particular, NGOs focussed on environment and health, but also stakeholders from a science and research background, expressed concerns that the current standards do not sufficiently protect from the adverse impacts of air pollution. Similar views have been explicitly stressed by the European Parliament which *'urges the Commission and the Member States to assess and review air quality policies only on the basis of robust, up-to-date, independent and peer-reviewed scientific evidence'*.⁷⁹

Conversely, a number of stakeholders also highlighted the issue of economic viability of following scientific advice. Several national and regional authorities cautioned that more stringent air quality standards might create unrealistic challenges for those Member States that do not yet meet the current air quality standards. Similarly, industry associations highlighted the importance of air quality standards requirements to be cost-effective, reachable by the industry with available technologies, and in line with the Best Available Techniques (BAT), as defined in the Industrial Emissions Directive. The above also called for more time and flexibility to reach current air quality standards.

The continuing exceedances of EU air quality standards have led a small number of stakeholders to question the ambition level of the AAQ Directives, arguing that some limit values may be disproportionately strict compared to expected impacts of exceedances. In particular, in the German public debate, the nitrogen dioxide limit values have been questioned by some: in response, the German National Academy of Sciences has, in April 2019, offered an opinion reasserting that both nitrogen dioxide and fine particulate matter exceedances remain problematic (noting also that, from a scientific perspective, a further tightening of the nitrogen dioxide limit values is not urgent).⁸⁰

In their feedback to the targeted questionnaire (43 responses in total, see Annex 2), several stakeholders reflected in their comments on specific air quality standards. One industry association indicated that the daily limit values for PM₁₀ were too stringent. Another industry association suggested increased focus should be given on average population exposure rather than standards; this view was shared by one research organisation. Other respondents noted that the short-term and annual PM₁₀ and PM_{2.5} data are highly correlated, which could improve the efficiency of the monitoring system. One regional authority suggested that, due to the problems large cities have with compliance

⁷⁹ European Parliament resolution on 'A Europe that protects: Clean air for all'. See also Section 5 of Annex 9 to this SWD.

⁸⁰ Nationale Akademie der Wissenschaften Leopoldina (2019): Saubere Luft. Stickstoffoxide und Feinstaub in der Atemluft: Grundlagen und Empfehlungen.

with the air quality standards, different thresholds should apply for urban areas (see also Box 6).

Box 6 – REFIT Platform Opinion on adapting limit values to population density

In March 2018, the REFIT Platform considered submissions by the House of Dutch Provinces for Better Regulation which suggested a simplification of the Ambient Air Quality Directive by which provinces and other subnational authorities would be given more possibilities for solving the problems by taking the objectives of the regulations into account, rather than having to strictly comply with the rules. The REFIT Platform’s Stakeholder Group disagreed with the submitter’s suggestion to adapt air quality limits according to the amount of population and establish different thresholds depending on the area (e.g. residential versus low populated) and its degree of population. The Stakeholder group considers that air quality limits should remain the same across the entire EU territory, to protect all EU citizens and that current EU rules provide enough flexibility to national and local authorities as to the correct measures to be adopted to meet existing limits. The Stakeholder group recalls that the European directive seeks to establish *minimum limits* for human health, requiring one standard methodology, as such seeking differentiation or adaptation according the population density is not possible.⁸¹

Conversely, one NGO specifically noted that, contrary to the limit values, other types of air quality standards (such as the target values, or the national exposure reduction target) do not provide certainty to the public. It argued that several flexibilities, inherent to these standards, and the ability of Member States to balance the protection of health and the environment with other factors (such as the costs of measures), significantly weaken the ability of these obligations to deliver improvements of air quality.

Regarding pollutants which are not addressed by the AAQ Directives, but would warrant future consideration, open public consultation respondents were given an open text field and were able to name multiple pollutants in their answers. Among the 237 responses to this question, the most commonly cited additional pollutants were ultrafine particles (96 responses), black carbon (70 responses) and ammonia (45 responses). Also, several NGOs, research organisations and public authorities suggest including one or several of the above pollutants into the scope of air quality policy, and expand related monitoring.

⁸¹ https://ec.europa.eu/info/sites/info/files/recommendation-ix-5-a_air-quality-directive_en.pdf

5.2. Effectiveness

Evaluation question: To what degree have the AAQ Directives acted as an incentive to implement effective measures to improve air quality, reach the EU air quality standards and thus reduce the adverse impacts of air pollution?

Overall response: Over the past decade, the AAQ Directives have been only partially effective in achieving their overall objectives of reducing air pollution and curbing its adverse effects. While they have guided the monitoring of air quality, set clear air quality standards, and facilitated the exchange of information on air quality, they have not ensured that sufficient action is taken throughout the EU to meet air quality standards and keep exceedances as short as possible, resulting in a mixed picture.

On the one hand, air quality has improved and the share of air quality zones across the EU that report exceedances of limit values or targets values, have declined significantly for several pollutants. Both the number and magnitude of exceedances have decreased for most pollutants and in most Member States. As a result, also the share of urban population exposed to air pollution above EU air quality standards is lower now than a decade ago, with exposure to particulate matter amounting to half of what it was in 2008.

On the other hand, persistent and widespread exceedances still continue for particulate matter, nitrogen dioxide, ozone and benzo(a)pyrene.⁸² Air quality plans and their implementation, in several instances, have not lived up to the requirement to keep exceedance periods as short as possible and secure effective compliance. The European Commission has responded to these shortcomings, including through enforcement action, initiating infringement procedures against 20 Member States not only to address exceedances, but also because it regarded the measures taken to be insufficient.

Although air quality has improved over the past decade, exceedance periods have not been kept as short as possible in all instances. This indicates that the AAQ Directives have been at least *partially* effective in achieving the EU air quality standards and thus reducing the impacts of air pollution. It is moreover evident that where improvements have occurred, they have at least in part been incentivised by the requirements to meet EU air quality standards, and to put in place plans and measures. However, it remains that the AAQ Directives have not been *fully* effective as EU air quality standards are still not being met in many Member States.

What is the issue?

The AAQ Directives' overall aim is to reduce air pollution and the harmful effects on human health and the environment. Practically this translates into a string of more specific objectives upon which the effective implementation of both AAQ Directives depends – this is outlined in detail in the intervention logic presented in section 2.1.

In short, effective implementation of the AAQ Directives is thus expected to ensure the setting up and maintenance of a representative and high quality network for the monitoring and assessment of air quality in all EU Member States. This network needs to make available reliable, objective and comparable information on air quality across the

⁸² See, in particular, Figure 8, Section 3.2 and Annex 7 to this SWD.

EU as a basis for taking coherent action to avoid, prevent or reduce the adverse effects of poor air quality (see section 5.3 for a discussion about its effectiveness and efficiency).

In line with the overall purpose of the AAQ Directives to avoid, prevent or reduce harmful effects of air pollution and achieve good air quality, the ultimate metric of their success will be whether EU air quality standards have been met, or not (see section 2.3). Simply put, full compliance would translate into full effectiveness. This has not been achieved, and is well-documented (see also section 3.2 and Annex 7 for an overview).

It is thus meaningful to also assess whether and by how much the number and magnitude of the remaining exceedance situations have decreased. This can provide a metric of partial effectiveness, and allow an assessment of progress towards the AAQ Directives overall aim to avoid, prevent or reduce harmful effects of air pollution. It is therefore methodologically relevant to also take into account the overall reductions in population exposed to air pollution over the AAQ Directives implementation period.

What are the findings?

The AAQ Directives provide an approach to manage air quality across the EU. This builds on four main strands of intervention by which (1) air quality is monitored based on common methods, (2) agreed air quality standards provide benchmarks to achieve, (3) information on air quality is reported and communicated, and (4) action is taken to improve air quality if, when and where it does not meet agreed air quality standards.

The AAQ Directives have arguably successfully guided the monitoring of air quality (see sections 3.1 and 5.3), established clear air quality standards (see sections 2.3 and 5.1), and facilitated the exchange of information on air quality (see sections 3.4 and 5.3). However, they have not fully ensured that sufficient action is taken to meet air quality standards and keep exceedances as short as possible throughout the EU.

As a result, the present picture is mixed, with persistent and widespread exceedances still being prevalent in many Member States. Substantial exceedances continue in up to 20 Member States, depending on the air pollutant (this included, in 2017, reported exceedances of nitrogen dioxide in 17 Member States; particulate matter (PM₁₀ or PM_{2.5}) in 15 Member States; ozone in 13 Member States;⁸³ benzo(a)pyrene in 12 Member States; arsenic and nickel in 4 Member States each; sulphur dioxide, cadmium and benzene in 2 Member States each; and carbon monoxide in 1 Member State).^{84,85}

At the same time, reported air quality data shows that the number and magnitude of exceedances of EU limit values and target values have significantly decreased over time for most pollutants. Generally, both the number of Member States experiencing exceedances as well as the share of air quality zones reporting exceedances have decreased since the AAQ Directives have been adopted (Figure 8).

⁸³ It is also worth noting that exceedances reported for ozone vary significantly from year to year, as this pollutant is particularly sensitive to changes in meteorological conditions.

⁸⁴ COM(2019)149. 'Environmental Implementation Review 2019'; and air quality data as provided via the EEA Air Quality Portal. See also Section 3.2 and Annex 7 to this SWD.

⁸⁵ Also see Section 3.2 and Annex 7 to this SWD for a comparison of situation in 2008 and 2017.

Note that for fine particulate matter (PM_{2.5}) there had been an increase in the share of zones that reported exceedances in the initial years of the 2008 to 2018 evaluation period, especially in the first three years. During the same period, the monitoring network for PM_{2.5} was expanded in line with the requirements of Directive 2008/50/EC, thus adding almost 1 000 additional sampling points since 2008 (see Table 2). Since 2015, the year in which the limit value for PM_{2.5} entered into force, there has been a clear downward trend.

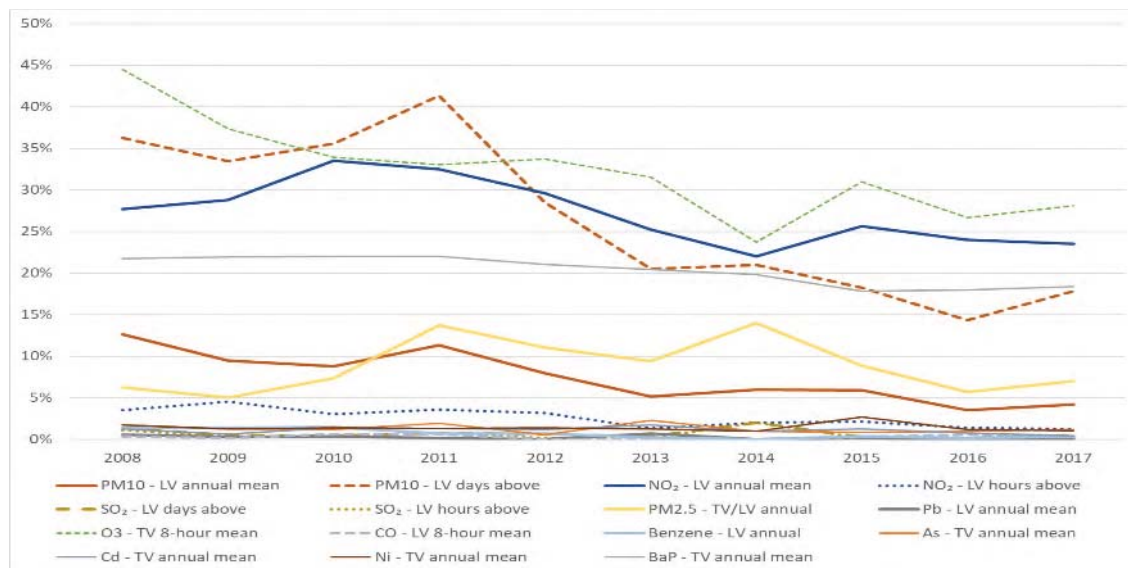


Figure 8 – Share of zones with exceedances above EU target/limit values, 2008 to 2017⁸⁶

Looking in more detail at specific pollutants, a more complex picture unfolds. In particular, the trends for particulate matter and nitrogen dioxide are illustrative here, not least as these are the two pollutants for which persistent and widespread exceedances above the limit value prevailed after their respective dates of becoming binding. This has triggered a number of infringement cases by the European Commission focussed on these two pollutants (see Section 3.5 and Annex 6 of the SWD for an overview).

Overall reductions in these two pollutant concentrations had a positive impact on the share of urban population exposed to air pollution above limit values and target values. This exposure is lower now than a decade ago: For particulate matter (PM₁₀), this share has almost halved, from 23.9% in 2008; at the same time for nitrogen dioxide (NO₂) this share has decreased from 12.3% in 2008 to 7.3% in 2016. See Annex 7 to this SWD.

For *particulate matter (PM₁₀)*, the number of zones with exceedances has more than halved between 2008 and 2017, and the number and magnitude of the remaining exceedances has been reduced. The highest annual average concentrations reported has decreased in all but two Member States between 2008 and 2017, and on average this decline has been one of more than 20%. The highest reported levels were 99 µg/m³ in 2008 and 64 µg/m³ in 2017. Similarly, exceedances above the daily limit value have declined.⁸⁷

⁸⁶ Based on annual ETC Technical Papers on ‘Reporting on ambient air quality assessment in the EU Member States’ for 2008 to 2012 (see <https://acm.eionet.europa.eu/reports/#tp>), and on data by Member States via e-reporting for 2013 to 2017 (see <http://aideg.apps.eea.europa.eu>).

⁸⁷ For a comparison between 2008 and 2017 per Member State for PM₁₀, see Section 3.2 and Annex 7 to this SWD.

In several cases, air quality measures taken have resulted in compliance, in particular in Western Europe.⁸⁸ A range of air quality measures have contributed to this success, including the successful reduction of particulate matter emissions from transport due to the use of diesel particle filters, and the use of urban vehicle access restrictions (see Box 7). Where exceedances remain, especially in Eastern Europe and Northern Italy, they relate primarily to emissions from the energy sector and often residential heating, as well as from transport.

Box 7 – Case Study Berlin: Urban Vehicle Access Regulations

Urban Vehicle Access Regulations have, in a majority of cases, been established as Low Emission Zones that primarily aim at improving air quality. Evidence suggests that they have successfully lowered local transport emissions in several cases, notably of particulate matter.⁸⁹ For example, according to the Berlin air quality plan, the existing Low Emission Zone in Berlin reduced the local increment to this pollutant from engines from 11% to 4%.⁹⁰

Also for *nitrogen dioxide (NO₂)* widespread exceedances prevail, with exceedances in more than 130 cities in 2017. At the same time, the number and magnitude of exceedances has been reduced. In 2008, 21 Member States reported annual average concentrations above the EU air quality standards, five of which with levels at above double the limit value (and even levels of 115 µg/m³ and 106 µg/m³ at sampling points in the United Kingdom and Germany, respectively). In 2017, still 17 Member States reported exceedances, even if the maximum levels decreased in most cases.⁹¹

Despite some progress made, this indicates that the measures taken by Member States to date have been insufficient. This is the case for most urban areas across the EU, and the highest levels are reported for London, Paris, Turin, Munich and Athens. Air quality plans point to a number of measures to reduce NO_x emissions in cities, in particular from road transport, including by improving public transport options or promoting a modal shift. However, the resulting emission reductions have been partially offset by increased transport demand and a high proportion of high emitting diesel vehicles in the fleet due to Euro 5 and early Euro 6 vehicles having high emissions in real driving, which reduced the effectiveness of scrapping schemes and low emissions zones.

Where, in given zones or agglomerations, the levels of pollutants in ambient air exceed any limit value or target value, Member States, including regions and municipalities, shall ensure that air quality plans are established, and where limit values are exceeded measures are to be taken to keep exceedance periods as short as possible. In line with the subsidiarity principle, the AAQ Directives give flexibility to Member States to apply those measures that best fit their local conditions. While additional measures to improve air quality may also result from other EU legislation (see section 5.5) as well as from

⁸⁸ For instance, the number of zones in exceedance in Belgium has decreased from nine in 2008 to none in 2017.

⁸⁹ EEA Report 24/2018. ‘Europe’s urban air quality’. See also the support study informing this Fitness Check, Appendix I; see also Annex 9 to this SWD.

⁹⁰ When comparing source apportionment results before and after the introduction of the LEZ; see Entwurf Luftreinhalteplan für Berlin (2 Fortschreibung, Stand 15 April 2019).

⁹¹ For a comparison between 2008 and 2017 per Member State for NO₂, see Section 3.2 and Annex 7 to this SWD.

other Member State actions, the choice of measures primarily lies with the competent national authorities.

The air quality plans, and the air quality measures they mandate, are reported to the European Environment Agency. Looking at the reporting period from 2013 to 2016 (i.e. the period for which air quality plans and measures have been reported in accordance with the requirements of Implementing Decision 2011/850/EU), most measures reported focus on emissions from the transport, energy and industry sectors (as these tend to be the main sources of pollution for particulate matter and/or nitrogen dioxide).

The effectiveness of any air quality plan depends strongly on the political commitment and coordination between levels of government. The ultimate test for the success of a plan is whether the measures implemented have led to reductions in the concentration levels of the air pollutants targeted, and indeed kept the exceedance period as short as possible (which needs to be determined on a case by case basis).⁹² And, against the metric of reduced concentration levels (and reduced exposure to concentration levels above EU air quality standards), there have been both successes and shortcomings, as illustrated above.

The European Court of Auditors⁹³ indicated that the insufficient quality of air quality plans in Member States, and the lack of requirements for Member States to report on the implementation and performance of these plans, means that they generally do not provide appropriate information about the real impact of measures taken. The European Court of Auditors points to three reasons that, in their view, compromise the effectiveness of air quality plans: (a) they were not sufficiently targeted and could not be implemented quickly enough for the areas with highest concentration levels, (b) they could not deliver results in the short term because they went beyond the powers of the local authorities responsible for implementing them, or because they were designed for the long-term, and (c) they were not supported by cost estimates or were not funded.

It is worth noting that by their very definition, air quality plans require time. In accordance with the provisions of Directive 2008/50/EC, air quality plans shall be communicated no later than two years after the end of the year the first exceedance was observed (even if Member States can choose to accelerate this). This in itself carries the risk that up to three years can pass, before necessary measures are actually taken. And the measures themselves, especially where they address large scale infrastructure development, can take even longer than this to show effect. These considerations need to be carefully factored in by the competent authorities in order to ensure exceedance periods are kept as short as possible, and not delayed unduly.

The AAQ Directives offered the possibility for the so-called *time extensions* (in accordance with Article 22 of Directive 2008/50/EC). Several Member States have made use of the opportunity to apply for a time extension to comply with particulate matter and nitrogen dioxide limit values. While time extension for particulate matter tend to have resulted in an above-average rate of air quality improvements in these zones, time extensions for nitrogen dioxide did not (mainly as vehicle emissions did not decrease as

⁹² Note that Article 23 and Annex XV of Directive 2008/50/EC explicitly require air quality plans developed to keep exceedance periods as short as possible to include an '*estimate of the improvement of air quality planned and of the expected time required*'.

⁹³ European Court of Auditors Special Report on Air Pollution. See section 1 of Annex 9 to this SWD.

planned during the time extension period, and the higher than expected emissions from diesel vehicles was not sufficiently compensated for in the relevant local air quality plans).

Furthermore, Directive 2008/50/EC provides the option to deduct contributions from natural sources, i.e. emissions of pollutants not caused directly or indirectly by human activities, including natural events such as volcanic eruptions, seismic activities, geothermal activities, wild-land fires, high-wind events, sea spray or the atmospheric re-suspension or transport of natural particles from dry regions (see Box 8). In addition, deductions for winter-sanding and -salting are explicitly warranted by this Directive: for the year 2017, two Member States made use of this possibility in seven instances.

Box 8 – Subtraction of contributions from natural sources

The subtraction of exceedances of particulate matter attributable to natural sources is guided by six key principles laid out in a dedicated guideline document.⁹⁴ For the year 2008, eleven Member States made use of the provision to subtract contributions to particulate matter exceedances from natural sources.⁹⁵ For the year 2017, six Member States did so in 37 instances: in 17 instances (in six Member States) this changed the compliance status, where as in 20 instances (in four Member States) it did not.⁹⁶ The main natural sources cited were ‘transport of natural particles from dry regions outside the Member State’ (i.e. Saharan dust), followed by sea spray and wild-land fires. The contributions of natural sources to the annual mean concentrations of particulate matter were estimated in the range of between 1 and 5 µg/m³, and in some cases as high as 13 µg/m³ (due to Saharan dust).

Having said this, the available air quality data for the period 2008 to 2017 shows that exceedance occurrences have generally decreased for all pollutants. Many air quality zones have either improved air quality or reached compliance with EU air quality standards during the assessment period for most pollutants. This does indicate that the AAQ Directives have been at least partially effective in reaching their objectives.

Views of stakeholders⁹⁷

Stakeholders largely consider that the AAQ Directives have been effective in establishing common EU air quality standards (with more than 70% agreeing or completely agreeing with this in the open public consultation). Also, responses to the targeted questionnaire survey rated ‘the extent to which the established standards of air quality to achieve across the EU has been achieved’ positively. Respondents considered that establishing of common standards and associated framework provide a ‘push’ to improve air quality, by urging authorities to act: a view that was also expressed by most of the local and regional authorities that provided feedback to the stakeholder consultation (Box 9).

⁹⁴ SEC(2011)208. ‘Guidelines for demonstration and subtraction of exceedances attributable to natural sources under the Directive 2008/50/EC’.

⁹⁵ Based on EEA Technical Report 10/2012. ‘Particulate matter from natural sources and related reporting under the EU Air Quality Directive in 2008 and 2009’.

⁹⁶ <http://aideg.apps.eea.europa.eu>

⁹⁷ For an overview of the stakeholder feedback, and details of views of expressed by different stakeholder groups in the open consultation, please also see Annex 2 to this SWD.

In particular, the mandatory nature of the air quality standards, and their enforcement by the European Commission, has been identified by stakeholders as a key factor that contributed to better air quality (44% of respondents to the open public consultation expressed a view that ‘ambition and stringency of the standards established’ were contributing to air quality improvements to a very large or large extent – compared with 21% who indicated them to be contributing very little or not at all). While the importance of these factors is acknowledged by a proportion of the respondents, this view is not unanimous. It is in particular noticeable that the perceptions on enforcement action (see Annex 6 to this SWD for an overview of infringement cases) and cooperation are highly varied, indicating different experiences and perceptions.

Box 9 – Perspectives of local and regional authorities

To inform this fitness check, detailed responses to the targeted questionnaire or ad-hoc contributions were received from 11 local or regional authorities (see Annex 2 to this SWD). These mostly consider that the AAQ Directives have been instrumental in driving air quality improvements, including through binding limit values and the possibility of legal action.

A key reason identified by local and regional authorities for not achieving compliance throughout the EU is a lack of coordination between governance levels, and a suboptimal allocation of responsibilities between them. Another reason referred to are shortcomings in policy coordination at EU level, such as with climate policies or with regulation of pollutant emissions at source.

Several local and regional authorities emphasise the need to adapt to local conditions. The AAQ Directives’ provisions on air quality monitoring are praised as ensuring comparable, high quality information on air quality across the EU, with some room for improvement on specifying assessment and monitoring requirements (while accounting for local practical needs).

While the responses to the open public consultation indicated that stakeholders considered the AAQ Directives to be effective in triggering a need and urgency for air quality improvements, respondents seem somewhat critical about the effectiveness of the AAQ Directives to actually facilitate coherent action to avoid, prevent, or reduce the effect of poor air quality: less than half of the respondents agreed that the AAQ Directives have been effective in achieving this output. Several industry stakeholders expressed the view that the air quality standards were not always fully actionable.

Reasons named for this lingering dissatisfaction include the continued exceedances of the target and limit values, as well as the pace of EU-level enforcement actions. In particular the air quality plans and measures mandated by the AAQ Directives received mixed feedback in the feedback to the targeted questionnaire (43 responses in total, see Annex 2 to this SWD). On the one hand, several stakeholders (including both NGOs and some national authorities) were positive about the provisions on air quality plans in the AAQ Directives. On the other hand, others explicitly flagged limitations in these provisions, including: the issue of timing when air quality plans are required and drawn up (one national authority and two NGOs), ambiguity of air quality plans (one scientific institution and one NGO), and the ineffectiveness of these plans (one national authority and one NGO).

A key limitation raised by several stakeholders was the fact that the AAQ Directives do not tackle the sources of air pollution as such (meaning they do not include provisions that limit emissions at national level or per source – note that the coherence of different legislation to this effect is discussed in section 5.6). A further limitation identified in particular by local and regional authorities were shortcomings in the coordination between different governance levels (Box 9).

5.3. Effectiveness and efficiency of air quality monitoring

Evaluation question: To what degree are the monitoring and reporting approaches mandated by the AAQ Directives (and their respective implementation) fit for purpose?

Overall response: The AAQ Directives spell out the clear criteria for determining minimum numbers of sampling points, for data quality and acceptable uncertainty in monitoring and modelling, as well as for macroscale and microscale siting of sampling points. These criteria set limits to the flexibility that Member States have in setting up their respective air quality monitoring regimes, but within these limits leave the establishment and maintenance of the network to national, regional or local authorities. This flexibility ensures that siting of sampling points is based on local expertise.

Over time, this has guided the build-up of an effective air quality monitoring network across the EU which, by and large, adheres to the provisions of the AAQ Directives, and ensures that reliable and representative air quality measurements and data are available. The key challenge here is to ascertain that air quality sampling points indeed provide information both for where the highest concentrations of air pollutants occur as well as for other areas which are representative of the exposure of the general population.

Some stakeholders question the comparability of the data provided by sampling points in different locations, as the spatial representativeness of measurements may vary considerably even on small scales (i.e. tens of meters) for some pollutants, notably nitrogen dioxide. Meanwhile, the European Court of Auditors has expressed concerns that air pollution might be underestimated, if not monitored in the right places. On balance, this fitness check found that air quality information collected and reported is effective, and delivers air quality data that is robust and reliable enough to act upon.

In terms of efficiency, the information entails relatively low per capita administrative burden. There are some indications that efficiency could be improved in Member States, relating to different governance approaches. It is worth noting that the monitoring requirements depend on the number of air quality zones designated, the population in these zones, as well as on whether pollution levels are above specific assessment thresholds defined in the AAQ Directives. Simply put: less pollution, or less people living in an area, will require less monitoring and thus lower monitoring costs.

The successful establishment and operation of a Europe-wide e-reporting database during the past decade (based on standardised and machine-readable reporting formats) will allow further improvements in the way information is reported, quality assured and made accessible, but may require detailed additional (future) guidance on reporting of air quality information (for example as regards air quality modelling).

What is the issue?

Reliable, objective and comparable information on air pollution is at the core of all the efforts to maintain air quality where it is good, or improve it where it is not. Representative and quality assured data about air quality also highlights whether, when and where air pollution exceeds acceptable thresholds and whether concentration levels result in risks to human health and the environment. Air quality monitoring is not an aim in itself: it is supposed to be helpful for authorities (and the public) in finding out facts and guiding appropriate response options: are limit values respected and if not, why not

and what to do about it? It is also crucial to understand whether measures taken to improve air quality rendered successes or not.

The AAQ Directives define common approaches and criteria on how and where to monitor and assess ambient air quality. These criteria include a dual requirement to sample air quality both where the highest concentrations occur as well as in other areas which are representative of the exposure of the general population.

The level of detail as to which air quality is to be monitored depends on the population potentially exposed to air pollution, and whether concentrations are expected to actually exceed clearly defined assessment thresholds, or not. Depending on this, techniques other than measurements, including modelling of air quality and indicative measurements, can also be used to assess ambient air quality, provided that the criteria defined by the AAQ Directives for their required accuracy are met.

Commission Implementing Decision 2011/850/EU lays down in considerable detail rules on reporting on ambient air quality and on the reciprocal exchange of information. As a result of this, reporting of air quality is based on a state-of-the-art electronic reporting approach by which air quality information is made available in a standardised and machine-readable format – and made accessible in full via the websites of the European Environment Agency.⁹⁸

There is no question that good information on the state of the air is key for the successful implementation of the AAQ Directives. But are the requirements for monitoring, assessing and reporting of air quality as set out in the AAQ Directives, the corresponding Implementing Decision, and supporting guidance documents (fully) fit to ensure that the ‘right information’ is available at the ‘right time’ and without resulting in excessive administrative burdens, overlaps and/or synergies, gaps, inconsistencies?

What are the findings?

Overall, the information about air quality across the EU is good: an extensive monitoring network of more than 4 000 monitoring stations that report data to the European Commission today includes at least 600 sampling points for each of the pollutants and, for particulate matter and nitrogen dioxide, even more than 3 000 sampling points each. The number of sampling points varies between Member States (Table 2), as monitoring requirements depend on the number of designated air quality zones, the population density in these zones, as well as on whether pollution levels are above specific assessment thresholds defined in the AAQ Directives.

The monitoring and reporting of air quality is and has been broadly in line with the requirements established in the AAQ Directives. Even if there are still today isolated instances where the requirements of the AAQ Directives as regards monitoring and reporting are not met, most zones in the Member States have the minimum number of sampling points required by the AAQ Directives. Where this is not the case, the European Commission has, in several instances, initiated infringement procedures and is constantly encouraging further compliance efforts, which have led to the result that the total number of sampling points has in general increased.

⁹⁸ <https://www.eea.europa.eu/>

In its 2018 Special Report, the European Court of Auditors has identified a number of issues that hamper effective and efficient monitoring and reporting, relating to the number and location of sampling points (see below), and has identified as a limiting factor that the Commission does not have the mandate to require additional monitoring points at specific locations when and where it considers this is necessary to better measure air pollution.⁹⁹

Furthermore, the European Court of Auditors has stressed that timely air quality data is important, both for the Member States to take appropriate actions to reduce air pollution, and for the Commission to act earlier to take enforcement procedures against the Member State. The AAQ Directives require that Member States provide annual validated data only by 30 September of the following year - with e-reporting this could be accelerated, decreasing the time lags between observation and reporting, making it easier also for citizens to access more recent air quality data.

Number and type of sampling points

The AAQ Directives provide a clear indication as regards the number and type of sampling points needed in each zone (or agglomeration) for each pollutant. For nitrogen dioxide, particulate matter, benzene and carbon monoxide this shall include at least one urban background monitoring station and one traffic-orientated station, provided this does not increase the number of sampling points.

Generally speaking, there are three types of sampling points: (a) at *urban background locations*, depicting pollution levels influenced by the integrated contribution of all sources rather than a single source (as a general rule, these are representative for several square kilometres); (b) at *traffic-orientated locations*, sited in such a way that the air sampled is representative of air quality for a street segment of no less than 100 m length; and (c) at *rural background locations*, away from significant sources of air pollution.

Most Member States have put in place the minimum number of sampling points required by the AAQ Directives. An analysis of the monitoring and assessment regimes in each of the 28 Member States for particulate matter and nitrogen dioxide did not point to fundamental gaps in the number of monitoring stations in Member States: in 2015, more than 98% of the required sampling points for nitrogen dioxide reported data (and this has since increased further). For particulate matter, this number was slightly lower at just under 96%: here, traffic-oriented PM_{2.5} sampling points are missing in some cases.¹⁰⁰ Data for 2017 indicates that this has improved further since 2015.¹⁰¹

Similarly, analysing the implications of a sub-set of only five Member States, a study published by the European Parliament Research Service¹⁰² in spring 2019 notes that most of the monitoring requirements of the AAQ Directives were fulfilled in the analysed

⁹⁹ European Court of Auditors Special Report on Air Pollution. See section 1 of Annex 9 to this SWD.

¹⁰⁰ Ricardo (*forthcoming*). ‘Assessment of monitoring regimes 2015’.

¹⁰¹ EEA Air Quality Data Portal: <http://aqportal.discomap.eea.europa.eu/>

¹⁰² European Parliament (2019). ‘Sampling points for air quality: Representativeness and comparability of measurements in accordance with Directive 2008/50/EC on ambient air quality and cleaner air in Europe’ (study requested by the ENVI Committee).

Member States: especially the number of monitoring stations was sufficient in every case (even if the study also noted that it is not clear from the available documentation if the location with the highest concentration is covered in all Member States).

Compliance has in general increased for the different air pollution types since the start of the implementation of the AAQ Directives. Hence, it seems that the AAQ Directives have generally improved the availability of reliable and comparable data, thus enabling the monitoring of trends at EU-wide level.

In addition to this, over the past five years, the use and reporting of modelling techniques to complement data from fixed monitoring stations has increased substantially. Such air quality modelling helps improve the spatial representativeness of air quality information, and generally does so at a relatively moderate costs (see Box 10).

While in 2013 only four Member States reported modelled data to the European Commission, this had, by 2017, increased to twelve Member States.¹⁰³ Stakeholders, and especially local and regional authorities, noted a lack of clear provisions on air quality modelling in the AAQ Directives, and pointed to a need to further improve guidance.

Location of sampling points

While the EU rules prescribe certain minimum criteria on the positioning of monitoring stations, they provide some discretion to Member States for choosing the exact locations.

Flexibility of the criteria for classifying measurement stations are identified as possible factors that have led to differences in the way this has been done in the Member States and so may have led to limitations in comparability of data. Regarding external factors, resource constraints (e.g. costs, qualified staff) may have led to a varied coverage and data quality of the monitoring network across the EU. In terms of other possible external factors, no firm conclusions can be drawn from the analysis.

Some concerns have also been raised about the representativeness of sampling points that may, in some cases, limit the comparability. Even if the AAQ Directives require to locate sampling points both *‘where the highest concentrations occur’* and *‘other areas [...] which are representative of the exposure of the general population’*, it is not always clear that the monitoring network lives up to this. Most notably, the European Court of Auditors concluded in 2018 that *‘air pollution can be underestimated as it might not be monitored in the right places.’*¹⁰⁴

Furthermore, in particular the criteria for the microscale siting of sampling points leaves a degree of flexibility to national authorities (aligned with the overall principle of subsidiarity) when establishing monitoring networks in order to be mindful of specific circumstances, including local spatial planning requirements. Specifically, while the AAQ Directives – amended further by Commission Directive (EU) 2015/1480 – do set out a series of criteria, they require such criteria to apply *‘in so far as practicable’*.

¹⁰³ In 2013: Netherlands, Poland, Spain, and the United Kingdom. In 2017: the previous four, plus Belgium, Germany, Portugal, Romania, Croatia, Latvia, Lithuania, and Sweden.

¹⁰⁴ Note that this has also been subject to interpretation by the Court of Justice of the EU; see section 3 of Annex 6 to this SWD.

A position paper published by the JRC and the network of National Reference Laboratories (AQUILA) in 2013 related to siting criteria, classification and representativeness of air quality monitoring stations noted that the spatial representativeness of measuring sites is not defined in the legislation, which can hinder the effectiveness of the monitoring network design and suitability to assess exposures and model performances.¹⁰⁵

Furthermore, a study published by the European Parliament Research Service in 2019 pointed to a number (22) of specific ‘ambiguities’ in the provisions laid down in the AAQ Directives as regards the macroscale and microscale siting of sampling point. This refers in particular to the methods for the identification of the highest concentration and general population exposure, ‘*thereby potentially compromising the protection of human health*’. It also points to the fact that the use of terminology such as ‘*some metres*’, ‘*at least 180°*’, or ‘*immediate vicinity*’ may leave an excessive margin of discretion.¹⁰⁶

Costs of monitoring and reporting

The Commission Better Regulation Toolbox defines the costs linked to the legal obligation to provide information as administrative costs; it also defines information in a broad sense, including monitoring, reporting and assessment needed to provide the information.¹⁰⁷

All costs related to the AAQ Directives requirements for monitoring and reporting are therefore administrative costs. However, only a sub-set of these administrative costs can be considered administrative burden, stemming specifically from the AAQ Directives. Indeed, even in the absence of the AAQ Directives, it is very likely that Member States would undertake some air quality monitoring (and already did so before the AAQ Directives were adopted, see Table 2 for an overview) and information to the public (see more details on the typology of costs in Annex 3).

The estimates of the costs of air quality monitoring and reporting have therefore to distinguish, within these overall administrative costs, between the ones stemming specifically from the AAQ Directives (administrative burden) and the ‘business as usual’ administrative costs (see Box 10 for examples for selected Member States).

Estimates based on data provided by eight Member States through the support study¹⁰⁸ indicate that the per capita overall administrative costs (see Annex 3) of air quality

¹⁰⁵ JRC (2013). ‘Assessment on siting criteria, classification and representativeness of air quality monitoring stations’.

¹⁰⁶ See Annex 9 to this SWD.

¹⁰⁷ Section 2 of Tool #59 of the Better Regulation Toolbox: ‘Administrative costs are defined as the costs incurred by enterprises, the voluntary sector, public authorities and citizens in meeting legal obligations to provide information on their action or production, either to public authorities or to private parties. Information is to be construed in a broad sense, i.e. including labelling, reporting, registration, monitoring and assessment needed to provide the information. In some cases, the information has to be transferred to public authorities or private parties. In others, it only has to be available for inspection or supply on request.’ (https://ec.europa.eu/info/sites/info/files/file_import/better-regulation-toolbox-59_en_0.pdf).

¹⁰⁸ Support study informing this Fitness Check, Section 6.3.3 and Appendix F3.

monitoring and reporting are between EUR 0.14 and 0.98 per year per person. Accordingly the estimated costs of monitoring are several orders of magnitude smaller than the costs of exceeding EU air quality standards (which are estimated to amount to about EUR 240 billion for the period 2008 to 2016, see section 5.4). It is also worth noting that the AAQ Directives provide a mechanism for a proportionate approach to monitoring, whereby pollutants that are below well-defined assessment thresholds, can be covered by less extensive monitoring regimes, thus decreasing monitoring costs.

Based on a smaller sample of three Member States, administrative burden (see Annex 3 to this SWD) stemming directly from the monitoring requirements established in the AAQ Directives per capita are estimated between EUR 0.12 and 0.38 per year person.¹⁰⁹

Box 10 - Monitoring and reporting costs: information on selected Member States¹¹⁰

The case studies and targeted questionnaires allowed to gather rather detailed information about the cost of air quality monitoring and reporting directly from the authorities operating the monitoring networks. Although not always covering exactly the same items, this information provides an order of magnitude on several aspects of the monitoring and reporting costs.

Annual operating costs, per monitoring station: the 2005 impact assessment for the Thematic Strategy on Air Pollution estimated an annual costs per monitoring station at EUR 24 000 (covering sampling equipment, maintenance costs, labour and analysis). This broadly corresponds to the findings of the 2018 case studies (see Annex 9 to this SWD), with annual operating costs ranging from EUR 7 500 (in Sweden) to EUR 32 000 (in Italy), and up to EUR 70 000 in some Spanish regions.

Annual capital cost (i.e. equipment related costs) are estimated at EUR 380 000 for Ireland, while for Spain the estimates vary by region from EUR 345 000 (Castilla y Leon) to EUR 2.7 million (Andalucia). Estimates for annual laboratory costs to check the measurements done by the monitoring network are estimated at EUR 30 000 for Spain and EUR 50 000 for Sweden. Annual modelling costs are estimated at EUR 65 000 for Sweden.

Not all these costs can be exclusively attributed to the AAQ Directives, which can explain the considerable range in the above estimates. Both Dublin City Council and the Swedish Environmental Protection Agency, for example, indicated that the setting up of the air quality monitoring network already started before 2008, which reduced the amount of additional costs incurred as a result of AAQ Directives.

The fitness check of reporting and monitoring of EU environment policy¹¹¹ approximated the administrative burden related to the regular reporting (i.e. only compiling and reporting of information, not monitoring) by Member States to the EU under the AAQ Directives to be fairly large (i.e. between EUR 100 000 and EUR 1 million in total across the EU). Since 2014, the two AAQ Directives utilise a common e-reporting system which has resulted in effectiveness and efficiency gains.

The annual cost incurred by the European Environment Agency for dealing with all reporting on air quality issues was estimated at EUR 760 000 for the 2014 to 2016

¹⁰⁹ Support study informing this Fitness Check, Section 6.3.3 and Appendix F3.

¹¹⁰ Based on case studies and replies to targeted questionnaire, see Annex 11 to this SWD

¹¹¹ SWD(2017)230. 'Fitness Check of Reporting and Monitoring of EU Environment Policy'.

period.¹¹² This covered large investment in new IT systems, including the Air Quality e-reporting database, with most of this cost arising from software development by contractors. No data from earlier periods was available.

Some specific areas have been identified which could explain the cost differences across Member States and regions (see Box 10) and where both effectiveness and efficiency in the monitoring and reporting could be improved:

- the extent to which the compliance with the requirements of the AAQ Directives is delegated to local authorities whilst supported and co-funded by national authorities;
- the availability of national level guidance in Member States;
- the level of use of modern information technology and media technology.

The level and kind of air quality information provided to a wider public beyond what is presented by the European Environment Agency and the European Commission differs significantly between Member States (see, for example Box 11 and Annex 11 to this SWD). While cost data for the full range of public authorities providing information is not available, these costs are likely to vary accordingly across Member States.

Box 11 – Public information on air quality: examples from Ireland¹¹³

The Environmental Protection Agency manages the national ambient air quality monitoring network and measures the levels of a number of atmospheric pollutants in ambient air. Its website provides freely and easily accessible information to the public, including: (1) *real-time monitoring data* for a number of stations across Ireland; (2) *an air quality index for health (AQIH)* with colour coded maps across different regions; (3) *air quality bulletins for NO₂, O₃ and PM₁₀* with information on exceedances of daily limit values or alert thresholds, as well as a variety of *official reports* on air quality; (4) *information for web-developers* for third party reporting solutions, providing a dynamically generated feed for the air quality index for health. The website also offers information to health professionals on how to use the *air quality index for health* to help pollution-sensitive patients manage their condition and reduce their symptoms, as well as general information on air quality zones, standards and management.

Views of stakeholders¹¹⁴

A large majority of respondents to the open public consultation (88%) indicated that, in their view, monitoring and reporting regimes under the AAQ Directives had helped

¹¹² SWD(2017)230. ‘Fitness Check of Reporting and Monitoring of EU Environment Policy’. The estimate of EUR 760 000 is based on the average budget and staff dedicated to air quality reporting by the EEA. Within this envelope, the EEA amongst other manages and maintains the relevant data repository as per Implementing Decision 2011/850/EC, ensures that reported data is publically accessible via a bespoke online information portal, analyses this data and publishes its assessment via an annual Air Quality in Europe report, and since 2017 host a European Air Quality Index available to citizens online including via mobile devices.

¹¹³ Based on case study (Ireland), see Annex 11 to this SWD. The website referred to includes:
Real-time monitoring data: <http://www.epa.ie/air/quality/data/>
Air Quality Index for Health (AQHI): <http://www.epa.ie/air/quality/>
Air quality bulletins & reports: <http://www.epa.ie/air/quality/reports/>
Information for web-developers: <http://www.epa.ie/air/quality/dev/>

¹¹⁴ For an overview of the stakeholder feedback, and details of views of expressed by different stakeholder groups in the open consultation, please also see Annex 2 to this SWD.

deliver reliable, accurate and comparable air quality information across the EU to a large or even very large extent. Feedback in particular from national and regional authorities acknowledged that the common methods established by the AAQ Directives have been instrumental in having reliable and comparable data across the European Union as a basis to monitor trends and guide air quality management (but noting that for some pollutants, namely benzo(a)pyrene or volatile organic compounds this could be improved).

More specifically, around half of the respondents to the open public consultation agreed that sufficient criteria are defined at the EU level for monitoring and assessment (58%), and that measurement techniques are sufficiently standardised across Member States (46%). However, a majority of respondents disagreed that there are sufficient sampling points and measurements to assess air quality (52%) and that sampling points are representative as regards the highest concentration or general population exposure.

Similar findings were echoed in the workshops, with participants identifying several factors that may limit the effectiveness of air quality objectives. NGOs and local and regional governments noted a lack of clear provisions and guidance on air quality modelling. National officials also emphasised that more attention should be given to measuring emissions in areas where vulnerable populations are present, with consideration given to applying more stringent limit values in these areas.

A number of comments were raised by representatives of authorities, industry and NGOs on the siting of monitoring stations: some stakeholders suggested that the AAQ Directives' criteria on siting are too flexible, while others suggested that they are too restrictive. Participants also raised aspects where AAQ Directives have made progress, such as the improvements in publicly available information and data on air quality and on the accessibility, timeliness and user-friendliness of information on air quality assessment thanks to the reporting obligations laid down by Implementing Decision 2011/850/EU.

Similarly, a majority of the respondents to the targeted questionnaire survey (43 responses in total, see Annex 2 to this SWD), stated that the AAQ Directives have achieved the objective of defining common methods to monitor and assess air quality to a large or a very large extent, as well as the objective of actually monitoring and assessing ambient air quality. Some stakeholders, in particular NGOs and representatives of authorities, noted areas of further improvement of comparability/reliability of data, for example due to potential for different interpretations by the Member States. National authorities indicated that guidance on how modelling should or can be incorporated in official reporting was limited.

Both during the stakeholder workshops and in the feedback to the targeted questionnaire, several respondents noted that there is scope to further clarify and improve monitoring requirements, and enhance the spatial representativeness where monitoring sites are limited. One industry association specifically identified the requirement for traffic measuring points to be within 10 meters from the kerbside (Annex III of Directive 2008/50/EC) as inappropriate for motorways and other highways where no one is living, and stated that this makes it difficult to establish a business in these locations, resulting in an undesirable shift of operating facilities into residential areas.

Regarding the costs of monitoring, reporting and assessment associated with the AAQ Directives, a larger share of respondents agreed somewhat or completely that significant costs were associated with monitoring equipment (46%). Furthermore, during the

stakeholder consultation, representatives from reporting authorities noted that the amount of information required to be reported goes beyond the essential in some cases.¹¹⁵

Meanwhile, in the open public consultation, a majority of respondents positively assessed the achievement of the objective of making air quality information available to the public, but it is worth highlighting that also here almost one in three respondents saw room for improvements (especially related to alert thresholds and/or information thresholds applied to inform the public).

¹¹⁵ See summary of discussions at the stakeholder workshop held on 18 June 2018 in the framework of this fitness check: https://ec.europa.eu/info/events/stakeholder-workshop-support-fitness-check-eu-ambient-air-quality-directives-2018-jun-18_en

5.4. Efficiency

Evaluation question: To what degree do the benefits of improved air quality justify the costs of improving air quality? Are there significant differences in costs (or benefits) between Member States, and if so, what is causing them?

Overall response: Good air quality makes good economic sense. Measures taken to improve air quality tend to be motivated by multiple expected outcomes, be they related to energy policy, transport policy or climate policy: many of the more expensive measures linked to air quality action plans are often taken also with other objectives in mind, such as reducing congestion, improving mobility or reducing greenhouse gases.

Aggregate estimates of the overall costs and benefits of air-related policies and of the AAQ Directives specifically are scarce and sometimes based on different assumptions. They are useful to provide an order of magnitude, but should not be used for comparison or as precise data.

An analysis published in 2017¹¹⁶ had estimated that the costs of all measures taken that result in air quality improvements (but which are often not primarily motivated by air quality considerations) add up to EUR 70 to 80 billion per year. Earlier estimates of the costs caused by air pollution to society, health and economic activities add up to between EUR 330 and 940 billion, per year, for the EU.¹¹⁷ This provides an order of magnitude of the relatively low level of the cost of action (measures) compared to the cost of inaction (harmful impacts) for air pollution in general.

Computations undertaken for the support study¹¹⁸ to this fitness check estimate that the costs of exceeding EU air quality standards have been decreasing since 2011 and amount to about EUR 240 billion for the whole 2008 to 2016 period – while the health benefits of measures taken to meet EU air quality standards are estimated to have increased over the same period and now amount to about EUR 50 billion. This estimate of benefits is however only a small sub-set of the overall benefits that can be attributed to the AAQ Directives, due to methodological constraints. If all benefits were to be accounted for (including all benefits to health, ecosystems, innovation or competitiveness), this would very likely increase the monetized estimate to a significant extent.

Both the costs and the benefits of taking air quality measures can vary substantially between Member States, by a factor of two or more, depending on the national specificities and the typology of measures put in place.

What is the issue?

Air quality has improved in the EU over the last decades, thanks to joint efforts by the EU and the national, regional and local authorities. As a result of actions taken, since 2000, the EU's GDP grew by 32% while emissions of the main air pollutants decreased by 10% to 70% depending on the pollutant (“absolute decoupling”). This improvement

¹¹⁶ IIASA (2017). ‘Costs, benefits and economic impacts of the EU Clean Air Strategy and their implications on innovation and competitiveness’

¹¹⁷ SWD(2013)531. ‘Clean Air Programme for Europe Impact Assessment’ (based on GAINS modelling).

¹¹⁸ Support study informing this Fitness Check, Sections 6.3.1 and 6.3.2, and Appendices F1 and F2.

has led to better health, a cleaner environment and direct economic benefits – but are they worth the costs of these improvements?

To provide context for this issue, it is useful to look first at the total costs of air pollution, or in other words, the potential benefits that could – theoretically – be achieved in an air pollution free world. In 2013, the Impact Assessment¹¹⁹ that underpinned the Clean Air Programme for Europe estimated the overall external economic costs of air pollution to be in the order of magnitude of EUR 330 to 940 billion per year.

This estimate includes the monetised valuation of ill health and increased mortality risk of the individual (which carries a high degree of uncertainty, which in turn explains the range of a factor three in the overall estimate); this includes also direct costs such as labour productivity losses, costs to the health care systems and lower crop yields, which add up to EUR 23 billion (note that this estimate does not include the total costs of ecosystem damages and biodiversity loss, including impacts on agricultural and forestry yields, nor impacts on materials and buildings).¹²⁰

These estimates are in the same order of magnitude as those provided by others: the OECD, for example, estimated the welfare costs attributed to premature deaths due to air pollution at around USD 730 billion in 2015 for those Member States that are part of the OECD.¹²¹

The total costs of air pollution include the foregone benefits that could be harvested through reduced pollution. Measures taken to enhance compliance with EU air quality standards, tap into these potential benefits, but are only a sub-set of those. It is important to note that many, if not all of these measures, bring with them substantial co-benefits and are not motivated by air quality policy alone: measures to improve energy efficiency (such as replacement of inefficient boilers), to subsidise shifts towards low emission mobility, to further develop public transport systems also have positive impacts for the way we source and use energy, for the decongestion of our urban mobility systems or for the fight against climate change. It is nearly impossible to disentangle these impacts from each other. Therefore, when assessing the costs and benefits of the measures taken to comply with the AAQ Directives, it is important to keep in mind that there are several linkages between these costs and benefits and wider ones related to environmental, energy and climate impacts overall.

Nevertheless, the findings accrued under this evaluation question attempt to provide some indications about the overall costs of emission control and measures taken to meet air quality limit values and target values, as well as the costs of the monitoring and reporting obligations set by the Directives. In addition, the analysis put these costs in perspective with the benefits of meeting air quality standards on the one hand, and with the costs of poor implementation (i.e. the benefits foregone by not meeting the EU air quality standards) on the other hand. More information about the methodology used for all these findings and their limitations can be found in Annex 3.

¹¹⁹ SWD(2013)531. ‘Clean Air Programme for Europe Impact Assessment’.

¹²⁰ SWD(2013)531. ‘Clean Air Programme for Europe Impact Assessment’.

¹²¹ OECD (2016). ‘The Economic Consequences of Outdoor Air Pollution’.

What are the findings?

There is a wide variety of air quality measures available to national, regional and local authorities to comply with the AAQ Directives. These include actions to reduce traffic demand, promote cleaner vehicles and modes of transport, lower emissions from domestic heating, and additional actions beyond Best Available Techniques (BAT) for industrial facilities. There are many others, and Commission Communication ‘A Europe that protects: Clean air for all’¹²² provides an overview of such measures.

Comprehensive estimates of costs of air quality measures are rare, not least as these costs are not reported to the European Commission or the European Environment Agency as such. In 2018, the GAINS model was used to estimate the costs that compliance with the whole EU Clean Air Policy would incur.¹²³ This provided an order of magnitude estimate in the range of EUR 70 to 80 billion per year including the costs of implementation of all source-oriented legislation and of the NEC Directive, and of synergetic measures delivering also energy and climate objectives.

It is instructive that the above approximated costs vary substantially from EUR 93 per person per year (for Romania) to EUR 239 per person per year (for Poland), with Luxembourg being an outlier at an estimated more than EUR 500 per person per year.¹²⁴ This illustrates the variety of each specific situation, but also the potential for efficiency gains by sharing best practices.

To illustrate this further, the case study conducted in Bulgaria¹²⁵ indicates that, for the period 2011 to 2015, the costs of the air quality measures taken in the Plovdiv agglomeration amounted to around EUR 25 million for measures related to road infrastructure, street cleaning, greening of public spaces and preparation of an action plan for new heating technologies and renewable energy.

In addition to the costs of the measures put in place to fulfil the limit values and target values, the monitoring and reporting obligations of the AAQ Directives also entail some administrative costs (see previous evaluation question). These have been estimated, based on information received from a sub-set of Member States, to amount to less than EUR 1 per person per year.

How do these costs stemming from the AAQ Directives compare with the original expectations, and, more importantly, with the health benefits accrued and with remaining costs of poor implementation?

The Impact Assessment underpinning Directive 2008/50/EC in 2005¹²⁶ estimated the direct costs of complying with provisions put forward in the Commission proposal to be in the range of EUR 5 to 8 billion – compared with a monetised health benefit estimated

¹²² COM(2018)330. ‘A Europe that protects: Clean air for all’.

¹²³ IIASA (2017). ‘Costs, benefits and economic impacts of the EU Clean Air Strategy and their implications on innovation and competitiveness’

¹²⁴ IIASA (2018). ‘Progress towards the achievement of the EU’s air quality and emissions objectives’.

¹²⁵ Support study informing this Fitness Check, Appendix I.

¹²⁶ SEC(2005)1133. ‘Thematic Strategy on air pollution: Impact Assessment’.

at the time in the range of EUR 37 to 119 billion per annum by 2020 (these benefits do not include those related to ecosystems,¹²⁷ materials and buildings). It is very important to note that these 2005 estimates were restricted to costs and benefits of limiting fine particulate matter (PM_{2.5}) only, as other EU air quality standards at the time were inherited from predecessor legislation.

Newer estimates¹²⁸ indicate that a sub-set of the accrued health benefits of air quality measures taken to comply with the limit values from 2008 to 2016 are in the order of EUR 50 billion over the whole period, increasing over time and corresponding to just under 8 000 avoided premature deaths in 2016. However, the overall set of benefits of the measures taken is expected to be much wider as, for example, the following benefits are not accounted for in this estimate:

- benefits to natural ecosystems and to agricultural and forestry yields;
- benefits to buildings and materials;
- health co-benefits: for instance, the promotion of cycling, walking, public transport fleets renewal have not only air-related health benefits but also benefits linked to increased physical activity and reduced noise;
- mental health benefits of reduced air pollution.

In addition, due to the methodology used for this estimate, a significant part of the benefits is not accounted for. Indeed, the estimate only considers the benefits enjoyed by the EU population living in air quality zones that have moved from above to below the air quality limit values or target values over the 2008 to 2016 period. However, this excludes a wide arrays of situations where benefits will also have been enjoyed, e.g.:

- when the air quality zones remain above limit values or target values, but with a lower level of exceedance over the period;
- when the air quality zones are maintained below the limit values or target values, as required by the AAQ Directives;
- when neighbouring zones also benefit from improvements in a given zone.

Figure 9 shows the trends in the estimates of some health benefits of the measures put in place in order to comply with the air quality standards, estimated with all caveats described above. It is salient to see that the health benefits increase over time, as more measures are implemented and successfully deliver air quality improvements.

¹²⁷ Cost of ecosystem impacts of air pollution was estimated in FP7 project (Effects of Climate Change on Air Pollution and Response Strategies for European Ecosystems) and is presented in the Support Study Appendix F1.7.2. It estimates the crop damages from exposure to ozone at EUR 8 billion per year (for the period 2010 to 2030), damage to forests from ozone in terms of loss of production and greenhouse gas sequestration at between EUR 3 and 34 billion per year, and damage to biodiversity through nitrogen deposition and eutrophication at between EUR 3 and 12 billion per year, depending on the method adopted. These estimates total EUR 14 to 54 billion per year.

¹²⁸ Support study informing this Fitness Check, Sections 6.3.1 and 6.3.2, and Appendices F1 and F2; see also Annex 3 to this SWD.

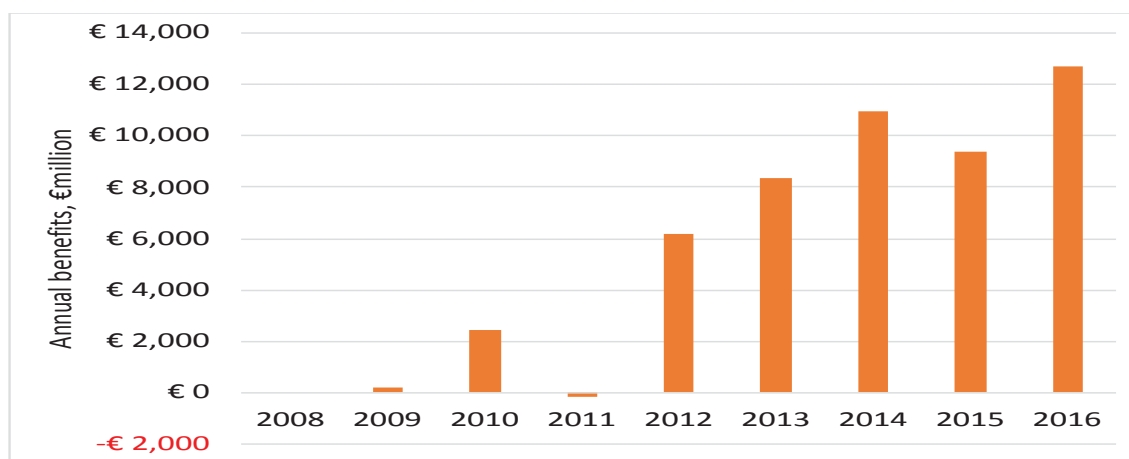


Figure 9 – Annual benefits of the AAQ Directives relating to reduction in exposure to NO₂, ozone and PM₁₀ (with methodological caveats as described in support study).¹²⁹

In parallel, the same methodology (see Annex 3 to this SWD) has been used to estimate the costs of poor implementation of the AAQ Directives, through the degree of non-compliance with limit values and target values for particulate matter, nitrogen dioxide and ground-level ozone, respectively. The economic value of health impacts associated with related exceedances is estimated to be in the order of EUR 240 billion for the EU for the period 2008 to 2016, decreasing over time, with the same caveats on the methodology as for the benefits presented above.

In addition to health benefits (delivered or foregone) mentioned above, it is useful to assess the wider impacts of the AAQ Directives on the economy (and in particular competitiveness) and on social sustainability. The 2013 Clean Air Programme for Europe, for example, identified that better air also offers economic opportunities including for the EU's clean technology sectors, and noted that major engineering firms in the EU already earn up to 40% of revenues from their environment portfolios.¹³⁰

Competitiveness impacts are difficult to ascertain and disentangle from the overall impacts of environmental policy. However, based on literature review,¹³¹ they are estimated to be minor over the whole economy but positive for the innovative sectors that have benefited from new markets due to the measures put in place to reduce pollution. More specifically, a 2019 OECD report estimates that “reductions in air pollution could explain up to 15% of recent GDP growth in Europe” over the period 2000 to 2015, due to increased labour productivity (less absenteeism and increased physical and cognitive capabilities).¹³²

Overall, variations in cost and benefits of the AAQ Directives and air pollution in general across EU Member States are due to national specificities (age and composition of the vehicle fleet, type and age of industrial facilities, predominant heating systems, scope for

¹²⁹ Support study informing this Fitness Check, Section 6.3 and Appendix F.

¹³⁰ COM(2013)918. ‘A Clean Air Programme for Europe’.

¹³¹ Support study informing this Fitness Check, Section 6.3.4 and Appendix F4.

¹³² OECD (2019). ‘The economic cost of air pollution – Evidence from Europe’; this study uses econometric analysis on satellite-based pollution data at EU NUTS-3 level and estimates reduction of air pollution through the achievement of the national exposure reduction target for PM_{2.5}.

upgrades or fuel switches e.g.) and to the methodology used for estimating the benefits, which reflects, i.a., the level of exceedances and population density, and therefore the types of measures put in place and their potential for co-benefits.

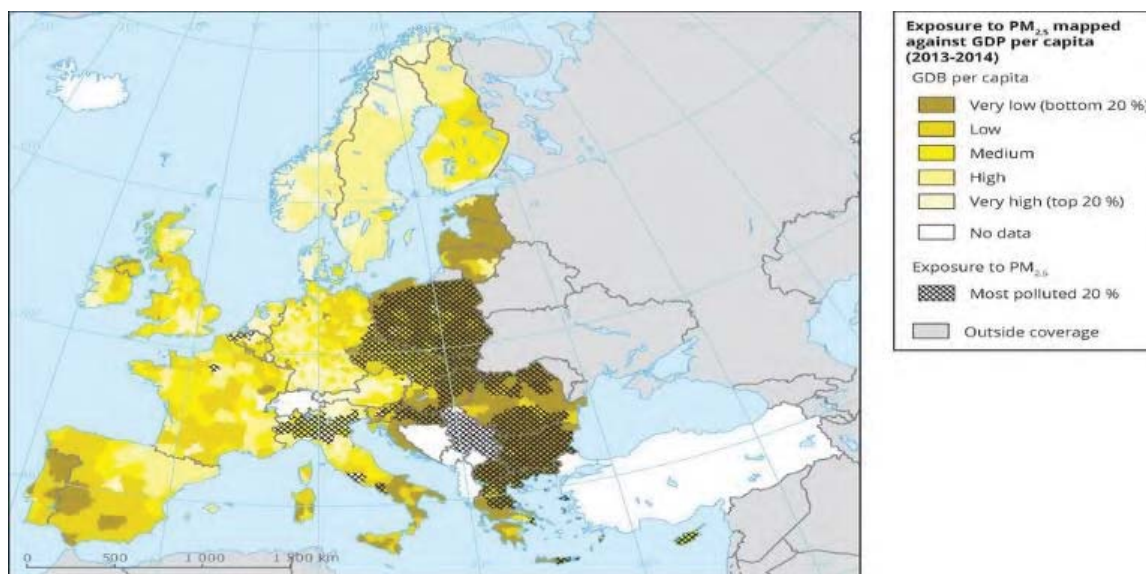


Figure 10 – Exposure to PM_{2.5} mapped against GDP per capita, 2013-2014¹³³

Air pollution also brings social cost in terms of inequalities and social sustainability: groups of lower economic status tend to be more negatively affected by air pollution, as a result of both greater exposure and higher vulnerability. Figure 10 illustrates, for example, that EU regions with the lowest GDP per capita (e.g. regions in Central and Eastern Europe, as well as parts of Southern Europe) generally experience higher exposure to fine particulate matter concentrations than other regions. Measures towards reducing air pollution and complying with the AAQ Directives can therefore act positively towards improved social sustainability.

All the numbers presented above should be handled with care as they are subject to several limitations (see Annex 3 to this SWD), stemming also from the fact that there is a lack of ex-post data available to describe actual cost and effect of actions. However, despite these methodological difficulties, the available evidence clearly suggests that the benefits of measures tackling air pollution exceed cost. In line with EU legislation, such measures should be guided by the principles that pollution is rectified at source and that the polluter should pay.

Views of stakeholders¹³⁴

A large proportion of open public consultation respondents believed that AAQ Directives have delivered significant benefits for protecting human health (42%) and the environment (39%) either to a very large or large extent. Views were less positive (a bit more than 20%) for the directives' effects on reducing economic costs linked to air pollution and boosting competitiveness and innovation, or supporting the development of

¹³³ EEA Report 22/2018. 'Unequal exposure and unequal impacts'.

¹³⁴ For an overview of the stakeholder feedback, and details of views of expressed by different stakeholder groups in the open consultation, please also see Annex 2 to this SWD.

new industrial sectors. The economic sectors considered to benefit from AAQ Directives implementation were innovative industries (in all sectors) (58%) and healthcare (48%).

As regards who is bearing the costs arising from abatement measures, a majority of respondents considered that these are borne by ‘all citizens’ (59%) and ‘citizens living in urban areas’ (47%). Just over half of respondents expressed the view that the transport sector had borne costs to comply with the AAQ Directives (but only 4 out of 14 respondents that self-identified as from the transport sector). Manufacturing industries (47% of all respondents, and 11 out of 12 that self-identified as from this industry) and energy providers (46% of all respondents, and 10 out of 12 that self-identified as from this sector) were also most frequently identified as bearing the costs, along with the competent public authorities (37% of all respondents, and 20 out of 24 that self-identified as from public administrations), see Annex 2 to this SWD for a more detailed analysis.

Other issues raised – especially in the stakeholder workshops – relate to the methodology to be used for assessing costs and benefits, and in particular to the importance of capturing costs by key sectors contributing to air pollution. In this regard, participants noted the absence of a common methodology to quantify the costs of air pollution, not only on health but also on agriculture and ecosystems: it was argued that such common methodology would help to show the value of addressing air pollution.

Another methodological difficulty identified during the stakeholder workshops is the attribution of costs (and benefits) of improved air quality to the AAQ Directives, due to the interactions between the Directives and other policy interventions. It was also noted that the majority of air quality plans do not have a cost-effectiveness analysis despite many low-costs measures being available at the local level.

Business and industry representatives in particular noted an imbalance between those that pollute the most and those that are asked to shoulder the costs for air quality improvements, referring in particular to the investments made by industry. Industry stakeholders more generally pointed to the need for air quality measures to be cost-effective and firmly embedded in the wider clean air policy framework in general, and aligned with best available techniques (BAT) developed under the Industrial Emissions Directive.¹³⁵

The evaluation of efficiency relied heavily upon the input of stakeholders via the targeted questionnaire (43 responses in total, see Annex 2 to this SWD), which also included questions focused on the administrative costs and burdens associated with the AAQ Directives. Explaining the lack of data provided, the respondents commented on the challenges of quantifying the costs and benefits associated with the AAQ Directives.

Both in the targeted questionnaire and in their feedback to the open public consultation, NGOs were significantly more likely to express concerns about the costs of non-implementation than other stakeholders. Responses by local authorities tended to note they bear a disproportionate share of the costs of implementing measures needed to ensure compliance with the Directive (see Annex 2 to this SWD). The responses from industry stakeholders provided very limited concrete figures on costs and benefits and generally little comment on the topic of efficiency.

¹³⁵ Directive 2010/75/EU

5.5. Coherence

Evaluation question: Are the AAQ Directives coherent internally, with other EU Clean Air policies, with other EU legislation (e.g. on transport, energy, agriculture or nature protection), and with international commitments?

Overall response: The AAQ Directives together form a coherent regulatory system to improve air quality in the EU, with only minor internal consistencies that may have a limited impact on the effectiveness of the monitoring networks in achieving air quality objectives. The AAQ Directives are also coherent with the overall EU clean air policy framework, including in particular with the National Emissions Ceilings (NEC) Directive. This coherence was strengthened over the evaluation period with the release of the 2013 Clean Air Policy Package and the revision of the NEC Directive.

The AAQ Directives are also in a mutually supportive relationship with environmental, sectoral and other relevant policies and legislation, including those on climate, energy, transport and agriculture. Impact assessments of the EU climate and energy framework for 2020, 2030 and for the long-term strategy consistently assume positive impacts for air quality for the EU.¹³⁶

However, analysis as well as stakeholder feedback also identified instances where the coherence of, and implementation of, specific EU policies may run counter to the implementation of the AAQ Directives. This includes the promotion of biomass combustion for energy production resulting from climate and energy policy, the shortcomings in the implementation of EU Type Approval Framework for cars in relation to NO_x emissions or the choices made by some Member States to support diesel over petrol cars with a view to reducing greenhouse gas emissions. These findings were corroborated by those of the European Court of Auditors.

In terms of EU funding, substantial funding has been made available to directly support air quality improvements (i.e. in the 2014-2020 period Member States have allocated about EUR 2 billion for air quality projects), and much larger cohesion policy allocations in other areas support actions that can improve air quality indirectly, such as for low-carbon economy (EUR 45 billion), environmental protection and resource efficiency (EUR 63 billion) and network infrastructure (EUR 58 billion).

The AAQ Directives have also supported the Member States in their efforts to fulfil their commitment under international law, in particular in relation to the UNECE Convention on Long-Range Transboundary Air Pollution (Air Convention) and the IMO Convention for the Prevention of Pollution from Ships (MARPOL).

What is the issue?

Coherence is concerned with how well different EU interventions work together, both internally and with other interventions in other EU competence areas.

Broadly speaking, four levels of coherence can be distinguished: (a) internal coherence, i.e. within each Directive and between each other; (b) coherence within the overarching

¹³⁶ European Commission (2018). 'In-depth analysis in support of the Commission Communication COM(2018) 773'.
https://ec.europa.eu/clima/sites/clima/files/docs/pages/com_2018_733_analysis_in_support_en_0.pdf

EU Clean Air policy framework (including with the national emission reduction commitments via Directive 2016/2284/EU, and emission standards established for key pollution sources); (c) coherence with other EU legislation, i.e. on environment, transport, climate, energy, agriculture, as well as funding regimes, and (d) with international commitments.

As air pollution in the EU has its sources in many different sectors of economic activity, it is necessary to look at a broad range of EU interventions regulating or having an effect on these sectors from different angles.

What are the findings?

Internal coherence

From the perspective of internal coherence, the AAQ Directives form a coherent regulatory system to improve air quality in the EU. Both directives were designed to avoid, prevent or reduce harmful effects of different pollutants on human health and the environment. For this purpose, they both set ambient air quality standards to be attained, assessment requirements and methods to determine air pollutant concentrations, public information provisions and requirements to take action to improve air quality.

The AAQ Directives form a complementary set, stemming also from their historical development. Directive 2004/107/EC was historically one of the five daughter directives of the previous legal framework for air quality (see Annex 4 to this SWD). The main difference between the two directives is in the pollutants that they regulate, which is then in turn reflected in the type of air quality standards that they set (Directive 2004/107/EC prescribes only target values for heavy metals and BaP, whereas Directive 2008/50/EC uses limit values, target values and other air quality objectives that are to be attained in the long term – see Box 1). The preamble to Directive 2008/50/EC refers to the possible merger of the two Directives once sufficient experience is gained in the implementation of Directive 2004/107/EC. Such merger in itself, however, would not change the functioning of either Directive (at least as long as none of the provisions are changed).

Against the backdrop of an overall coherent system, individual instances of incoherence within the respective AAQ Directives were identified, in particular in relation to the requirements that are prescribed for air quality monitoring networks. For example, the European Court of Auditors noted that, while Member States should maintain sampling points for diffuse sources of PM₁₀ where there has been an exceedance in the last three years, it is not clear why such provisions are not set for other pollutants.¹³⁷

Furthermore, a joint submission by a group of NGOs¹³⁸ pointed to further instances where a lack of precision of the monitoring requirement may lead to incoherent applications of these requirements. However, no systemic issues in this regard have been observed. Therefore, these individual instances do not undermine the conclusion that the AAQ Directives together form an overall coherent system of air quality management, confirmed by views of stakeholders.

¹³⁷ European Court of Auditors Special Report on Air Pollution. See section 1 of Annex 9 to this SWD.

¹³⁸ In their reply to the targeted questionnaire.

Coherence with other EU clean air legislation

The AAQ Directives are coherent with the overall EU clean air policy framework, i.e. with the *National Emissions Ceilings (NEC) Directive*¹³⁹ as well as with EU legislation setting emission standards for various industrial installations – the *Industrial Emissions Directive (IED)*¹⁴⁰ and the *Medium Combustion Plants (MCP) Directive*.¹⁴¹

Coherence with the related legislation was strengthened over the evaluation period with the release of the 2013 Clean Air Policy Package and the revision of the NEC Directive. The impact assessment for the Clean Air Policy Package¹⁴² explicitly referred to ‘untapped synergies between the AAQ Directives and the NEC Directive’. For this reason, the new NEC Directive strengthened the national emissions reductions commitments for four pollutants which relate both directly and indirectly to the achievement of the AAQ Directives objectives: ammonia, sulphur dioxide, nitrogen oxides and non-methane volatile organic compounds (note that the former three are precursors to particulate matter, the latter two are precursors to ozone). It also introduced national emissions reductions commitments for fine particulate matter (PM_{2.5}).

With regard to legislation on industrial emissions, the *Industrial Emissions Directive* aims to reduce emissions from large combustion plants for a number of pollutants (most of which are also included in the AAQ Directives) through the applications of permits based on Best Available Techniques (BAT), in turn based on BAT reference documents (BREFs) prepared at EU level. To date, 16 BREFs had been reviewed for a number of air polluting sectors, including for large combustion plants, non-ferrous metals industries, refining of mineral oils and gas, as well as the intensive rearing of poultry and pigs.¹⁴³ Having said this, the European Court of Auditors has noted that the IED still ‘allows Member States to set less stringent emission limit values’ if they determine that BAT would lead to ‘disproportionately higher costs’ than environmental benefits, and allows ‘flexibility instruments’, under which some Member States have less stringent standards for certain plants. Currently, the Industrial Emissions Directive is subject to an evaluation which will i.a. look at how it is contributing to air quality policies, including in terms of relevance of its scope (industry sectors) and pollutants covered.

The *Medium Combustion Plants Directive* sets emission limits of SO₂, NO_x and dust for medium-sized facilities, thus covering plants that were previously not covered by other any EU legislation. However, since these limits became applicable to new plants only as of December 2018 and will become mandatory for existing plants only as of 2024 or 2029 (depending on the capacity), it was not possible to evaluate the concrete effects of their implementation in the framework of this fitness check.

¹³⁹ Directive (EU) 2016/2284.

¹⁴⁰ Directive 2010/75/EU.

¹⁴¹ Directive (EU) 2015/2193.

¹⁴² SWD(2013)531. ‘Clean Air Programme for Europe Impact Assessment’.

¹⁴³ <https://eippcb.jrc.ec.europa.eu/reference/>

The First Clean Air Outlook¹⁴⁴ concluded that, taken together, the package of measures adopted by the co-legislators since the 2013 Clean Air Programme¹⁴⁵ are expected by 2030 to deliver PM_{2.5} concentrations in most of the EU which are below the WHO Guidelines value: it projects that the population exposed to concentrations above the WHO Guidelines value would drop from 88% in 2005, to 13% in 2030. Where exceedances are projected to continue, additional and less cost-effective measures not considered in the analysis would still be needed and may require financial and other targeted support to reach concentration levels recommended by the WHO Guidelines (Annex 8).

Coherence with other environmental legislation and policies

The AAQ Directives are broadly coherent with different environmental legislation and policy documents. This includes the overarching policy documents i.e. the 6th and the 7th *Environment Action Programmes*; cross-cutting environmental policies such as the *Strategic Environmental Assessment (SEA)* and *Environmental Impact Assessment (EIA) Directives* as well as key environmental legislation in specific areas, including the *Habitats and Birds Directives*, the *Nitrates Directive*, and the *Noise Directive*.

Specifically, the 6th *Environment Action Programme*¹⁴⁶ from 2002 set an objective that air quality levels ‘do not give rise to unacceptable impacts on, and risks to, human health and the environment’; and both AAQ Directives refer to the 6th EAP in their first recitals. The 7th *Environment Action Programme*,¹⁴⁷ from 2013, further strengthened the commitment to better air quality, by calling for significant improvement of air quality by 2020, ‘moving closer to WHO recommended levels’. In this way, environmental policy and air quality legislation contribute also directly to the EU health policy targets.

The *Strategic Environmental Assessment (SEA)*¹⁴⁸ and *Environmental Impact Assessment (EIA)*¹⁴⁹ *Directives* aim to ensure that environmental impacts are considered before decisions on plans, programmes and projects that are likely to have significant effects on the environment. Taking into account the provisions of these Directives calling specifically to consider effects i.a. on air and human health, it can be concluded that the SEA and EIA Directives contribute to the achievement of the AAQ Directives’ objectives. Unless a specific air quality plan meets the criteria laid down in Article 2a and 3(2) of the SEA Directive, it does not require a strategic environment assessment.

Habitats and Birds Directives (or the *Nature Directives*)¹⁵⁰ aim to contribute to ensuring the conservation of biodiversity through the conservation of species and habitats of EU

¹⁴⁴ COM(2018)446. ‘The First Clean Air Outlook’.

¹⁴⁵ COM(2013)918. ‘A Clean Air Programme for Europe’.

¹⁴⁶ Decision No 1600/2002/EC.

¹⁴⁷ Decision No 1386/2013/EU.

¹⁴⁸ Directive 2001/42/EC.

¹⁴⁹ Directive 85/337/EEC.

¹⁵⁰ Council Directive 92/43/EEC, and Directive 2009/147/EC.

conservation concern. An EEA study¹⁵¹ has found that the AAQ Directives have contributed to reductions in atmospheric deposition of sulphur and nitrogen compounds, yielding positive impacts on ecosystems, Natura 2000 sites and habitats.

Although it does not apply specifically to air emissions, the *Nitrates Directive*¹⁵² has an indirect impact on air quality. It aims to protect water quality across Europe by preventing nitrates from agricultural sources to pollute both ground and surface waters and by promoting the use of good farming practices. Since manure and fertilisers are also sources of air emissions (in particular nitrogen oxides (NO_x) and ammonia (NH₃); both are precursors of particulate matter), preventing water pollution with nitrates from agriculture can have an impact on air emission.

When it comes to the *Environmental Noise Directive*,¹⁵³ the link with air quality is more direct in a way that noise and air pollution have overlapping sources and cities are both noise and air pollution hotspots.¹⁵⁴ Directive 2008/50/EC explicitly requires air quality plans to be consistent and integrated with plans and programmes for the assessment and management of environmental noise.

Coherence with key sectoral policies

Climate & energy

The AAQ Directives and the greenhouse gas emissions reduction targets set out in *EU climate policy and legislation* are broadly considered coherent – this includes the 2020 Climate and Energy Package, the 2030 Climate and Energy Framework and in particular the 2050 Low Carbon Roadmap and the Long-Term Emissions Reduction Strategy which specifically note the synergies that can be achieved when climate and air quality policies are well coordinated. It is also confirmed by studies¹⁵⁵ where modelling shows that EU climate policy reduce the emissions of key air pollutants like NO_x, SO₂ and PM_{2.5}, hence also increasing the overall efficiency of the measures taken under this policy.

Similarly, the implementation of the Energy Efficiency Directive¹⁵⁶ is considered as positive for air quality, since it overall decreases energy consumption. The Ecodesign regulatory framework (including the regulation for solid fuel boilers (EU 2015/1189) or the EU energy labelling regulation for solid fuel boilers (EU 2015/1187), and the 2018 Commission Guidelines on Ecodesign requirements for heaters and solid fuel boilers)

¹⁵¹ EEA Report 11/2014. ‘Effects of air pollution on European ecosystems’

¹⁵² Council Directive 91/676/EEC.

¹⁵³ Directive 2002/49/EC.

¹⁵⁴ Science for Environment Policy In-depth Report (2016). ‘Links between noise and air pollution and socioeconomic status’.

¹⁵⁵ ETC/ACM Technical paper 2011/20, ‘Co-benefits of climate and air pollution regulations’; IIASA (2014), ‘Complementary Impact Assessment on interactions between EU air quality policy and climate and energy policy’; JRC (2017), ‘Global Energy and Climate Outlook 2017: How climate policies improve air’; European Commission (2018), ‘In-depth analysis in support of the Commission Communication COM(2018) 773’.

¹⁵⁶ Directive 2012/27/EU, as amended.

contributes to the reduction of domestic emissions and is therefore positive for air quality.

The impacts of the Renewable Energy Directive¹⁵⁷ are overall positive, but impacts depend on the sources of renewable energy that ultimately displace conventional energy generation. Some sources (e.g. solar, wind) are clearly having positive impacts on air quality, while the air quality benefits of other sources (e.g. biomass) are less clear. In particular, the use of inefficient biomass combustion technologies may have a negative effect on air quality as it can increase particulate matter concentrations in specific locations. This was one of the issues that the stakeholders frequently raised as regards coherence. This was also emphasised by the European Court of Auditors in its Special Reports 05/2018 on Renewable Energy and 23/2018 on Air Pollution, pointing out that the combustion of wood biomass can also lead to higher emissions of certain harmful air pollutants. In order to address this issue, under the Ecodesign Regulation new energy efficiency and air quality requirements will enter into force in 2020 for solid fuel boilers and local space heaters. In addition, the new EU sustainability criteria post-2020 include minimum energy efficiency standards for large-scale biomass in heat and power.

Transport

When it comes to road transport, the EU's transport policy goals are found to be consistent with EU air quality objectives. EU legislation and strategic policy documents for road transport (i.a. the Transport White paper, 2016 Low-Emission Mobility Strategy, 2017 and 2018 Mobility Packages, Non-Road Mobile Machinery Regulation, Eurovignette Directive, Alternative Fuels Infrastructure Directive, Clean Vehicle Directive) overall set air quality among their goals, limit vehicle emissions and promote alternatives to current transport systems.

However, it became clear that, during the evaluation period, implementation and enforcement of EU provisions for vehicle emission standards and for controlling vehicle emissions in the Type Approval Framework have had shortcomings with negative consequences for air quality. This has also been confirmed by an European Parliament Inquiry into Emission Measurements in the Automotive Sector.¹⁵⁸

Legislative changes since 2015, in particular the adoption of new EU type-approval legislation and market surveillance legislation, significantly raising the quality level and independence of vehicle type-approval and testing, increasing checks of cars that are already on the EU market and strengthening the overall system through the introduction of a tighter European oversight and Real Driving Emissions test procedure, will address many of the abovementioned weaknesses.

In terms of maritime transport, the Sulphur Directive¹⁵⁹ regulates the maximum sulphur content in fuels used on board ships with a view of reducing sulphur dioxide (SO₂) emissions from this sector. As a result of the good rate of compliance with and enhanced enforcement of sulphur standards, concentrations of SO₂ in coastal regions, notably in the

¹⁵⁷ Directive (EU) 2018/2001.

¹⁵⁸ European Parliament (2017). 'Report on the inquiry into emission measurements in the automotive sector'.

¹⁵⁹ Directive (EU) 2016/802.

SO_x Emission Control Areas where stricter standards apply, have gone down significantly.¹⁶⁰ Furthermore, it should be noted that nitrogen oxides and particulate matter emissions from shipping contribute to local air quality problems in the EU and to the eutrophication of European seas. This has led to further action, including through the establishment of a NO_x Emission Control Area in the Baltic and North Seas.¹⁶¹ The Commission is currently working with EU and non-EU riparian states with a view to possibly designate an Emission Control Area covering the Mediterranean Sea. In addition, the contribution to port/coastal areas emissions from ships could be addressed by Member States via the further deployment of ‘shore side electricity’ or facilitating the access in their ports of greener ships with high-energy efficiency or using alternative fuels.

Agriculture

In terms of air quality, the most relevant issue associated with agriculture and the EU’s common agricultural policy (CAP) are emissions of ammonia – a precursor for particulate matter. The agricultural sector accounts for over 92% of total ammonia emissions across the EU.^{162,163} While for most other sectors and pollutants, source legislation requiring emission reductions is in place, agriculture’s ammonia emissions are an exception. As a result, ammonia emissions have decreased considerably less than other pollutant emissions over the period of the fitness check.

This said, the CAP has undergone a series of reforms that aimed to enhance its environmental sustainability. In particular, the 2013 reform aimed at finding a balance between agricultural production, rural development and the environment. Under direct payments to farmers (the main part of ‘Pillar I’ of the CAP), payments for implementing compulsory ‘green’ measures were introduced to support basic environmental management on all agricultural land in the EU-28.¹⁶⁴ The cross-compliance rules refer to soil management banning the burning of arable stubble, a provision that should reduce air emissions of particulates. The cross-compliance rules also include the Nitrates Directive, whose measures can reduce air emissions, as noted above.

The second pillar of the 2014-2020 CAP supports rural development: the European Agricultural Fund for Rural Development includes among its objectives ensuring the

¹⁶⁰ COM(2018)188. Commission report on implementation and compliance with the sulphur standards for marine fuels set out in Directive (EU) 2016/802.

¹⁶¹ This NO_x Emission Control Area, established under the International Maritime Organization, will be in effect as of 2021.

¹⁶² EEA Report 10/2019. ‘Air quality in Europe – 2019 report’. Note that, since 2000, ammonia emissions have decreased by less than 10%, compared to 77% for sulphur dioxide emissions.

¹⁶³ It is worth noting that about 75% of all ammonia emissions in the EU- 28 are caused by manure management from livestock farming, with 80% of manures originating from 4% of the farms. See: IIASA, 2017. ‘Measures to address air pollution from agricultural source’.

¹⁶⁴ SWD(2018)478. Evaluation of the ‘Regulation (EU) No 1307/2013 of the European Parliament and of the Council of 17 December 2013 establishing rules for direct payments to farmers under support schemes within the framework of the common agricultural policy and repealing Council Regulation (EC) No 637/2008 and Council Regulation (EC) No 73/2009’ concerning the greening in direct payments.

sustainable management of natural resources and addressing climate change. A sub-priority of this Fund includes measures to reduce greenhouse gases and ammonia emissions from agriculture, but their use has been limited. In addition to measures under the CAP, certain large agriculture enterprises, including intensive pig and poultry rearing facilities, come within the scope of the Industrial Emissions Directive, whose 2017 ‘Best available techniques Reference’ document (BREF) includes techniques to reduce emissions from this sector.

Further improvements are expected if the additional measures proposed by the European Commission¹⁶⁵ are agreed by the co-legislator and fully implemented by Member States.

Coherence with EU funding and taxation

When it comes to air quality investments, the cohesion policy funds, in particular the European Regional Development Fund (ERDF) and the Cohesion Fund (CF) provided about EUR 1.2 billion¹⁶⁶ for air quality investments in the 2007-2013 programming period, while for the current, 2014-2020 period Member States have allocated about EUR 2 billion for air quality projects (as of June 2019).

In addition, much larger cohesion policy allocations in other areas support actions that can improve air quality. These include allocations in the 2014-2020 period for the low-carbon economy (EUR 45 billion), environmental protection and resource efficiency (EUR 64 billion) and network infrastructure (EUR 58 billion) across all five European Structural and Investment Funds (ESIF).

The LIFE programme has also been instrumental in delivering clean air benefits. In the 2014-2020 period, more than 50 projects and about EUR 300 million have been allocated to projects with a direct or indirect impact on improving air quality.

Several studies indicate, however, that Member States did not use the full potential of ERDF and CF resources for air quality. The European Court of Auditors noted that it found cases ‘*where Member States did not prioritise [...] funding of projects that target the main sources and pollutants identified*’.¹⁶⁷ Reiterating the European Court of Auditors’ findings, the report from EUROSAI¹⁶⁸ noted that EU funding for air quality can provide useful support, but that it was not always well-targeted by Member States.

Investments, including those supported by EU funds, can also support projects that may negatively affect air quality. An example would be investments into new roads (where and when they lead to additional air pollution from traffic in areas that already face air quality challenges). Approximately EUR 42.5 billion of cohesion policy funds was used for roads (both new and reconstructed) in the 2007-2013 period, whereas in the

¹⁶⁵ For the Commission proposals on the future of the common agricultural policy beyond 2020, see https://ec.europa.eu/info/food-farming-fisheries/key-policies/common-agricultural-policy/future-cap_en

¹⁶⁶ COWI (2019). ‘Integration of environmental concerns in Cohesion Policy Funds’.

¹⁶⁷ European Court of Auditors Special Report on Air Pollution. See section 1 of Annex 9 to this SWD.

¹⁶⁸ EUROSAI Joint Report on Air Quality. See section 4 of Annex 9 to this SWD.

2014-2020 period, Member States have admittedly allocated a lower amount, EUR 30 billion,¹⁶⁹ favouring other transport modes such as rail.

Another example concerns projects supporting the use of biomass – as noted above in relation to coherence with climate and energy policy, burning biomass may have negative impacts on local air quality. In the 2007-2013 period, EUR 690 million was spent in funding for biomass projects. In the 2014-2020 period, allocations of EUR 1.6 billion were made for biomass, contributing to cohesion policy's objective of supporting the shift to a low-carbon economy, for which allocations were earmarked. The European Court of Auditors also raised concerns about the coherence of biomass investments with air quality objectives.

In addition, financing under the *European Fund for Strategic Investments* and the *Connecting Europe Facility* (CEF) are expected to provide further indirect benefits for air quality by funding projects that, for instance, support the modal shift towards railway in the TEN-T network. Those programmes are also providing benefits for air quality by funding projects that support the deployment of alternative fuels. For instance, under the CEF funding objective ensuring sustainable and efficient transport systems (155 actions with around EUR 930 million) many projects concern the deployment of alternative fuels both in vehicles and for infrastructure.

Other EU funding instruments, including research programmes like Horizon 2020, have also provided significant resources for projects that can support air quality objectives. It can also be observed that EU funding instruments increasingly devote greater attention to sustainable and low-carbon investments (which can, as pointed out above, bring about air quality improvements - but impacts depend on the sources of renewable energy that ultimately displace conventional energy generation).

When it comes to *taxation* as a means of influencing citizen behaviour, tax policies at both EU and Member State levels may, in some instances, also be at odds with air quality goals. The minimum levels of taxation for transport fuels set out in the Energy Taxation Directive (2003/96/EC) (in its Article 7 and Annex I) set lower minimum tax rates per litre for diesel than for petrol – with diesel being taxed at an around 8% lower level than for unleaded petrol. Moreover, in 2017 most Member States had diesel taxes between 10% and 40% lower than petrol and, as of 1 January 2018, all but two Member States (the United Kingdom and Hungary) taxed diesel fuel at a lower rate than petrol.¹⁷⁰ These tax incentives have encouraged greater private use of diesel vehicles, which – together with weaknesses in the implementation of vehicle testing under the Type Approval Framework during the evaluation period – may have worsened air quality.

¹⁶⁹ COWI (2019). 'Integration of environmental concerns in Cohesion Policy Funds'.

¹⁷⁰ European Commission (2018). 'Excise Duty Tables Part II Energy products and electricity'. See also EEA indicator 'Transport fuel prices and taxes': <https://www.eea.europa.eu/data-and-maps/indicators/fuel-prices-and-taxes/assessment-2>

International commitments

The UNECE Convention on Long-Range Transboundary Air Pollution (Air Convention) is reflected in EU legislation in the Directive on the reduction of national emissions of certain atmospheric pollutants (NEC Directive). Therefore, the conclusion on the strong coherence between the latter directive and the AAQ Directives in the above sections also applies to the Air Convention.

When it comes to emissions of air pollutants from ships, on the international level the main act is Annex VI to the International Maritime Organization Convention for the Prevention of Pollution from Ships (MARPOL), which sets rules on the progressive reduction of SO_x, NO_x and particulate matter emissions from ships, as well as the introduction of emission control areas for stricter requirements near cities and coastal areas. Requirements for low sulphur content of marine fuels as expressed also via requirements agreed under the rules of MARPOL have proven to be beneficial for air quality.

Views of stakeholders¹⁷¹

A high number of respondents to the open public consultation (57%) considered Directive 2008/50/EC to be more internally coherent than Directive 2004/107/EC (41%). In responses to the targeted questionnaire, a relatively significant number of respondents commented on issues relating to the internal coherence of the Directives (for example, consistent approaches in setting limit values, consistency in the requirements of siting of monitoring stations, coherence of alert thresholds).

Similarly, participants at the stakeholder workshops highlighted several areas where there is a lack of internal coherence in or between the two AAQ Directives: (a) looking at the provisions on the minimum number of monitoring stations (e.g. under Annex V of Directive 2008/50/EC), it is not straightforward to establish the mix of types of sampling points needed in each zone; (b) the absence of reference methods for modelling in Annex VI of Directive 2008/50/EC; (c) and the provisions on air quality plans appear outdated, as information still refers to measures adopted prior to June 2008.

As regards coherence with other EU Clean Air or environmental legislation, open public consultation respondents considered the National Emissions Ceiling Directive to be strongly coherent with the AAQ Directives, with 70% indicating that it either strongly supports or supports the implementation of AAQ Directives. Coherence with the Industrial Emissions Directives was seen similarly positively (71%). Of the small number of industry respondents, most (4 out of 5) emphasised the need to ensure coherence between the AAQ Directives and other legislation relevant to air quality, notably the NEC Directive and the Industrial Emissions Directives – two commented that air quality standards should be informed by what is feasible within the framework of the Industrial Emissions Directive.

On coherence with other EU policies, open public consultation respondents believed that the AAQ Directives support the EU Energy Union, Climate and low-emission mobility policies, as well as Research and Innovation (Horizon 2020). At the same time

¹⁷¹ For an overview of the stakeholder feedback, and details of views of expressed by different stakeholder groups in the open consultation, please also see Annex 2 to this SWD.

respondents, especially in the targeted questionnaires but across all stakeholder groups, expressed concerns about the coherence between air quality goals and transport, energy and climate policy. In particular the participants at the workshops and representatives in the expert group expressed concern that greenhouse gas related measures taken in the transport sector (for example, concerns about support for diesel vehicles), usually at the national or local level, had the potential to undermine air quality.

However, looking at (sectoral) EU policies aimed at reducing emissions from specific sources, the highest proportion of respondents commented positively on coherence related to the emission standards for heavy goods vehicles (73%), noting that this supports the implementation of AAQ Directives compared. This was closely followed by emission standards for cars and vans (70%). Specific concerns were raised by several stakeholders about the effectiveness of the Euro vehicle emissions standards in protecting air quality (with one representative of a regional authority suggesting that the EU should consider additional requirements for the existing fleet, not just new vehicles). According to stakeholder comments at the workshops, Member States have struggled to meet air quality standards due to weaknesses in the EU legal framework for vehicle emissions. NGO and national authority respondents to the targeted questionnaire were also more likely to cite concerns about the coherence between air quality, climate policy and transport policy (and in particular expressed concerns about support for diesel vehicles in Member State responses to climate change challenges).

Other comments on sectoral policy focused on the treatment of biomass under the Renewable Energy Directive, emissions standards for boilers under the Ecodesign Directive, and air pollutant emissions from agricultural activities. Concerns about emissions from biomass-generated heat tended to be raised by government authorities: of the nine responses on this topic, seven were from national or local government authorities.

Also, the common agricultural policy was deemed by respondents to the open public consultation to potentially hamper implementation of the AAQ Directives. This issue was also raised in the stakeholder workshops with a representative of a national NGO noting that EU funding schemes for biomass and the common agricultural policy supported various measures that increase air pollution. These have in turn made it difficult, in their view, to obtain EU funding mechanisms that support actions for air quality at national level, including under the CAP's rural development funding.

Open public consultation respondents identified a lack of coherence in the implementation of the AAQ Directives and a number of national policies, notably taxation, public procurement, urban development policy and industrial policy. Meanwhile, respondents were much more positive about mechanisms to promote coordinated action between the EU and MS than between levels of government, or ministries, within their country. In one of the stakeholder workshops, a representative of a government health institute noted that permitting and spatial planning decisions in the stakeholder's Member State consider whether new activities are aligned with air quality limit values, but this is not the case across the EU.

5.6. EU Added Value

Evaluation question: To what degree have common EU air quality standards and comparable monitoring, reporting and assessment regimes enabled Member States to take successful action beyond what would have been possible without EU action?

Overall response: There is a clear case for a harmonised approach to air quality through the establishment of air quality standards and assessment framework at EU level. The AAQ Directives have harmonised the criteria for monitoring Member States apply and the air quality they aspire to. This has both enabled and prompted successful action beyond what would have been the case without them. Three aspects stand out:

Firstly, the AAQ Directives introduced new and reinforced previous air quality standards, which has led to a harmonised approach across Member States and contributed to the overall reduction of air pollutant concentrations. What is more, by prescribing minimum obligations for all Member States, the AAQ Directives are designed to equally protect the health of all EU citizens and in this respect create a level playing field across the EU.

Secondly, the AAQ Directives' common framework for air quality assessment and monitoring have brought added value by providing reliable and comparable air quality data across Member States, which has led to increased public awareness and supported implementation and enforcement of air quality standards. Stakeholders overwhelmingly agree that the AAQ Directives have been instrumental in motivating and framing action in the Member States and achieving better air quality.

Thirdly, the AAQ Directives are in line with the principles of subsidiarity and proportionality, leaving a substantial margin to the Member States in deciding how to best achieve the prescribed objectives – to ensure the measures taken are appropriate and cost-effective within the specific context of respective local and national circumstances.

What is the issue?

Obligations stemming from the AAQ Directives, like all requirements linked to EU legislation, should be subject to the principle of subsidiarity, which is fundamental to the functioning of the EU. Whereas air pollution is transboundary in nature, in many cases the harmful effects of poor air quality become a local problem. The AAQ Directives are specifically designed to tackle such local air quality problems (which tends to be a result of the interplay of local, regional, national and transboundary air pollution, see Annex 5 to this SWD).

There is thus a need to demonstrate that there is a clear case for regulating air quality standards as well as the corresponding monitoring, reporting and assessment regimes at EU level, compared to leaving this for each Member State to tackle at national level.

What are the findings?

Common air quality standards

At the time of their respective adoption, the AAQ Directives introduced air quality standards for five additional pollutants that had not been regulated at EU level before, i.e. fine particulate matter (PM_{2.5}) (limit and target values and the national exposure reduction target), arsenic, cadmium, nickel and benzo(a)pyrene (target values). They also reinforced pre-existent standards for other pollutants, i.e. particulate matter (PM₁₀),

nitrogen dioxide (NO₂) and nitrogen oxides (NO_x), sulphur dioxide (SO₂), ozone (O₃), carbon monoxide and benzene, which were in force at EU level prior to the adoption of the two AAQ Directives (see also Annex 4).

Prior to their introduction at EU level, air quality standards varied considerably across Member States in terms of the type of pollutants that were regulated, the level of protection (weaker or stricter limits) and the legal nature of the regulations (binding or voluntary, limit values or guidelines, obligation of results or obligation of means).¹⁷² For instance, based on available data, when it comes to limit values for PM_{2.5} concentrations, at least 13 Member States had no standards in force prior to the adoption of Directive 2008/50/EC. The situation is similar with respect to heavy metals, with at least nine Member States without air quality standards in force for heavy metals before 2004.

In areas where the AAQ Directives have not introduced harmonising provisions, Member States have adopted different solutions and approaches. This is the case with levels of alert and information thresholds for PM₁₀ and PM_{2.5} – which are not regulated at EU level, or defined in the AAQ Directives – and which still vary significantly across the EU. The *alert thresholds* for PM₁₀ range from 50 µg/m³ (in Finland, Germany, and parts of Italy) to 300 µg/m³ (in Poland).^{173,174}

In terms of the effects that EU air quality standards had on pollutant concentrations in ambient air during the evaluation period, there is a declining trend across most regulated pollutants, as shown above (see section 5.2). It should be kept in mind that effective air quality policies often need to address several levels of governments, sectors and policy areas, and take time to implement and have an effect. Correspondingly, when comparing historical trends of emissions with temporal milestones for the adoption and transposition of the AAQ Directives, no sudden or sharp declines can be observed. It is also difficult to precisely attribute these developments to the implementation of the AAQ Directives' standards, due to confounding factors that most likely have also impacted these trends (e.g. legislation on emission sources, the National Emission Ceilings Directive, pre-existent national legislation in place, prevalence of activity in certain sectors in specific Member States).

Nevertheless, irrespective of the difficulties to precisely attribute the reduction of air pollutant concentrations to their respective standards, stakeholders agree across the board, corroborated by the conducted case studies, that the AAQ Directives have been instrumental in achieving better air quality. The setting of EU air quality standards had the added value of setting a common level of ambition across the EU and its single market and providing a focused and complementary approach in dealing with pollutant concentrations. Common air quality standards ensured the equal treatment of all EU citizens, with the same level of health protection guaranteed.

¹⁷² Support study informing this Fitness Check, Section 6.3.1.1.

¹⁷³ The situation regarding the *information thresholds* for PM₁₀ is similar (ranging from 50 to 200 µg/m³).

¹⁷⁴ Support study informing this Fitness Check, based on Wiesen (2017), Air Pollution Emergency schemes, and EUROSAI Joint Report on Air Quality.

Common framework for assessment and monitoring

The AAQ Directives also introduced a common framework for assessment and monitoring, which led to the availability of better quality and more comparable information to the public.¹⁷⁵ Although there is insufficient comprehensive evidence on how and whether Member States would have changed their monitoring systems in the absence of the AAQ Directives, it is likely that the differences would have remained, imposing challenges in terms of data quality and comparability across Member States. It further follows from the case studies that in the selected Member States the AAQ Directives have contributed to a significant improvement of the monitoring network (e.g. in Bulgaria, Germany or Ireland), shifted the focus of monitoring to areas where the most population lives (Slovakia, Spain) or prompted national coordination and quality assurance of monitoring of air pollution (Italy).

In addition to the common framework set out by the provisions of the AAQ Directives, the Commission also provided various guideline documents (e.g. guidelines on setting up common measuring stations for PM_{2.5}) as well as networks to ensure the quality of assessment information generated through monitoring, modelling or objective estimation. Examples of such networks include the Forum for Air Quality Modelling in Europe ('FAIRMODE') and the Network of Air Quality Reference Laboratories ('AQUILA').

Effective monitoring and assessment of air quality and collection and dissemination of comparable and reliable data has been of key importance in ensuring awareness and access to information on air quality to the wider public. The comparability and reliability of data allows for direct and easy comparison of the air quality situation in different Member States, which is further facilitated by the information products of the European Environment Agency, such as the annual report 'Air quality in Europe'¹⁷⁶ or the European Air Quality Index,¹⁷⁷ where consolidated historic as well as near-real-time air quality information across Europe is presented in a visually clear and user-friendly manner.

To promote exchanges on successful air quality measures and lesson learnt between practitioners, the Commission has supported Member States, both at national and local level, via targeted awareness raising and dissemination of good practices.

In that regard, the Commission has engaged with Member States in bilateral structured exchanges – Clean Air Dialogues – designed to foster the collaborative approach required to deliver actions for enhancing air quality and reducing air pollution in the future, with the involvement of national, regional, and local levels of governance and other stakeholders. By the end of 2018, Clean Air Dialogues have been held with six Member States, see Box 12.

¹⁷⁵ COWI et al. (2019). Support study to inform this fitness check (see section 6.3.1.2).

¹⁷⁶ Latest edition: EEA Report 10/2019. 'Air quality in Europe – 2019 report'.

¹⁷⁷ <http://airindex.eea.europa.eu/>

Box 12 – Clean Air Dialogues held in 2017 and 2018

- Clean Air Dialogue with Ireland – Dublin, 1-2 March 2017
- Clean Air Dialogue with Luxembourg – Luxembourg, 29-30 June 2017
- Clean Air Dialogue with Hungary – Budapest, 3-4 October 2017
- Clean Air Dialogue with Slovakia – Bratislava, 24-25 April 2018
- Clean Air Dialogue with Spain – Madrid, 8-9 October 2018
- Clean Air Dialogue with Czechia – Prague, 7-8 November 2018

A full overview as well as the shared conclusions from each Clean Air Dialogue are available at: https://ec.europa.eu/environment/air/clean_air/dialogue.htm

Furthermore, in the context of the Environmental Implementation Review ‘Peer-to-Peer’ tool, several multi-country workshops focused on the implementation of clean air policies, see Box 13. In addition, a biennial Clean Air Forum was launched by the European Commission in 2017 to reinforce the capacity of stakeholders to improve air quality.¹⁷⁸

Box 13 – TAIEX-EIR PEER 2 PEER Workshops focussed on clean air policies in 2018

- Monitoring air pollution impacts on ecosystems, Lisbon (with 6 Member States)
- Road Transport Emission Reduction, Prague (with 4 Member States)
- Air pollution from household heating, Bratislava (with 13 Member States)
- Air quality programmes and their effectiveness, Graz (with 15 Member States)
- Ammonia emissions from agriculture, Budapest (with 24 Member States)
- Air quality policy implementation related to ozone, Madrid (with 22 Member States)

A full overview and links are available at: http://ec.europa.eu/environment/eir/p2p/index_en.htm

Raising citizen awareness and thus motivating action by competent authorities, making comparable and reliable data available has supported enforcement efforts in the Member States as well as by the Commission on EU level. This finding is corroborated by numerous proceedings before national courts brought by NGOs demanding the elaboration or implementation of appropriate air quality plans (for instance, in Austria, Bulgaria, Czechia, France, Germany, Hungary, the Netherlands, Poland, Slovakia, Sweden and the United Kingdom)¹⁷⁹ as well as successful judicial action against Member States with highest air pollutant concentrations before the Court of Justice of the European Union.¹⁸⁰

In relation to proceedings in front of national courts and the right to access to justice, the European Court of Auditors pointed out that the AAQ Directives do not contain a corresponding specific provision.¹⁸¹ It should be noted that the reason for this is that, at the time of the adoption of Directive 2008/50/EC, the Council and Parliament had before

¹⁷⁸ http://ec.europa.eu/environment/air/clean_air/forum.htm

¹⁷⁹ Support study informing this Fitness Check, Appendix H; see also Annex 6 to this SWD for relevant case law.

¹⁸⁰ See Annex 6 to this SWD for an overview of completed and pending infringement proceeding before the Court of Justice of the European Union.

¹⁸¹ European Court of Auditors Special Report on Air Pollution. See section 1 of Annex 9 to this SWD.

them a separate Commission proposal aimed at ensuring broad access to justice in environmental matters.¹⁸² This would have rendered superfluous the need for specific access-to-justice provisions in the AAQ Directives but there was insufficient Council support for this separate proposal. Nevertheless, despite the lack of a specific legislative provision, the AAQ Directives confer substantive health-related rights on individuals and NGOs which national courts should be ready to protect, as illustrated by the case law of the Court of Justice of the European Union.¹⁸³ The Commission has drawn attention to this case law in its 2017 notice on access to justice in environmental matters.¹⁸⁴

The analysis also revealed aspects in which the AAQ Directives could have been more effective in bringing EU added value. As evidenced in particular by reports from the European Court of Auditors and from EUROSAI (see Annex 9 to this SWD), certain provisions of the AAQ Directives on the siting of monitoring stations offer a degree of flexibility to the Member States which may, within the boundaries of this flexibility, lead to limited differences in monitoring and assessment. In addition, stakeholders have noted the lack of coordination between different levels of governance in a single Member State – i.e. between national, regional and local authorities, based on how the Member State concerned has defined their respective competence in the field of air quality – in dealing with exceedances of EU air quality standards.

Principles of subsidiarity and proportionality

The analysis shows that the AAQ Directives are in line with the principle of subsidiarity. The AAQ Directives only require Member States to designate at the appropriate levels competent authorities and bodies responsible for different aspects of air quality management,¹⁸⁵ while leaving the decision on the exact division of responsibility to the Member States, which are best placed to make such a decision in full consideration of their respective circumstances.

However, by prescribing *minimum* standards for air quality, the AAQ Directives impose the same air quality objectives to *all* Member States with the freedom to go further. In this way, they help create a level playing field between the Member States and contribute to the reduction of transboundary air pollution by addressing pollution sources that usually have both local and transboundary impact (see Annex 5 to this SWD).

In terms of the principle of proportionality, the AAQ Directives call for appropriate measures and do not require to go beyond what is necessary to tackle the problem efficiently. The approach does not generate unjustified costs as such and leaves as much scope as possible for decisions to be taken at the local level.

¹⁸² COM(2003)624. ‘Proposal for a Directive of the European Parliament and of the Council on access to justice in environmental matters’.

¹⁸³ See section 3 of Annex 9 to this SWD.

¹⁸⁴ C(2017)2616. ‘Commission Notice on Access to Justice in Environmental Matters’.

¹⁸⁵ Article 3 of Directive 2008/50.

Views of stakeholders¹⁸⁶

The views of stakeholders are in line with the above conclusions. Respondents in the open public consultation agreed almost unanimously that EU level legislation is necessary to improve air quality at national, regional and local level (94%), as well as to address transboundary air pollution across different Member States (91%).

Also a recent representative survey in all Member States (Eurobarometer 2017, with more than 27 000 respondents) confirmed that almost half of Europeans think the issue of air pollution can best be addressed at the EU level (48%), while a third (33%) thinks that it is better addressed at the national one, and 14% favour action focussed at the regional or local level. When looking at the results per country, in as much as 20 Member States the EU level is seen as the best suited to address the issue of air pollution.

Stakeholders across sectors, i.e. national, local and regional authorities, NGOs, industry and the scientific community, agree that the AAQ Directives have been instrumental in creating pressure and incentivising action to improve air quality. Stakeholders also pointed out that this pressure was further increased by the enforcement action by the Commission. There is also agreement among NGOs and authorities at different levels that the AAQ Directives have improved air quality through the reduction of air pollutant concentrations (e.g. of sulphur dioxide as the most prominent example).

Box 14 – Air Quality Partnership under the Urban Agenda for the EU

The Urban Agenda for the EU¹⁸⁷ brings together Member States, cities, the European Commission and other stakeholders in order to promote their cooperation across different levels of governance on urban challenges such as economic growth, liveability, innovation and social challenges. Under this umbrella a bespoke air quality partnership¹⁸⁸ was established, and focussed on Better Regulation, Better Funding and Better Knowledge to reduce air pollution.

When it comes to Better Regulation, the Partnership recommended a precautionary approach to actions that may impact air quality and health, focusing on health improvements through better air quality, and exploring the extension of source emission legislation. The Partnership also identified a lack of communication on air quality plans and measures across levels of governance as a factor hindering coherent action across these levels.

Specifically, members of the Partnership criticised that local and regional authorities are often responsible for drafting and implementing air quality plans but do not have the competence to implement all the measures defined in the plan. The Partnership also found a lack of EU funding directly targeted towards air quality improvement in general, and for drafting and implementation of air quality plans in particular.

As it follows from the responses to the targeted questionnaire, key factors identified by stakeholders for making the AAQ Directives more effective than national legislation alone are EU enforcement capacity, including through infringement procedures, reporting

¹⁸⁶ For an overview of the stakeholder feedback, and details on views of expressed by different stakeholder groups in the open consultation, please also see Annex 2 to this SWD.

¹⁸⁷ <https://ec.europa.eu/futurium/en/urban-agenda-eu/what-urban-agenda>

¹⁸⁸ <https://ec.europa.eu/futurium/en/air-quality>

and monitoring coordination by the EEA, and the establishment of supporting networks facilitating the sharing of good practices.

Conversely, a main hindering factors mentioned include the lack of coordination between different levels of governance within Member States, the distribution of responsibilities between those levels (this aspect was particularly mentioned at the stakeholder workshops but was not directly attributed to the AAQ Directives) as well as a lack of guidance on the use of modelling in air quality assessment – as identified, for example, the consolidated feedback by Air Quality Partnership under the Urban Agenda for the EU, see Box 14.

Another limitation flagged by respondents was the limited mandate for action concerning the cross-border air pollution in the AAQ Directives (as raised by several NGOs and national authorities), see Box 15.

Box 15 – Transboundary cooperation

The AAQ Directives foresee cooperation between Member States and, where appropriate, joint activities if air quality standards are not met due to significant transboundary transport of air pollutants or their precursors (Article 25 of Directive 2008/50/EC). While this legal framework has been used formally only once, EU support for transboundary cooperation on air quality has been taken up in several instances, including projects under the LIFE programme,¹⁸⁹ Interreg,¹⁹⁰ and the TAIEX-EIR-Peer2Peer tool,¹⁹¹ which specifically facilitates exchanges of good practices and knowledge between public administrations of different Member States. Progress in monitoring and reporting over the past decade has also improved air quality data on transboundary contributions to exceedance situations, resulting in potential for more coordinated action across Member States.

¹⁸⁹ <http://ec.europa.eu/environment/life/project/Projects/index.cfm>

¹⁹⁰ Interreg provides a framework for joint action between Member States to address common challenges such as air quality, including opportunities for cross-border, transnational and interregional cooperation, https://ec.europa.eu/regional_policy/en/policy/cooperation/european-territorial

¹⁹¹ http://ec.europa.eu/environment/eir/p2p/index_en.htm

6. CONCLUSIONS¹⁹²

Clean air is essential to human health. It is also essential to sustaining the environment, and provides multiple economic and social benefits. There is well-established and robust scientific evidence of the harmful effects of air pollution, and this points to a clear need for action. Air quality continues to be relevant and of high concern to citizens across the EU, with a clear expectation for policy to act. [#Section5.1](#)

The current AAQ Directives constitute the third generation of EU level air quality policies since the early 1980s, and have inherited many provisions, including many air quality standards, from predecessor legislation. This history has resulted in a degree of maturity in the legislative framework, which, over the past decade, has delivered measurable improvements of air quality in many, if not most parts, of the EU. [#Annex4](#)

The AAQ Directives have been partially effective in achieving their overall objectives of reducing air pollution and curbing its adverse effects. While they have guided the monitoring of air quality, set clear air quality standards, and facilitated the exchange of information on air quality, they have not fully ensured that sufficient action is taken throughout the EU to meet air quality standards and keep exceedances as short as possible, resulting an overall mixed picture. [#Section5.2](#)

EU level air quality policies have had some success. The European Parliament earlier this year acknowledged that *'air quality in Europe has seen a slow but steady improvement over the past decades and European legislation has been the main driver for this beneficial development'*.¹⁹³ Similarly, the EU Council of Ministers stressed in December 2018 that air quality has significantly improved with the adoption of Union air quality standards with the Ambient Air Quality Directives as major drivers of such improvements.¹⁹⁴ [#Annex9](#)

The number and magnitude of exceedances has decreased for most pollutants throughout the EU between 2008 and 2017. Fewer Member States report exceedances today than ten years ago, and the highest pollution peaks for particulate matter and nitrogen dioxide have decreased substantially in most Member States. Similarly, the number of people exposed to air pollution above EU air quality standards has declined steadily, see Figure 11. [#Section5.2](#), [#Annex7](#)

However, despite this overall improvement, the air quality challenge is far from solved. For several air pollutants, especially particulate matter, nitrogen dioxide, ozone and benzo(a)pyrene, widespread and persistent exceedances above EU air quality standards continue, and still lead to significant impacts on human health and the environment as a whole. Air pollution is still the number one environmental health risk in the EU (and world-wide). [#Section3.2](#), [#Section5.2](#), [#Figure8](#)

¹⁹² For ease of read, each paragraph in this section includes a reference the section of the SWD it is based on, marked in with a #, e.g. [#Section5.2](#).

¹⁹³ European Parliament resolution on 'A Europe that protects: Clean air for all'. See also section 5 of Annex 9 to this SWD.

¹⁹⁴ Conclusions of the Council of the European Union no. 14794/18, 20 December 2018.

In this light, it is clear that the AAQ Directives have not met all of their objectives in full, in particular due to the lack of implementation by Member States. The European Court of Auditors, for example, concluded that EU action to protect human health from air pollution had not delivered the expected impact. Their audit noted that the significant human and economic costs of air pollution have not yet been reflected in adequate action across the EU.¹⁹⁵ Also, the EU Council of Ministers notes that not all goals of the AAQ Directives have been fully met.¹⁹⁶ #Annex8

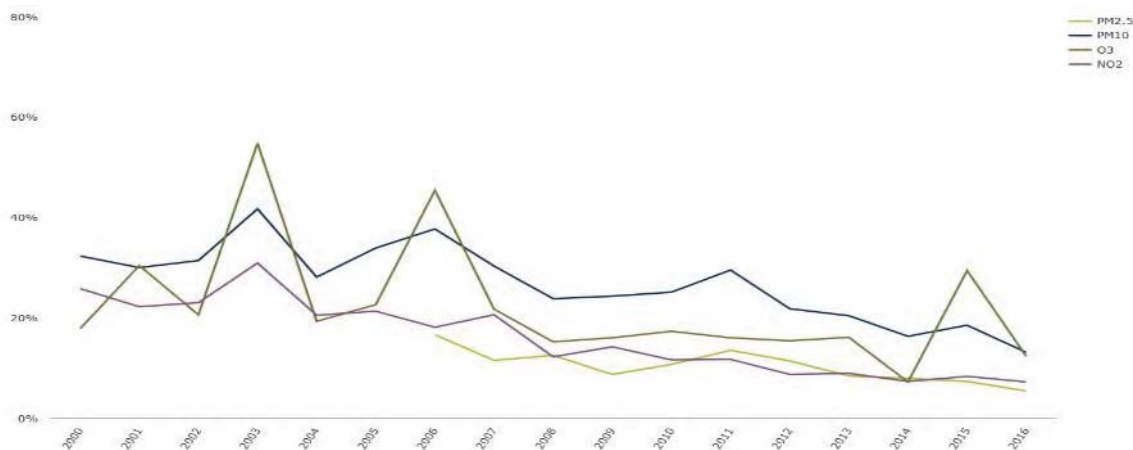


Figure 11 – Urban population exposed to air pollution concentrations above selected limit and target values¹⁹⁷

6.1. Clear air quality standards

The AAQ Directives set air quality standards for a total of 13 air pollutants, namely for sulphur dioxide (SO₂), nitrogen dioxide (NO₂) and nitrogen oxides (NO_x), particulate matter (PM₁₀ and PM_{2.5}), ozone (O₃), benzene, lead (Pb), carbon monoxide (CO), arsenic (As), cadmium (Cd), nickel (Ni), and benzo(a)pyrene. These standards take the form of limit values, target values, critical values, alert and information thresholds or long term objectives. #Section 2.3, #Section 3.2, #Section 5.1

Scientific evidence of the harmful effects of the air pollutants covered by the AAQ Directives has been periodically reviewed and further consolidated: all the pollutants covered by the AAQ Directives have harmful effects. On balance, the evidence does not support including other pollutants: there are to date no established WHO Guidelines on, for example, black carbon or ultrafine particles. The WHO Guidelines are currently under revision with an expected publication date in the early 2020s.¹⁹⁸ #Section5.1

¹⁹⁵ European Court of Auditors Special Report on Air Pollution. See section 1 of Annex 9 to this SWD.

¹⁹⁶ Conclusions of the Council of the European Union No. 14794/18, 20 December 2018.

¹⁹⁷ Urban areas provide a home to more than 70% of the population of the EU. Their high population densities in urban areas and related economic activities result in increased emissions of air pollutants, which in turn lead to higher ambient concentrations of these pollutants and greater exposure to them. <https://www.eea.europa.eu/data-and-maps/indicators/exceedance-of-air-quality-limit-3/assessment-4>.

¹⁹⁸ <http://www.euro.who.int/en/health-topics/environment-and-health/air-quality/activities/update-of-who-global-air-quality-guidelines> (accessed: 18 May 2019).

It should be noted that while the EU air quality standards have been set taking into account the WHO Guidelines, other important considerations included information on the technical feasibility of meeting different standards, and their costs and benefits. For some pollutants, such as nitrogen dioxide, EU air quality standards are currently aligned with the WHO Guidelines: for others, they are less ambitious than the levels recommended: most notably for particulate matter, especially fine particulate matter, sulphur dioxide, benzene and benzo(a)pyrene (and to a lesser extent, ozone). [#Section5.1](#)

Especially the discrepancy in fine particulate matter (PM_{2.5}) continues to cause concern, as scientific evidence points to substantial health impacts attributable to exceedance of the WHO Guidelines (noting that there are no observed safe levels of fine particulate matter).¹⁹⁹ The European Parliament thus also urges to act without delay on fine particulate matter by proposing the introduction of more stringent compliance values for these particles in EU legislation.²⁰⁰ [#Section5.1](#)

At the same time, the EU air quality standards are not fully met throughout Member State territories and the quality of life of EU citizens remains hampered. A high number of 20 Member States still report exceedances above EU limit values for at least one pollutant - in particular for particulate matter, nitrogen dioxide, ozone and benzo(a)pyrene. For fine particulate matter (PM_{2.5}) specifically, 7 Member States reported exceedances above EU limit values and WHO Guidelines, in 2017. [#Section5.2](#) [#Annex7](#)

Therefore, two somewhat contradictory shortcomings remain: on the one hand, EU air quality standards are not fully aligned with existing scientific advice; on the other hand, due to insufficiently effective air quality plans and lack of commitment to take appropriate measures by Member States, there have been (and continue to be) substantial delays in taking appropriate and effective measures to meet the existing air quality standards. [#Section5.1](#) [#Section5.2](#)

Air quality data over the past decade supports the conclusion that EU air quality standards as such have been instrumental in driving concentrations of air pollutants downward and reducing exceedance levels albeit subject to, at times considerable, delays. More comprehensive requirements, complemented with appropriate guidance, as regards air quality plans, their timeframes and implementation, might have made them more operational and yielded faster and better results (see below).

6.2. Representative high-quality monitoring of air quality

Across the EU, Member States have established more than 4 000 monitoring stations, based on common criteria and using common approaches defined by the AAQ Directives. This includes criteria for determining minimum numbers of sampling points, for data quality and acceptable uncertainty in monitoring and modelling, as well as for macroscale and microscale siting of sampling points. [#Section3.1](#)

¹⁹⁹ The World Health Organization (2013), ‘Review of evidence on health aspects of air pollution’ notes that *“the adverse effects on health of particulate matter (PM) are especially well documented”* and *“there is no evidence of a safe level of exposure or a threshold below which no adverse health effects occur.”*

²⁰⁰ European Parliament resolution on ‘A Europe that protects: Clean air for all’. See also section 5 of Annex 9 to this SWD.

The monitoring network set up by the competent authorities at national level, by and large adheres to the provisions of the AAQ Directives, and ensures that reliable and representative air quality measurements and data are available. There have been and still are instances when and where, in specific air quality zones or agglomerations, air quality monitoring does not live up to the criteria the AAQ Directives set: where this is the case, the Commission has intervened, including via infringement proceedings. [#Section5.3](#)

The criteria, as defined by the annexes of the AAQ Directives, offer some flexibility to competent authorities so that air quality monitoring networks are optimally set up depending on the respective local circumstances. These flexibilities are limited by the requirement to provide information both for where the highest concentrations of air pollutants occur and for other areas which are representative of the exposure of the general population. Both are difficult to verify objectively. [#Section5.3](#)

Concerns have been raised that the criteria as defined offer too much leeway to competent authorities and that more restrictively defined siting criteria or (additional) guidance would help ensure a higher degree of confidence in the comparability of monitored air quality. A number of ambiguities as regards the siting criteria have been identified, but these have not been found to have led to systemic shortcomings in the monitoring network. On balance, air quality information collected and reported appears to deliver air quality data that is robust and of satisfactory quality to act upon. [#Section5.3](#)

It emerges from the above analysis that the monitoring network benefits from continuous investment to ensure it is well maintained and adapted to local realities, and additional guidance that address the ambiguities in the siting criteria or further strengthen the approaches to air quality modelling would improve the comparability of air quality information further.

6.3. Reliable, objective, comparable information on air quality

Effective monitoring and assessment of air quality and collection and dissemination of comparable and reliable data has been of key importance in ensuring awareness and access to information on air quality to the wider public. [#Section 3.3](#)

The AAQ Directives revised the provisions on reporting and dissemination of public information enabling the establishment of improved reporting systems. As of 2014, the EEA has successfully maintained an upgraded air quality e-Reporting database serving as a hub for all reporting requirements, including both official reporting of validated air quality data as well as up-to-date data reported by Member States. [#Section 5.3](#)

The air quality data reported by Member States is made available to the public by the EEA (in full); both in their original form, as well as via aggregated assessment data. The latter is the basis for annual air quality reports. This information has been increasingly made available, and accessed, by a wider public: for example, the number of visits to the EEA air quality website pages has increased nine-fold since 2008. [#Section 3.5](#)

Air quality information is also made available by national, regional and local authorities, and more recently also by private operators (usually based on the officially reported data made available via the EEA, and augmented by data from remote sensing and air quality sensors). At this level, the information provided can be less comparable, partly because the variety in approaches and metrics used. [#Section 5.3](#)

The AAQ Directives have not, for example, defined information and alert thresholds for some pollutants (in particular, for particulate matter), which has resulted in a non-harmonised approach in terms of information to the public for some pollutants across Member States, entailing extensive differences also in government and/or media coverage of alarming levels of air pollution. Similarly, the absence of a common metric used for publicised Air Quality Indices often means that the same data is presented in different ways in different locations. The Commission and the EEA have thus introduced a European Air Quality Index in 2017. [#Section 5.6](#)

Overall, the AAQ Directives have facilitated the availability and accessibility of reliable and comparable air quality data across the EU, including by providing a clear structure to ensure the use of modern information technology – with a clear EU added value. Further harmonisation of the way air quality information is presented would be both possible and desirable, and help ensure even higher comparability. [#Section 5.3](#), [#Section 5.6](#)

It can be concluded that there might be further scope to make use of the possibilities afforded by the use of e-Reporting, including an acceleration of reporting of validated air quality data (currently due nine months after the end of any given year) – but this would require additional feasibility assessments

6.4. Action to avoid, prevent and reduce the impact of poor air quality

The AAQ Directives introduced a specific requirement to take action when air quality does not meet the agreed standards. Such action requires both the preparation and implementation of air quality plans for zones and agglomerations within which concentrations of pollutants in ambient air exceed the relevant air limit values under Directive [2008/50/EC](#); or the adoption of all necessary measures not entailing disproportionate costs when target values set by Directive [2004/107/EC](#) are exceeded. [#Section 3.4](#)

Stakeholder feedback and case studies confirm that the requirements to adopt air quality plans or all necessary measures are among the most fundamental and compelling elements of the AAQ Directives for incentivising remedial action by the Member States. In practice, almost all Member States have had to prepare air quality plans as required by the AAQ Directives for air quality zones and agglomerations that have seen exceedances of the EU air quality standards. This split of responsibilities between different levels of government is appropriate and reflects the principle of subsidiarity. [#Section 5.2](#)

While the AAQ Directives establish a common format and key elements that such plans need to cover, it does not prescribe a clear timeframe and the measures that need to be taken or considered: this is left to the competent national authorities with a view to ensure that the most cost-effective measures are taken to end the exceedances as soon as possible. Besides economic considerations, coordination and consistency of action between authorities within and beyond the Member States is essential and has often been insufficient. [#Section 5.5](#), [#Section 5.6](#)

Improvements in air quality critically depend on action taken by Member States to address the sources of air pollution that lead to the exceedances in the specific circumstances, and typically require action in the transport sector, energy (including domestic heating) and agricultural sectors or by industry actors. And such improvements need to rely on coherent action. Measures to improve air quality are thus not solely steered by the air quality plans but also influenced by other EU legislation as well as by

governance arrangements at national level, and this offers scope for synergies with other Community objectives and policies in different fields. [#Section 3.4](#), [#Section 5.5](#)

Synergies with climate, energy and transport policies have been strengthened over the past decade, but would yield greater benefits if further improved and made more coherent. The European Court of Auditors pointed out that some EU policies do not sufficiently reflect the importance of air pollution. Specifically, stakeholder feedback identified instances where the implementation of other EU policies may not fully support the implementation of the AAQ Directives. This includes in particular the promotion of biomass combustion for energy production under the climate and energy policy, the shortcomings in the implementation of EU Type Approval Framework for cars in relation to NO_x emissions or the choices made by some Member States to support diesel over petrol with a view of reducing greenhouse gas emissions. Some of the above incoherencies or hindrances have been addressed by recent adjustments to related regulatory frameworks (e.g revised Type Approval Framework). This fitness check can feed into review processes and reflections regarding sectoral legislation. [#Section 5.5](#)

Furthermore, the persistent widespread exceedances for some pollutants indicate that action taken to date has not been sufficient to improve air quality as quickly as possible. The European Court of Auditors pointed out that air quality plans and measures suffered from serious deficiencies, including a lack of coordination between national and local authorities, the absence of costing or funding, and the non-provision of information about the real impact of measures taken on air quality. [#Annex 9](#)

While the approach to air quality plans can certainly be improved, the clear requirement to take remedial action when and where exceedances are observed has been decisive in triggering improvement in air quality, yet often with delay.

6.5. Simplification and burden reduction potential

This fitness check evidenced a number of provisions of the AAQ Directives that have become redundant since 2008, meaning that they have been exhausted or have lost relevance. Whereas these provisions are no longer necessary, they do not affect the implementation of the other provisions of the AAQ Directives. [#Section 5.1](#)

When it comes to monitoring and its costs, the AAQ Directives are designed in a way to decrease the burden associated to fixed monitoring stations depending on the observed levels of air pollutant concentrations. In other words, as air pollution decreases, so do the minimum monitoring requirements. This means that the proportionality of the monitoring costs is ensured by the very design of the AAQ Directives. [#Section 5.3](#)

The same cannot be said for the reporting requirements of the AAQ Directives which are extensive and not decreasing as a function of air pollutant levels. However, the removal of any of the reporting requirements in the AAQ Directives would involve a change in the structure of e-reporting and would thus require further assessment of the broader consequences and administrative burden implications of such changes. [#Section 5.3](#)

Redundant provisions have been identified in the AAQ Directives as well as elements that could reduce administrative burden in terms of air quality reporting.

6.6. Some lessons learned

This fitness check shows that over the past decade, the AAQ Directives have guided the establishment of a representative high-quality monitoring of air quality, set clear air quality standards, and facilitated the exchange of reliable, objective, comparable information on air quality, including to a wider public.

At the same time, the AAQ Directives have been less successful in ensuring that sufficient action is taken to meet air quality standards and keep exceedances as short as possible. Having said that, the evidence shows that they significantly contributed to a downward trend in air pollution and reduced the number and magnitude of exceedances.

This *partial* success allows to conclude that the AAQ Directives have been broadly fit for purpose, with clear shortcomings as regards achieving the overarching ambition to *fully* meet all air quality standards for all pollutants and throughout the European Union according to the timelines foreseen in the AAQ Directives at the time of adoption.

This points to scope for improvements to the existing framework for air quality management. In particular, it emerges from this fitness check that additional guidance, or clearer requirements in the AAQ Directives themselves, could help to make monitoring, modelling and the provisions for plans and measures more effective and efficient.

Specifically, this fitness check identifies several lessons learnt to be considered in the follow up to this fitness check, including the below:

- air pollution continues to be a major health and environmental concern to the citizens of the EU, and surveys show it to be one of the two most important environmental issues (the other being climate change) – a relative majority of citizens share the view that the issue of air pollution can be best addressed at the EU level: this underlines the continued relevance of the AAQ Directives;
- the EU air quality standards have been instrumental in driving a downward trend in exceedances and exposure of population to exceedances – however, the current air quality standards are not as ambitious as established scientific advice suggests for several pollutants, especially fine particulate matter (PM_{2.5}); the WHO Guidelines are currently being reviewed, and the Commission is following this closely;
- trends in exceedance levels for fine particulate matter (PM_{2.5}) indicate that limit values have been more effective in facilitating downward trends than other types of air quality standards, such as target values – especially where this has been done in conjunction with an exposure concentration obligation requirement and national emission reduction targets as established under the NEC Directive;
- enforcement action by the European Commission and in particular also by civil society actors in front of national courts (under general right to access to justice provisions, as there are no explicit provisions in the AAQ Directives on this) has resulted in actionable rulings, shown that the legislation is enforceable, and proven to be important to accelerate downward trends for air pollution;
- the AAQ Directives have given flexibility to competent national authorities to ensure air quality monitoring and air quality measures optimally fit local circumstances in line with the principle of subsidiarity – yet additional guidance or implementing acts

could help to further harmonise approaches applied to monitoring, information provisions, and air quality plans and measures;

- for air quality data, not all data reported is equally useful and the successful establishment of an EU-wide e-reporting based on machine-readable formats now allows for further efficiency gains – and opens the way for further up-to-date reporting of air quality data and to make further use of air quality modelling (which is increasingly reported, but would benefit from further guidance).

Annex 1: Procedural information and evidence used

1. Lead DG, Decide Planning/CWP references

The fitness check of the Ambient Air Quality Directives is led by the Directorate General for Environment. It was included as item PLAN/2016/88 in the Agenda Planning.

2. Organisation and timing

This fitness check started in July 2017.

An Interservice Group to steer the evaluation was set up in 2017 with representatives from the Secretariat-General (SG), Directorates-General for Economic and Financial Affairs (ECFIN); Agriculture and Rural Development (AGRI); Mobility and Transports (MOVE); Energy (ENER); Environment (ENV); Climate Action (CLIMA); Research and Innovation (RTD); Joint Research Centre (JRC) and Regional and Urban Policy (REGIO). Invitations and regular updates were also sent throughout the process to the Legal Service (SJ); Directorates-General for Internal Market, Industry, Entrepreneurship and SMEs (GROW); Maritime Affairs and Fisheries (MARE); Taxation and Customs Union (TAXUD) and Health and Food Safety (SANTE).

The Interservice Group met eight times during the evaluation process.

Timeline

12 Jul 2017	(COM)	1st ISG meeting: discussion of overall process, draft road map and draft terms of reference for the support study
26 Jul 2017	(EXT)	Publication of the Roadmap ²⁰¹ on the Better Regulation Portal (public feedback closing date: 23 Aug 2017)
21 Sep 2017	(COM)	2nd ISG meeting: discussion of outcome of the public consultation on the draft roadmap, discussion and finalisation of the draft terms of reference for the support study
19 Oct 2017	(Other)	Launch of the service request to the contractors under the Framework Contract ENV.F.1/FRA/2014/0063 (Ares(2017)5105087) (closing date to submit offers: 9 Nov 2017)
16-17 Nov 2017	(Other)	1st Clean Air Forum ²⁰² in Paris, France
22 Dec 2017	(COM)	Signature of the contract for the support study with the consortium led by COWI
29-30 Jan 2018	(MS)	Ambient Air Quality Expert Group meeting with a session on the fitness check on 30 Jan 2018

²⁰¹ https://ec.europa.eu/info/law/better-regulation/initiatives/ares-2017-3763998_en

²⁰² https://ec.europa.eu/info/events/cities-events/clean-air-forum-2017-nov-16_en

- 1 Feb 2018 (COM) **3rd ISG meeting**: discussion of the consultation strategy and the draft inception report for the support study, feedback received from the Ambient Air Quality Expert Group, results of stakeholder consultation and 1st draft of evaluation report
- 8 May 2018 (EXT) Launch of the **open public consultation**²⁰³ of the fitness check (closing date 31 Jul 2018)
- 21-25 May 2018 (Other) **Green Week 2018** – Green cities for a greener future – session dedicated to the fitness check
- 18 Jun 2018 (EXT) **1st stakeholder workshop**²⁰⁴ on the fitness check of the Ambient Air Quality Directives
- 5 Jul 2019 (MS) **Ambient Air Quality Expert Group** meeting focussed on AAQ fitness check
- 10 Jul 2018 (COM) **4th ISG meeting**: discussion of the results of the first stakeholder workshop held on 18 June 2018 and the feedback from the Ambient Air Quality Expert Group
- 31 Jul 2018 (EXT) End of the **open public consultation**
- 11 Sep 2018 (Other) Publication of the **European Court of Auditors Special Report** no. 23/2018: ‘Air pollution: Our health still insufficiently protected’²⁰⁵
- 18 Oct 2018 (COM) **5th ISG meeting**: update on the conclusion of the open public consultation, presentation of the initial findings emerging from the support study
- 24-25 Oct 2018 (MS) **Ambient Air Quality Expert Group** meeting with a session on the fitness check on 25 Oct 2018
- 12 Dec 2018 (Other) Opinion of the **European Economic and Social Committee** on the ‘Clean air for all’ Communication of the Commission²⁰⁶
- 12 Dec 2018 (Other) Exploratory opinion of the **European Economic and Social Committee**: ‘Implementation of EU environmental legislation in the areas of air quality, water and waste’²⁰⁷

²⁰³ https://ec.europa.eu/info/consultations/public-consultation-support-fitness-check-eu-ambient-air-quality-directives_en

²⁰⁴ https://ec.europa.eu/info/events/stakeholder-workshop-support-fitness-check-eu-ambient-air-quality-directives-2018-jun-18_en

²⁰⁵ See section 1 of Annex 9 to this SWD.

²⁰⁶ See section 2 of Annex 9 to this SWD.

²⁰⁷ NAT/744-EESC-2018-02510.

20 Dec 2018	(Other)	Conclusions of the Council of the European Union on the European Court of Auditors Special Report no. 23/2018 on air pollution ²⁰⁸
15 Jan 2019	(EXT)	2nd Stakeholder Workshop ²⁰⁹ on the fitness check of the Ambient Air Quality Directives
30 Jan 2019	(Other)	Joint report on air quality by the European Organisation of Supreme Audit Institutions (EUROSAI) ²¹⁰
12 Feb 2019	(COM)	Up-stream meeting with the Regulatory Scrutiny Board
11-12 Mar 2019	(MS)	Ambient Air Quality Expert Group meeting with a session on the fitness check on 11 Mar 2019
12 Mar 2019	(COM)	Written update in lieu of 6 th ISG meeting , on the 2 nd Stakeholder workshop of 15 Jan 2019, upstream meeting with the Regulatory Scrutiny Board of 12 Feb 2019 and on the support study
12 Mar 2019	(Other)	European Parliament resolution on the Commission Communication ‘A Europe that protects: Clean air for all’ ²¹¹
8 Apr 2019	(COM)	7 th ISG meeting : discussion of the findings and the quality of the draft final report of the support study
21 May 2019	(COM)	8 th ISG meeting : discussion of the draft Staff Working Document for the conclusion of the fitness check
17 Jul 2019	(COM)	Meeting with the Regulatory Scrutiny Board
19 Jul 2019	(COM)	First opinion of the Regulatory Scrutiny Board
23 Oct 2019	(COM)	Finalisation of the support study ‘Supporting the fitness check of the EU Ambient Air Quality Directives (2008/50/EC, 2004/107/EC)’
6 Nov 2019	(COM)	Second opinion of the Regulatory Scrutiny Board
xx Nov 2019	(COM)	Launch of the Inter-service consultation on the final Staff Working Document

LEGEND	(COM)	Interservice Group or Regulatory Scrutiny Board
	(MS)	Member States input via Ambient Air Quality Expert Group
	(EXT)	(External) stakeholder input (including stakeholder consultation)
	(Other)	Other key events or input

²⁰⁸ See section 3 of Annex 9 to this SWD.

²⁰⁹ https://ec.europa.eu/info/events/second-stakeholder-workshop-support-fitness-check-eu-ambient-air-quality-directives-2019-jan-15-0_en

²¹⁰ See section 4 of Annex 9 to this SWD.

²¹¹ See section 5 of Annex 9 to this SWD.

3. Exceptions to the Better Regulation Guidelines

No exceptions were made to the Better Regulation Guidelines²¹² during this fitness check.

4. Consultation of the Regulatory Scrutiny Board

In relation to this fitness check, the Regulatory Scrutiny Board (RSB) delivered a positive opinion with comments on 6 November 2019. The following table provides information on how the comments made have been addressed in this Staff Working Document:

<i>RSB comments</i>	<i>Reflection in text</i>
<i>(1) The report does not sufficiently discuss how societal developments and changing awareness of citizens about air pollution have influenced the relevance of the legislation and its air quality standards.</i>	
Public perceptions and debate around air pollution have evolved since the adoption of the EU Ambient Air Quality Directives. The report would benefit from a discussion of these developments and their effect on the relevance of the directives. It should analyse to what extent the directives and their air quality standards meet the population's current needs and requirements.	A new Annex 10 on public perceptions has been added, providing an overview of relevant Eurobarometer surveys carried out in the evaluation period and a summary of the most recent Eurobarometer survey on air quality. Analysis has also been augmented with additional considerations linking public perceptions with the relevance of EU air quality standards in section 5.1.
<i>(2) The report does not justify having less ambitious air quality standards than those recommended by the World Health Organisation.</i>	
The report should provide an evidence-based discussion about the merits of having EU air quality standards that are less stringent than WHO Guidelines. It should assess whether the socio-economic and feasibility factors that argued for less ambitious standards remain valid.	This has been addressed in greater detail in section 5.1 and Annex 8, including via additional evidence on model-based projections assessing potential to reach WHO Guidelines values for PM _{2.5} in a 2030 perspective. This indicates that while large parts of the EU would be able to reach these, for some regions efforts required would exceed measures deemed cost-effective.
<i>Additional considerations</i>	
Investigating case-by-case the potential for simplification and burden reduction is a central promise by the Commission. Throughout the report, there are paragraphs discussing this potential. However, it could be helpful to have a dedicated section on why or why not there is room for simplification or burden reduction.	A new section 6.5 on simplification and burden reduction potential has been added, gathering relevant considerations present throughout the document and providing an overall conclusion on the potential to simplify the AAQ Directives' requirements with a view of reducing the burden.

²¹² https://ec.europa.eu/info/better-regulation-guidelines-and-toolbox_en

The Regulatory Scrutiny Board had previously provided a negative opinion with comments on 19 July 2019. The following table provides information on how the comments made have been addressed in this Staff Working Document:

<i>RSB Opinion</i>	<i>Reflection in text</i>
<i>(1) The report does not present an unbiased reading of the data with respect to the objective of meeting specific air quality standards by certain deadlines.</i>	
The report should be clear that one objective of the legislation was to meet certain air quality standards by certain deadlines. The effectiveness analysis should assess achievements against this benchmark.	This has been addressed extensively throughout the revised text, and in particular via revisions to Section 2.3, Section 3.2, Section 5.2, as well as to the Conclusions. Note that the existing standards are now introduced clearly in Section 2.3, including the typology (Box 1). Also the Conclusions and Executive Summary have been revised to reflect this emphasis on achieving standards. New Figures 4a, 4b and 4c in Section 3.2 provide a detailed assessment against the air quality standards, as the key benchmark and point for comparison between 2008 and 2017, noting changes in the number and magnitude of exceedances.
The report should show the air quality trends in more detail, in particular, by how much standards were breached in how many zones. The report should provide likely reasons for failures to achieve goals, making clear any material differences across Member States.	The comparison of the situation in 2008 with 2017 has been significantly improved and expanded, in particular by adding new Figures 4a, 4b and 4c that show changes in number and magnitude of exceedances per Member State for PM ₁₀ , PM _{2.5} and NO ₂ (see Section 3.2). Section 5.2 makes also clear and more detailed references to the observed improvements and differences across Member States for two key pollutants (PM and NO ₂), including identifying key reasons for these differences.
The report should answer the question whether the current design and enforcement structure of the directives are likely to meet the air quality standards if given enough time (i.e. whether they are fit for purpose).	This is now being more clearly argued in the Conclusions and Executive Summary. The fitness check finds the AAQ Directives to be <i>partially</i> effective and broadly fit for purpose, but also stresses a need to improve the existing framework in order to <i>fully</i> meet all objectives. The Conclusions offer more detailed lessons learned that can be drawn from the fitness check as regards potential improvements.

<i>RSB Opinion</i>	<i>Reflection in text</i>
<p><i>(2) The report does not sufficiently present successes and shortcomings of different intermediate steps towards end objectives, including measuring air quality, acting on the data and enforcing standards.</i></p>	
<p>The report should provide a nuanced discussion of each step between measuring air quality and achieving benchmark air quality standards.</p>	<p>The effectiveness of the steps foreseen in the AAQ Directives (i.e. monitor pollution, set standards, report data, improve air) as outlined in the Intervention Logic is now more clearly discussed in Section 5.2 and Conclusions.</p>
<p>For example, it could mention that the system to measure air quality still has room for improvement, but delivers data that is good enough to act upon; that enforcement is partially effective, also thanks to NGOs successfully taking legal action; that implementation respects the subsidiarity principle, but has suffered from a lack of political commitment and coordination between levels of government. This discussion should point to those aspects that would need to improve in order to achieve the original objective of meeting air quality standards.</p>	<p>Clear indications added to the document that the system to measure air quality still has room for improvement but delivers data that is reliable enough to act upon (this is now explicitly concluded in Section 5.3). Legal action by NGOs now further elaborated (Section 3.5 and Annex 6). A prevailing lack of political commitment and shortcomings in coordination between levels of government highlighted as important reason for the AAQ Directives only being partially effective to date is addressed in Section 5.2. Further reference is made to the polluter pays principle and the need to rectify pollution at source have been added to Section 5.2. The above points are also reflected in the lessons learned presented in the final part of the Conclusions.</p>
<p>It might also indicate if data collection capabilities have matured enough for the policy emphasis to shift towards more coordinated action across Member States.</p>	<p>Text on transboundary cooperation (Box 15) has been expanded to stress the availability of good air quality data on transboundary contributions to air quality exceedances.</p>
<p><i>(3) The report does not sufficiently investigate the issue of aligning EU air quality standards with the WHO Guidelines.</i></p>	
<p>The report should provide an evidence-based discussion about the merits of having EU air quality standards that are less stringent than WHO Guidelines.</p>	<p>The enhanced Section 5.1 and a new Annex 8 presents analysis as provided by the 2018 Clean Air Outlook – and discuss the comparison between EU air quality standards and WHO Guidelines in more detail, noting that “<i>there are cases where measures are technically feasible but not cost-effective, leading to a situation where some regions in the EU would not reach the WHO Guidelines in a 2030 projection.</i>”</p>

<i>RSB Opinion</i>	<i>Reflection in text</i>
It should assess whether the socio-economic and feasibility factors that argued for less ambitious standards are still valid.	In addition to the above, the socio-economic and feasibility factors are discussed in Section 5.1, with additional text added on socio-economic aspects. This section now also elaborates further on the process of setting WHO Guidelines (Box 3), and the trade-offs to consider in translating these into EU standards.
It should also conclude more clearly about the state of play of evidence on pollutants not covered in the legislation.	The text in Section 5.1 on additional pollutants has been expanded, now including also a bespoke box on the state of evidence for ultrafine particles (Box 4). The related findings are mirrored in the Executive Summary.
The relevance section could also present the changed societal context, for example, evidence of higher awareness of the public, increased demand for monitoring data, and adjusted expectations. The report should consider what this implies for the level of ambition of the air quality directives.	Reference to the changed societal context, and evidence of higher public awareness and engagement is addressed in revised Sections 3.4 and 5.1, including new text to highlight public engagement in using low cost sensors to augment official monitoring (Box 2). Also further reference to increased awareness added as a lesson learned to the Conclusions.
<i>(4) The report does not make clear which stakeholder groups thought what.</i>	
The report should differentiate stakeholders' responses across stakeholder groups. It should investigate how representative or relevant presented criticisms are.	Stakeholder responses have been elaborated in more detail throughout. In Annex 2, a detailed analysis of feedback as differentiated by stakeholder group has been added for each of the five criteria (see Box A2.1 through A2.5)
The report needs to explicitly cover the opinions voiced by local and regional authorities during the consultation activities.	In addition to the above, which includes feedback from national, regional and local authorities, two further boxes have been added to summarise the views offered by local and regional authorities (Box 9), another on the EU Urban Agenda (Box 14).
<i>Additional considerations</i>	
The efficiency analysis should discuss whether it is possible to simplify rules and reduce burdens without compromising the objectives.	Section 5.1 includes specific references to redundant elements in the current AAQ Directives. In addition, section 5.3 now indicates that not all data reported is equally relevant, which offers scope for some simplification.

<i>RSB Opinion</i>	<i>Reflection in text</i>
It should also discuss the proportionality of the monitoring costs.	Section 5.3 now emphasises the approach to proportionality of monitoring and stresses that related requirements (and thus related costs) decrease when air quality improves. Also this section now more clearly states that the costs of monitoring and reporting are several magnitudes smaller than the cost of pollution.

5. Evidence, sources and quality

Support study

A contract study ‘*Supporting the fitness check of the EU Ambient Air Quality Directives (2008/50/EC, 2004/107/EC)*’ (ENV.F.I/FRA/2014/0063/25, procurement procedure of 17 May 2014) informed the conclusions presented in this document. The contract for the support study was signed on 22 December 2017 and covered a period of 18 months (070201/2017/772581/SER/C3). The contract was carried out by a consortium of experts led by COWI A/S, and also comprised of Milieu Ltd and Eunomia. The final report for the study contract was accepted in October 2019.

The Interservice Group confirmed that the support study sufficiently satisfies the necessary quality requirements.

Consultation strategy

A consultation strategy²¹³ guided the gathering stakeholder input to this fitness check, and included the following:

- an open public consultation allowing the interested public and stakeholders to express their views;
- targeted stakeholder consultation, addressed at selected stakeholders in all Member States and at EU level;
- stakeholder workshops in order to confirm the scope and the hypotheses of the fitness check, and to validate the findings towards the end of the process.

A synopsis on the stakeholder consultation process are provided in Annex 2.

Bespoke modelling

For the analysis of the efficiency criterion, and in addition to the sources of information presented above (which informed mostly the analysis of the costs), the support study undertook specific computations based on previously published methodology, in order to estimate some of the health benefits of the AAQ Directives and some of the damage costs to society in case of their insufficient implementation. The precise steps of these computations together with the limitations of the modelling are described in Annex 3.

²¹³ http://ec.europa.eu/environment/air/pdf/AODs%20Fitness%20Check_consultation%20strategy.pdf

Evidence from air quality monitoring and reporting

Under the two Directives, Member States make available the information they use for reporting and reciprocal exchange of information via and air quality data repository (<http://www.eionet.europa.eu/aqportal>), including:

- monitoring and assessment regimes, including assessment methods: <http://aidec.apps.eea.europa.eu> and <http://aided.apps.eea.europa.eu>
- attainment of environmental objectives, including information on exceedance situations: <http://aideg.apps.eea.europa.eu>
- air quality plans and programmes, as well as air quality measures: <http://aideh.apps.eea.europa.eu> and <http://aidek.apps.eea.europa.eu>
- information on source apportionment in zones and agglomerations: <http://aidei.apps.eea.europa.eu>
- and information on air data and aggregated validated assessment data as summarised in the annual air quality reports published by the European Environment Agency
- online EEA indicators, such as:
 - Exceedance of air quality standards in urban areas: www.eea.europa.eu/data-and-maps/indicators/exceedance-of-air-quality-limit-3/assessment-4
 - Transport fuel prices and taxes: <https://www.eea.europa.eu/data-and-maps/indicators/fuel-prices-and-taxes/assessment-2>

Evidence from selected studies and policy documents

- COM(2005)446. ‘Thematic Strategy on air pollution’
- COM(2013)918. ‘A Clean Air Programme for Europe’, including, in particular: SWD(2013)531. ‘Clean Air Programme for Europe Impact Assessment’
- COM(2017)312. ‘Actions to Streamline Environmental Reporting’
- COM(2018)446. ‘The First Clean Air Outlook’
- COM(2018)330. ‘A Europe that protects: Clean air for all’
- COM(2019)149. ‘Environmental Implementation Review 2019’
- EEA Annual Air Quality Reports published from 2011 to 2018:
 - <https://www.eea.europa.eu/publications/air-quality-in-europe-2018>
 - <https://www.eea.europa.eu/publications/air-quality-in-europe-2017>
 - <https://www.eea.europa.eu/publications/air-quality-in-europe-2016>
 - <https://www.eea.europa.eu/publications/air-quality-in-europe-2015>
 - <https://www.eea.europa.eu/publications/air-quality-in-europe-2014>
 - <https://www.eea.europa.eu/publications/air-quality-in-europe-2013>
 - <https://www.eea.europa.eu/publications/air-quality-in-europe-2012>
 - <https://www.eea.europa.eu/publications/air-quality-in-europe-2011>
- EEA Briefing 9/2018. ‘Improving Europe’s air quality — measures reported by countries’
- EEA Report 11/2014. ‘Effects of air pollution on European ecosystems’
- EEA Report 6/2018. ‘European Union emission inventory report 1990-2016’

- EEA Report 22/2018. ‘Unequal exposure and unequal impacts’
- EEA Report 24/2018. ‘Europe’s urban air quality’
- ETC/ACC Technical paper 2010/1. ‘The state of the air quality in 2008’
- ETC/ACM Technical paper 2011/20. ‘Co-benefits of climate and air pollution regulations’
- European Commission (2013). Flash Eurobarometer 360: ‘Attitudes of Europeans towards air quality’
- European Commission (2017). Special Eurobarometer 468: ‘Attitudes of European citizens towards the environment’
- European Commission (2019). Special Eurobarometer 497: ‘Attitudes of Europeans towards air quality’
- European Court of Auditors Special Report 05/2018 on Renewable Energy
- European Court of Auditors Special Report 23/2018 on Air Pollution
- European Parliament (2017). ‘Report on the inquiry into emission measurements in the automotive sector’
- European Parliament (2019). ‘Sampling points for air quality: Representativeness and comparability of measurements in accordance with Directive 2008/50/EC on ambient air quality and cleaner air in Europe’ (study requested by the ENVI Committee)
- EUROSAI (2019). ‘Joint report on air quality by the European Organisation of Supreme Audit Institutions’
- IIASA (2014). ‘Complementary Impact Assessment on interactions between EU air quality policy and climate and energy policy’
- IIASA (2017). ‘Costs, benefits and economic impacts of the EU Clean Air Strategy and their implications on innovation and competitiveness’
- IIASA (2018). ‘Progress towards the achievement of the EU’s air quality and emissions objectives’
- JRC (2013). ‘Assessment on siting criteria, classification and representativeness of air quality monitoring stations’
- JRC (2017). ‘Urban PM_{2.5} Atlas: Air Quality in European Cities’
- JRC (2017). ‘Global Energy and Climate Outlook 2017: How climate policies improve air quality’
- Nationale Akademie der Wissenschaften Leopoldina (2019). ‘Saubere Luft. Stickstoffoxide und Feinstaub in der Atemluft: Grundlagen und Empfehlungen’
- OECD (2016). ‘The Economic Consequences of Outdoor Air Pollution’
- OECD (2019). ‘The economic cost of air pollution – Evidence from Europe’
- Urban Agenda for the EU (2018). ‘Position Paper on the Fitness Check of the EU Ambient Air Quality Directives’
- World Health Organization (2006). ‘Air quality guidelines – global update 2005’
- World Health Organization (2013). ‘Review of evidence on health aspects of air pollution’

Additional sources of evidence, including relevant academic literature and scientific articles, reports and conference papers, online and data sources, as well as further policy documents and guidelines, are listed in Appendix C of the support study informing this fitness check or cited as footnotes where referred to.

Annex 2: Stakeholder consultation

1. Aim of the consultation

The stakeholder consultation aimed to collect supporting information, data and knowledge on the implementation of various aspects of the AAQ Directives, with a view to fill any potential information/data gaps in the course of the fitness check and inform the analysis of the evaluation questions. Consultation activities also aimed at gathering stakeholders' views and opinions on the extent to which AAQ Directives have successfully met their objectives.

2. Consultation strategy²¹⁴

The consultation focused on gathering stakeholders' responses on the following aspects:

- awareness of the air quality issues in general and knowledge of the AAQ Directives' provisions;
- views regarding the contribution of the AAQ Directives to improved air quality;
- whether the provisions of the AAQ Directives continue to be relevant, effective, efficient, and coherent with other EU and national policies, as well as the extent to which an EU-level approach to air quality has added value.

A broad range of stakeholders were consulted for the fitness check, including Member State competent authorities at all relevant levels (i.e. national, regional and local), civil society and non-governmental organisations, organisations representing industry and trade, researchers and the scientific community, international organisations (such as the World Health Organization), as well as citizens.

The consultation has aimed to ensure that, in each Member State, stakeholders representing government, civil society and industry were provided the opportunity to provide input. Particular attention was paid to consulting stakeholders in regions and sectors where air quality issues were problematic.

3. Consultation activities

Feedback on the fitness check roadmap

The public consultation on the roadmap of the fitness check of the AAQ Directives resulted in 13 responses online and one additional response was received via email. Five replies were received at the EU-level and nine at Member state level.²¹⁵ By stakeholder group, two replies were received from business organisations, four from business associations, five from NGO/civil society, one from public authorities, one from a private

²¹⁴ http://ec.europa.eu/environment/air/pdf/AQDs%20Fitness%20Check_consultation%20strategy.pdf

²¹⁵ Germany (3), Austria (1), Denmark (1), Italy (1), Hungary (1), Netherlands (1), United Kingdom (1).

citizen and one from a city. The full responses are available online and were considered in the analysis underpinning this fitness check.²¹⁶

Table A2.1 - Respondents to roadmap

Organisation name	Member State	Organisation type
European Environmental Bureau	Belgium	NGO
German Chamber of Commerce (DIHK)	Germany	Company / business org.
AEGPL – European LPG Association	Belgium	Business association
European Respiratory Society	Belgium	NGO
Zentralverband des Deutschen Handwerks (ZDH)	Germany	Business association
Anonymous	Italy	EU citizen
Danish Environment Technology Association	Denmark	Business association
European Federation of Allergy and Airways Diseases Patients' Associations (EFA)	Belgium	NGO
Austrian Federal Economic Chamber (WKO)	Austria	Business association
ClientEarth	United Kingdom	NGO
SHV Energy	Netherlands	Company / business org.
Senior Corporate Silver Spoon, Environment and Nature Association	Hungary	NGO
German Federal Environment Agency (UBA Germany)	Germany	Public authorities

Targeted questionnaire

The targeted questionnaire aimed at collecting evidence and information relevant to answer the evaluation questions from a selected number of stakeholders at national and EU level. It was sent to approximately 160 representatives of public institutions at national, regional and local level; 100 representatives of NGOs at national and EU level; 80 representatives of industry and trade at national (including national chambers of commerce) and EU level; and 90 research institutes or universities in EU Member States covering environmental, health and industry sectors. The associations at EU level were selected in order to ensure a multiplier effect. The targeted questionnaire was sent out on 5 June 2018 with a deadline for responses on 24 July 2018, which was then extended to 15 September 2018.

In total, 43 responses were received. Of these, two organisations submitted position papers in lieu of completing the questionnaire and one provided feedback in email form. Respondents included 16 national authorities and five local or regional authorities (or associations of local governments) in Member States, ten NGOs, six educational or scientific organisations, five industry associations and one local authority employee responding in an individual capacity. The 43 responses represented around 10% of stakeholders approached. All major stakeholder groups were represented in the responses, except for EU and international organisations who nonetheless participated in other consultation activities (e.g. the stakeholder workshops).

²¹⁶ https://ec.europa.eu/info/law/better-regulation/initiatives/ares-2017-3763998/feedback_en

Table A2.2 - Respondents to targeted questionnaire

Organisation name	Member State	Organisation type
WKO Austrian Federal Economic Chamber	Austria	Industry
IRCEL-CELINE	Belgium	National authority
Executive Environment Agency	Bulgaria	National authority
Ministry of Environment and Energy	Croatia	National authority
Ministry of the Environment	Czechia	National authority
HSY Helsinki Region Environmental Services and City of Helsinki (joint response)	Finland	Local / regional authority
ATMO France	France	NGO
Airparif	France	NGO
Atmo Grand Est	France	NGO
City of Munich	Germany	Local / regional authority
Local authority employee responding in individual capacity	Germany	Citizen / individual expert
Clean Air Action Group	Hungary	NGO
Environmental Protection Agency	Ireland	National authority
Environmental Sustainability Lab University of Brescia	Italy	Scientific / research org.
Riga City Council	Latvia	Local / regional authority
Ministry of Environment Protection	Latvia	National authority
Administration de l'environnement	Luxembourg	National authority
Environment and Resources Authority	Malta	National authority
VNG Association of Netherlands Municipalities	Netherlands	Local / regional authority
Ministry of Infrastructure and Water Management	Netherlands	National authority
RIVM	Netherlands	Scientific/ research org.
Environment Agency	Norway	National authority
Norwegian Institute for Air Research	Norway	Scientific / research org.
Polish environmental authorities (joint response)	Poland	National authority
Romanian environmental authorities (joint response)	Romania	National authority
Ministry of Environment	Slovakia	National authority
Ecologistas en Accion	Spain	NGO
Ministry for the Ecological Transition	Spain	National authority
Environmental Protection Agency	Sweden	National authority
IVL Swedish Environmental Research Institute	Sweden	Scientific / research org.
British Heart Foundation	United Kingdom	NGO
Department for Environment, Food and Rural Affairs	United Kingdom	National authority
Greater London Authority	United Kingdom	Local / regional authority
Clean Air London	United Kingdom	NGO
Organisation name	International	Organisation type
Industrial Minerals Association Europe	EU	Industry
EPHA European Public Health Alliance	EU	NGO
CEMBUREAU - European Cement Association	EU	Industry
EUROFER	EU	Industry
ISEE International Society for Environmental Epidemiology	EU	Scientific / research org.
EFANET European Federation of Allergy and Airways Disease Patients' Associations	EU	NGO
CONCAWE	EU	Industry
ClientEarth, EEB, AirClim, HEAL and T&E (joint response)	EU	NGO
European Respiratory Society	EU	Scientific / research org.

Open public consultation

The aim of the open public consultation was to gather views from citizens and stakeholders on general awareness of air quality issues, and opinions on the implementation of AAQ Directives according to five evaluation criteria (relevance, effectiveness, efficiency, coherence and EU added value).

This survey was open to any interested party, including private citizens, companies, civil society organisations, researchers and public authorities. The open public consultation survey was accessible in 23 official EU languages (excluding Irish) and published online from the European Commission's public consultation portal website.²¹⁷ Supporting documentation in any of the EU official languages were also accepted. The public consultation was conducted on EUSurvey from 8 May 2018 to 31 July 2018.

The survey was structured into two parts. The first part focussed on background information about the respondent and general questions on views and concerns of air quality, awareness of the AAQ Directives, and effects of EU policy and legislation on air quality. The second part consisted of specific questions related to the effectiveness, relevance, efficiency, coherence and EU added value of the AAQ Directives. Participants could provide additional statements by uploading submission papers with the survey.

The open public consultation generated a total of 489 responses. The majority (248 responses) of respondents replied as individuals, followed by representatives in the 'Public Administration and Defence sector' (64 responses) and 'Professions, Scientific and Technical Activities' (33 responses). In addition, there were 29 responses representing 'Other Service Activities', which includes activities of professional membership organisations, trade unions, lobbyists and support groups, environmental and ecological groups, etc., with specific interests in issues related to air quality.

Of the 489 responses to the open public consultation, 122 responses identified as replying on behalf of an organisation and provided the name of this organisation. An analysis of this subset showed it to comprise 46 representatives of industry, 52 representatives of NGOs or scientific bodies, and 24 representatives of national, regional or local authorities. An additional 39 responses did not provide the name of this organisation and were thus treated as responses by individuals. A further 22 responses indicated their replies to be from individual in a professional capacity and provided the name of the organisation. The remainder either replied in a personal (248 responses) or professional capacity (58 responses) without providing further details.

Respondents came from 27 of the 28 EU Member States (with no response from stakeholders in Luxembourg) with the largest share from Belgium (102 responses), Germany (81 responses) and Italy (71 responses). The larger share of respondents from Belgium can be explained by a presence of EU-level and industry/civil society entities with headquarters in Brussels, Belgium. Furthermore, the large number of responses from Germany and Italy could be due to a prominence of specific types of industries directly or indirectly impacted by measures to improve air quality (for example, energy production and supply).

²¹⁷ https://ec.europa.eu/info/law/better-regulation/initiatives/ares-2017-3763998/public-consultation_en

As many as 90% of respondents either completely agreed or somewhat agreed with the statement that poor air quality is an issue of concern in Europe. Underlying these concerns were 75% or more who completely agreed that poor quality has negative impacts on individual health, wellbeing of the population, the health of the overall population in the EU and the environment. More than 60% of respondents reported feeling either very well informed or moderately informed about EU clean air policies, the AAQ Directives, or national/regional/local level air quality policy and plans.

Respondents as a whole felt the issue of air quality should be tackled more or less equally at all levels of governments, with a majority of respondents indicating the EU as most appropriate. In thinking about how EU policy and legislation on air quality has helped to improve a number of objectives, the largest share of respondents (60%) agreed either somewhat or completely on the objective of ensuring consistent rules on the levels of air pollution to which citizens were exposed. The weakest level of agreement related to the question regarding the provision of comparable information to citizens on air pollution levels (just under 40%).

The majority of respondents agreed either completely or somewhat that EU policies and legislation have helped prevent deteriorating air quality in Europe (86%), in the respondent's country (82%), and in the respondent's city or region (76%).

Workshops with stakeholders

Two workshops with stakeholders were held, in June 2018²¹⁸ and January 2019.²¹⁹ The purpose of the workshops was to gather evidence, confirm issues for the evaluation, solicit views on the performance and implementation of the AAQ Directives and seek feedback on emerging findings. Participants included representatives from national, regional and local governments in the EU, environmental and other public bodies, business and trade organisations, civil society, international bodies (WHO), academia and the research community.

Ad hoc contributions

During the fitness check, stakeholders made a number of ad hoc contributions to the process. These included a meeting between Commission staff and a port authority, where the port authority emphasised the need to ensure alignment between the AAQ Directives and source legislation and to support effective multi-level governance. An industry stakeholder also provided input in late-2018 in a position paper which noted concerns about the challenges faced by Member States in meeting the limit values from Directive 2008/50/EC and the need for a supporting regulatory framework addressing all relevant emission sources. Following the workshops, a small number of ad hoc contributions were made to the Commission and/or the consultants carrying out the support study:

²¹⁸ https://ec.europa.eu/info/events/stakeholder-workshop-support-fitness-check-eu-ambient-air-quality-directives-2018-jun-18_en

²¹⁹ <http://ec.europa.eu/environment/air/pdf/AAQD%20Fitness%20Check%20-%20Background%20document-%20Stakeholder%20workshop%20final.pdf>

Table A2.3 – Ad Hoc contributions

Organisation name	Member State	Organisation type
WKO Austrian Federal Economic Chamber	Austria	Industry
Veolia	France	Industry
Deutscher Industrie- und Handelskammertag	Germany	Industry
Reine Luft für Wetzlar	Germany	NGOs
Regione Lombardia	Italy	Local / regional authority
Association of Dutch Provinces	Netherlands	Local / regional authority
Randstad Region	Netherlands	Local / regional authority
Port of Rotterdam	Netherlands	Industry
Omgevingsdienst Zuid-Holland Zuid	Netherlands	Local / regional authority
Air Quality Partnership under the Urban Agenda of the EU	EU	Authorities and NGOs
Greater London Authority	United Kingdom	Local / regional authority

Other activities

Other stakeholder consultation activities included a workshop at Green Week 2018²²⁰ and follow-up with individual stakeholders in response to direct inquiries with the fitness check team and/or the consultants carrying out the supporting study. The Green Week session had the purpose to provide a city-level perspective on what works well, and what does not, as regards EU Clean Air policies. In addition, the European Commission’s Ambient Air Quality Expert Group²²¹ was consulted throughout the fitness check.

4. Results of the stakeholder consultation***Relevance***

An overwhelming majority of *open public consultation* respondents agreed either to a large or very large extent that air pollution poses a major concern to public health (94%) and the environment (88%). Respondents considered the following four provisions of the AAQ Directives as the most important in delivering air quality improvements: ‘defining and establishing objectives and common EU standards for ambient air quality’ (95%); ‘assessing air quality on the basis of common measurement and monitoring methods and criteria’ (96%); ‘obtaining accurate information on air quality’ (92%); and ‘maintaining air quality where it is good and improving it in other cases’ (91%). With regard to the limit values for pollutants under the AAQ Directives, respondents mostly felt that standards were set at about the right level for most pollutants, but limits were considered too lenient for particulate matter (PM₁₀ and PM_{2.5}), nitrogen dioxide, and benzo(a)pyrene.

Similar views were echoed at the *stakeholder workshops*. Participants noted that despite air pollution being the fifth most important risk factor for non-communicable diseases, current standards do not fully reflect scientific evidence suggesting health impacts at concentration levels below the current limit values. Particular concern was expressed regarding PM_{2.5}, where stakeholders noted the need for short-term limit values. Others pointed to the limitations of EU legislation in reacting swiftly to evolving knowledge

²²⁰ <http://ec.europa.eu/environment/air/pdf/20180524%20web%20summary%20FC%20session%20Green%20Week.pdf%20>

²²¹ <http://ec.europa.eu/transparency/regexpert/index.cfm?do=groupDetail.groupDetail&groupID=2790>

about pollutants and their effects. In this regard, the need for specific measures on microparticles was mentioned and greater alignment of standards with WHO Guidelines was sought, especially in the case of SO₂, where EU limit values are significantly higher than WHO recommendations. Other comments focused on the need for the air quality legal framework to be adaptable to new approaches to measure air quality, such as citizen science methods, which can help raise awareness but is not suitable for assessing compliance with air quality standards as the of precision of data is lacking.

Box A2.1 – Feedback by stakeholder groups on relevance

Out of the total of 489 responses to the open public consultation, 122 responses identified as replying on behalf of an organisation and provided the name of this organisation.

While a majority of representatives of **industry or business associations** (46 replies in total) agreed that poor air quality is an issue of concern in Europe, three respondents explicitly disagreed. All but one respondent considered all objectives of the AAQ Directives to be either ‘very important’, ‘important’ or ‘moderately important’, and particularly the objective to assess air quality on the basis of common methods and criteria was considered ‘very important’ (31 out of 46 replies). Views on the level of the air quality standards set in the AAQ Directives were mixed: 14 out of 46 considered them ‘too strict’ (especially for nitrogen dioxide and fine particulate matter), 8 considered them ‘too lenient’ (especially for particulate matter), and 21 considered them to be at the appropriate level (and a further 3 left the question unanswered). Four respondents explicitly stressed that no further pollutants should be included in the scope of the AAQ Directives, while several others noted a need to address black carbon and/or ultrafine particles.

Conversely, all but one representatives of **non-government organisations or scientific bodies** (52 replies in total) agreed that poor air quality is an issue of concern in Europe (1 respondent replied to ‘neither disagree nor agree’), and a clear majority even ‘completely agree’ that it had negative impacts on health and on the environment (in both cases 49 out of 52 replies). Most respondents in this group considered all objectives of the AAQ Directives to be ‘very important’, especially common methods and criteria (47 out of 52 replies) and setting air quality standards (45 out of 52 replies); note that the remainder noted both to be ‘important’ still. Having said this, a clear majority considered the level of the air quality standards set in the AAQ Directives to be either ‘far too lenient’ (21 out of 52 replies) or ‘somewhat too lenient’ (23 out of 52 replies): in particular as regards particulate matter, and too a slightly lesser degree also ozone, benzo(a)pyrene, nitrogen dioxide and sulphur dioxide. A majority of this subset of respondents explicitly noted a need to address black carbon, ultrafine particles and/or ammonia as part of the AAQ Directives.

Also, representatives of **national, regional or local authorities** (24 replies in total) in their majority agreed (and mostly ‘completely agree’) that poor air quality is an issue of concern in Europe, with negative impacts on health and on the environment (22 out of 24 responses). This group of respondents too considered all objectives of the AAQ Directives to be ‘very important’, especially common methods and criteria (21 out of 24 replies) and setting air quality standards (22 out of 24 replies). In relative terms, the promoting of increased cooperation across Member States was regards to be the least important objective. Questions about the levels at which the standards were set either rendered concerns about levels being ‘too lenient’ (11 out of 24 replies, especially for particulate matter, but also for nitrogen dioxide), or was saw them to be set at the ‘appropriate level’ (9 out of 24 replies). Only three considered them to be too strict (one referred to nitrogen dioxide, two to ozone, and one to particulate matter and all heavy metals). Half of the replies from this group noted a need to address black carbon and ultrafine particles.

Responses to the *targeted questionnaire* indicated that the AAQ Directives were still relevant and address important citizens' needs. The need to consider regulation of black carbon and ultrafine particles (or nanoparticles) were indicated by 18 of 43 replies each.

Other pollutants mentioned more than once included background levels of ozone, ammonia, pesticides, and polycyclic aromatic hydrocarbons other than benzo(a)pyrene. Some national organisations (5 of 16 respondents to the targeted questionnaire) mentioned pollutants they considered less relevant, in particular sulphur dioxide and carbon monoxide. Most respondents observed that one or more limit values were less strict than WHO Guidelines and should approach them (23 of 43 respondents), in particular for PM₁₀ and PM_{2.5}, but also SO₂, O₃, and BaP. Several mentioned the need for 24-hour limit value for PM_{2.5}, and information and alert thresholds for PM₁₀ and PM_{2.5}. Replies from industry and industry associations (4 of 5 respondents), however, indicated that they considered current limit values sufficient or too stringent.

Effectiveness

In general, respondents from the *open public consultation* perceived the AAQ Directives to be effective in achieving their objectives. Most respondents agreed either completely or somewhat that standards are well-established (71%), monitoring is in place (61%), and information is being made available (61%). There was less agreement in respect to the objective of taking coherent action to avoid, prevent or reduce the effect of poor air quality, with only 45% of respondents indicating that they completely or somewhat agreed that the Directives have been effective. More than half (58%) of the respondents agreed that sufficient criteria are defined at the EU level for monitoring and assessment, and that the measurement techniques are sufficiently standardised across the MS (46%). However, respondents were more likely to disagree that there are sufficient sampling points and measurements to assess air quality (52%). Finally, 88% of open public consultation respondents believed that monitoring and reporting regimes under the AAQ Directives has helped deliver reliable, accurate and comparable air quality information across the EU to a very large or large extent.

Similar findings were echoed in the *stakeholder workshops*, with participants identifying several factors that may limit the effectiveness of air quality objectives. Representatives from national authorities and NGOs raised the issues of widespread exceedances of air quality standards as an issue limiting the effectiveness of the Directives. Comments from NGOs and local and regional governments also focused on the lack of clear provisions and guidance on modelling. NGOs in particular also raised the issue of unclear distribution of responsibilities within Member States for the implementation of air quality plans which contributes to reduced effectiveness of the Directives. National officials emphasised that more attention should be given to measuring emissions in areas where vulnerable populations are present, with consideration given to applying more stringent limit values in these areas. A number of comments were raised by representatives of authorities, industry and NGOs on the siting of monitoring stations: some stakeholders suggested the AAQ Directives' criteria on siting is too flexible, while some suggested that it was too restrictive. Participants also acknowledged that the AAQ Directives facilitated air quality improvements.

Concerning the *targeted questionnaire*, 35 of the 43 respondents had provided contributions and examples on effectiveness, and 26 of these provided a quantitative estimate on their perceptions regarding the effectiveness of the AAQ Directives. Most commonly mentioned positive examples included that common methods for measuring and assessing air quality established by the AAQ Directives allow for comparison of information between different cities and countries in Europe, that provisions for fixed measurements are clear and detailed, that the Directives have encouraged availability of reliable and comparable data, that mandatory air quality standards has been a driving

force for Member States to ensure that the necessary policies and measures are put in place, that the AAQ Directives provisions on information availability, monitoring and reporting have facilitated public awareness and that AAQ Directives have contributed to maintaining or improving air quality. References were also made to the difficulties due the room for interpretation in the AAQ Directives regarding criteria for siting of stations. In terms of shortcomings, the respondents also pointed to continued exceedances, ongoing enforcement action, and action plans or measures considered ineffective (in particular by national authorities and NGOs).

Box A2.2 – Feedback by stakeholder groups on effectiveness

Out of the total of 489 responses to the open public consultation, 122 responses identified as replying on behalf of an organisation and provided the name of this organisation.

A large majority of representatives of **industry or business associations** (46 replies in total) agreed that the AAQ Directives have been effective in ensuring a representative, high quality monitoring and assessment of air quality (38 out of 46 ‘agree’, 10 of which ‘completely agree’), in establishing clean air quality standards (40 out of 46 ‘agree’, 28 of which ‘completely agree’), and ensuring relevant information is made available (39 out of 46 ‘agree’, 20 of which ‘completely agree’). This overall positive view also included that there are sufficient criteria for monitoring provided by the AAQ Directives (36 out of 46 ‘agree’) and that sampling point monitor both the highest exceedance (27 out of 46 ‘agree’, while 7 out of 46 ‘disagree’). and general exposure well (25 out of 46 ‘agree’, while 9 out of 46 ‘disagree’). Views were slightly less positive on whether they were effective in achieving coherent action to avoid, prevent or reduce poor air quality: 8 out of 46 ‘disagree’, while 21 out of 46 ‘agree’.

Representatives of **non-government organisations or scientific bodies** (52 replies in total) offered a slightly less positive view on the effectiveness of the AAQ Directives in ensuring representative, high quality monitoring and assessment of air quality (30 out of 52 ‘agree’, while 12 out of 52 ‘disagree’). Even if a majority of replies considered the criteria for monitoring provided by the AAQ Directives to be sufficient (29 out 52 ‘agree’), concerns were expressed by this group as to whether there are sufficient sampling points (41 out of 52 ‘disagree’) and whether the current network is representative of the highest pollution exposure (41 out of 52 ‘disagree’). Conversely, this group strongly agreed on the effectiveness of setting air quality standards (41 out 52 ‘agree’, 33 of which ‘completely agree’), and ensuring relevant information is made available (33 out of 52 ‘agree’). Views on the effectiveness in achieving coherent action to avoid, prevent or reduce poor air quality were split: 27 out of 52 ‘agree’ versus 18 out of 52 ‘disagree’. In particular, 32 out of 52 saw coordination across governance levels to have contributed ‘very little’ or ‘not at all’. Finally, it is worth noting that 18 out of 52 replies considered access to justice via national court cases to have contributed to a ‘large extent’ or a ‘very large extent’ to better air quality.

Also, representatives of **national, regional or local authorities** (24 replies in total) were overwhelmingly positive as regards the effectiveness of the AAQ Directives in ensuring a representative, high quality monitoring and assessment of air quality (21 out of 24 ‘agree’), in establishing clean air quality standards (24 out of 24 ‘agree’), and ensuring relevant information is made available (21 out of 24 ‘agree’). Public authorities also expressed satisfaction that the criteria for sampling points being sufficient, measurement techniques are sufficiently harmonised and that sampling points are representative of general population exposure (19 out of 24 ‘agree’ with each of the three statements). And a clear majority of this group agreed that the AAQ Directives had been effective in achieving coherent action to avoid, prevent or reduce poor air quality (17 out of 24 ‘agree’, while 3 out of 24 ‘disagree’), and resulted in effective air quality plans and/or measures (19 out of 24 noted they did to a ‘large extent’ or a ‘very large extent’). This group also, more than other groups, considered enforcement action by the Commission to be a key factor.

Efficiency

A relative majority of *open public consultation* respondents believed that AAQ Directives have delivered significant benefits to a large or very large extent for protecting human health (42%) and the environment (39%). The sectors considered to provide the most sectoral benefits of the implementation of the AAQ Directives were innovative industries (all sectors) (58%), healthcare (48%), competent public authorities (43%), transport (personal mobility service providers) (40%) and energy providers (40%). While

the sectors considered to have benefitted the least from implementation of the AAQ Directives were transport (logistic service providers) (24%), agriculture sector (24%), waste sector (22%), and construction (22%). Just over half of the respondents indicated that they agree with the view that the transport sector (including mobility and logistic service providers) had borne costs to comply with the AAQ Directives. Also manufacturing industries (47%) and energy producers (46%) were most frequently identified as bearing the costs, along with the competent public authorities (37%).

Box A2.3 – Feedback by stakeholder groups on efficiency

Out of the total of 489 responses to the open public consultation, 122 responses identified as replying on behalf of an organisation and provided the name of this organisation.

A large majority of representatives of **industry or business associations** (46 replies in total) agreed that the costs from abatement measures taken to comply with the AAQ Directives have been significant (32 out of 46, 26 of which ‘completely agree’). Respondents from different sectors of industry indicated that their respective sectors had borne significant costs, i.e. especially from the manufacturing sector (11 out of 12 replies ‘agree’), from the energy sector (10 out of 12 replies ‘agree’), and from the construction sector (6 out of 6 ‘agree’), but slightly less so from the transport service sector (4 out of 8 replies ‘agree’). A majority of respondent from this stakeholder group also agreed that other costs of implementation were significant, such as monitoring equipment (31 out of 46 ‘agree’) or preparation of air quality plans (26 out of 46 ‘agree’). At the same time this stakeholder group also pointed to some sectors that benefitted from the implementation of the AAQ Directive, especially innovative industries and mobility services.

Representatives of **national, regional or local authorities** (24 replies in total) also pointed to significant costs from abatement measures taken to comply with the AAQ Directives (20 out of 24 ‘agree’). Similarly more than half of the authorities that replied agreed that the monitoring equipment, administrative costs for reporting and preparation of air quality plans (18, 17, 16 out of 24 replies, respectively) led to significant costs: and noted that related costs have been primarily borne by local (20 out of 24 ‘agree’), regional (19 out of 24 ‘agree’) and national (13 out of 24 ‘agree’) authorities. Public authorities at all levels expressed overwhelming agreement that all segments of society had benefitted from the implementation of the AAQ Directives: all citizens (22 out of 24 ‘agree’), both in urban areas (22 out of 24 ‘agree’) and rural areas (16 out of 24 ‘agree’), as well as particularly vulnerable population groups (21 out of 24 ‘agree’).

In contrast to the above, representatives of **non-government organisations or scientific bodies** (52 replies in total) disagreed that the costs from abatement measures taken to comply with the AAQ Directives have been significant (30 out of 52 ‘disagree’, 25 of which ‘completely disagree’). Furthermore, a majority of respondents from this group disagreed that the monitoring equipment, administrative costs for reporting or other tasks associated with the AAQ Directives have led to significant costs. This group also expressed the view that the implementation of the AAQ Directives had benefitted all citizens (39 out of 52 ‘agree’) and especially citizens in urban areas (38 out of 52 ‘agree’), as well as a range of industries (with most agreement for innovative industries, the healthcare sector, mobility services and energy providers).

The comments in the *stakeholder workshops* focused on how to quantify the costs of measures taken to improve air quality in line with the limit values from the AAQ Directives, and quantifying benefits other than health benefits. Specifically, the costs of air quality measures were viewed as being more important than those of complying with other requirements from the AAQ Directives (e.g. costs of establishing monitoring networks, administrative costs such as reporting, etc). Participants suggested developing a common methodology to quantify the costs of air pollution not only to health but also to agriculture and ecosystems, as this would help to show the value of addressing air

pollution. Others pointed to the difficulty in attributing costs (and benefits) of improved air quality to the AAQ Directives, due to the interactions between the AAQ Directives and other policy interventions, e.g. in sectors such as transport. Finally, it was also noted that the majority of action plans do not have a cost-effectiveness analysis despite there being many low-cost measures available at the local level.

The evaluation of efficiency much benefitted from the input of evidence via the *targeted questionnaire*, which included questions focused on the administrative costs and burdens associated with the AAQ Directives. In addition to providing data, questionnaire respondents commented on the challenges of quantifying the costs and benefits associated with the AAQ Directives. While national authorities provided significant useful information, they also commented on the data limitations. NGOs were significantly more likely to express concerns about the costs of non-implementation than other respondents. Responses by local authorities tended to stress that they bear a disproportionate share of the costs of implementing measures needed to ensure compliance with the AAQ Directives. Industry stakeholders provided very little comment on the topic of efficiency.

Coherence

Respondents to the *open public consultation* considered the National Emissions Ceiling Directive to be strongly coherent with the AAQ Directives, with 70% indicating that it either supports or strongly supports the implementation of AAQ Directives. Also the coherence with the Industrial Emissions Directive (71%) was rated highly. On coherence with other EU policies, open public consultation respondents believed that the AAQ Directives support the EU Energy Union and Climate (low-emission mobility), the Energy Union and Climate (climate policy), the Energy Union and Climate (Energy policy) and Research and Innovation (Horizon 2020). In regard to policies/legislations aimed at reducing emissions from specific sources, the highest proportion of respondents saw coherence with the emission standards for heavy goods vehicles (73%) and emission standards for cars and vans (70%). The common agricultural policy, on the other hand, was deemed to hamper implementation of the AAQ Directives. Also a significant number of respondents in the open public consultation felt the EU Emissions Trading Scheme hampered the implementation of the AAQ Directives (17%). As regards the coherence with planning efforts at the national, regional and local levels, respondents felt that the objectives of the AAQ Directives were not coherently addressed in a number of national policies, notably, taxation policy, public procurement policy, urban development policy and industrial policy.

Stakeholder workshop participants highlighted several areas where there is a lack of internal coherence between the AAQ Directives. In addition, participants across all stakeholder groups expressed concerns about the coherence between air quality goals and transport, energy and climate policy. On the issue of vehicle emission limits, a representative of a regional authority noted the EU should consider adopting requirements applying to existing cars. According to stakeholder comments at the workshops, Member States have struggled to meet air quality standards due to weaknesses in the EU legal framework for vehicle emissions. Concerns about the coherence with agricultural and biomass related policies were raised in the workshops with a representative of a national NGO noting EU funding schemes such as those promoting biomass and the common agricultural policy supporting various measures that increase air pollution. These have in turn made it difficult to obtain EU funding mechanisms that support actions for air quality at national level – including under the

CAP's rural development funding. It also worth noting that in the workshop, a representative of a government health institute noted that permitting and spatial planning decisions in their Member State do consider whether new activities are aligned with air quality limit values, but this is not the case across the EU.

Box A2.4 – Feedback by stakeholder groups on coherence

Out of the total of 489 responses to the open public consultation, 122 responses identified as replying on behalf of an organisation and provided the name of this organisation.

Representatives of **industry or business associations** (46 replies in total) agreed that the NEC Directive supports the implementation of the AAQ Directives (40 out of 46 replies, of these 17 replies indicated 'strongly support'). Stakeholders from this group in particular noted that the AAQ Directives were supported by the Industrial Emission Directive and Medium Combustion Plans (in both cases: 38 out of 46 noted 'support', more than half of which even noted 'strongly support'). Only for four policies, 7 or more out of the 46 replies (i.e. 15% or more) indicated that the implementation of the AAQ Directives is hampered by other legislation, namely for Emission Standards ("Euro") for cars and vans (10 replies), CO₂ emissions performance standards for new cars and vans (10 replies), the EU Emissions Trading Directive (7 replies), and the Energy Taxation Directive (7 replies). But even for these policies more respondents considered these policies to be of 'support' rather than 'hamper' the implementation of the AAQ Directives.

Representatives of **non-government organisations or scientific bodies** (52 replies in total) agreed that the NEC Directive supports the implementation of the AAQ Directives (42 out of 52 replies, of these 30 replies indicated 'strongly support', this is the highest proportion of the three stakeholder groups analysed). Respondents from this group were particular positive about the support of most policies to the implementation of the AAQ Directives, including Energy Union and Climate (39 replies), Emission Standards ("Euro") both for cars and vans, and for trucks (each 39 replies), Emission Standards for Non-Road Mobile Machinery (34 replies), the Fuel Quality Directive (36 replies), the Directive on Sulphur Content of certain liquid fuels (33 replies), the Industrial Emissions Directive (35 replies), the Medium Combustion Plants Directive (36 replies), as well as funding via Horizon 2020 (35 replies) or the LIFE Programme (30 replies). Conversely, a relative majority of this group explicitly indicated that the implementation of the AAQ Directives is hampered by the common agriculture policy (27 replies indicated 'hamper' or 'strongly hamper', versus only 3 replies that indicated they 'support' the implementation of the AAQ Directives) and by the Trans-European Networks-Transport / Connecting Europe Facility (20 replies indicated 'hamper' versus 6 replies that indicated they 'support' AAQ Directives implementation).

Representatives of **national, regional or local authorities** (24 replies in total) agreed that the NEC Directive supports the implementation of the AAQ Directives (19 out of 24 replies, 11 of which indicated 'strongly support'). Feedback indicated that respondents from this group generally considered other policies to be of 'support' rather than 'hamper' the implementation of the AAQ Directives. Only for 3 policies a significant subset of 4 or more out of the 24 replies (i.e. 15% or more) indicated that the implementation of the AAQ Directives is hampered by other legislation, namely for the common agriculture policy (4 replies), 'Emission Standards ("Euro") for cars and vans (4 replies), and CO₂ emissions performance standards for new cars and vans (4 replies).

In responses to the *targeted questionnaire*, a number of respondents commented on issues relating to the internal coherence of the AAQ Directives (for example as regards consistent approaches in setting limit values, consistency in the requirements of siting of monitoring stations, coherence of alert thresholds). Comments on the coherence of the AAQ Directives with other sectoral policy areas were very much focused on transport, with 21 out of 43 respondents specifically commenting on this. Many of these responses focused on climate measures taken in the transport sector, usually at the national or local

level, to reduce greenhouse gas emissions and were concerned with the potential for such measures to undermine air quality. Other comments on sectoral policy focused on the treatment of biomass under the Renewable Energy Directive (this was mentioned in particular by government authorities), emissions standards for boilers under the Ecodesign Directive, and emissions from agricultural activities. Of the small number of industry respondents, most (4 out of 5) emphasised the need to ensure coherence between the AAQ Directives and other legislation relevant to air quality, notably the National Emission Ceilings Directive and the Industrial Emissions Directives – two commented that air quality standards should be informed by what is feasible within the framework of the Industrial Emissions Directive.

EU added value

Open public consultation respondents were generally positive about the added value of the AAQ Directives. On the one hand, just over 50% felt that the influence of the AAQ Directives had been strongest in increasing public awareness of air quality. On the other hand, a significant share (37%) of respondents believed the implementation of AAQ Directives had very little or no effect on the positive coordination at different governance levels within the respondents' countries. A significant majority of respondents also agreed that EU level legislation is necessary to improve air quality at national, regional and local level (94%), as well as to address transboundary air pollution across different Member States (91%). In addition, the majority (54%) disagreed that national legislation could have achieved the same results as the Air Quality Directives in reducing air pollution. Most respondents (56%) agreed that EU enforcement capacity (e.g. infringement procedures), reporting and monitoring coordination by the European Environment Agency (52%) and establishment of supporting networks (41%) were key factors in making the AAQ Directives more effective than national legislation alone.

Comments from the *stakeholder workshops* focused on areas where the AAQ Directives were considered to be more effective than national legislation alone. For example, a representative from an NGO emphasised the importance of Article 23 of Directive 2008/50/EC, which introduced the obligation to adopt air quality plans to keep exceedances of air quality standards as short as possible, and as a result provided EU added value driving local and national action for air quality. However, the same NGO noted that Annex XV of the same Directive is not sufficiently clear in relation to public participation and that AAQ Directives do not provide explicit access to justice for challenging authorities in court when air quality standards are breached.

Overall, the respondents to the *targeted questionnaire* commented on a number of aspects of EU added value of the AAQ Directives, including amongst others the added value brought by the introduction of common air quality standards, the requirements for monitoring and assessment, the requirements for setting up air quality plans. Most commonly mentioned the added value of the AAQ Directives was in terms of common air quality standards (16 respondents covering national authorities, local and regional authorities, NGOs, scientific or research organisations, industry), monitoring and assessment (8 respondents covering national authorities, local and regional authorities, NGOs), air quality plans (7 respondents covering national authorities, NGOs), information and awareness raising (6 respondents covering national authorities, NGOs).

Box A2.5 – Feedback by stakeholder groups on EU Added Value

Out of the total of 489 responses to the open public consultation, 122 responses identified as replying on behalf of an organisation and provided the name of this organisation. Across all three groups an overwhelming majority agreed that EU level legislation is necessary to improve air quality at national, regional and/or local level (117 out of 122 replies ‘agree’) and that the AAQ Directives are necessary to address transboundary air pollution (111 out of 122 replies ‘agree’).

Representatives of **national, regional or local authorities** (24 replies in total) had mixed views about whether national legislation could have achieved the same results as the AAQ Directives in reducing air pollution (9 out of 24 ‘agree’, versus 10 out of 24 ‘disagree’). A majority of this group, however, still acknowledged to a ‘large extent’ or ‘very large extent’ that the implementation of the AAQ Directives had resulted in positive change at local and/or regional level (21 out of 24 replies), as well as to a lesser degree at national level (17 out of 24 replies). Also this group noted that the AAQ Directives had been more effective than national legislation alone especially in the context of reporting and monitoring coordination by the European Environment Agency (19 out of 24 replies indicated this to be the case to ‘large extent’ or ‘very large extent’). The establishment of supporting networks (such as AQUILA or FAIRMODE) received similar large positive feedback. Finally, this group indicated that EU enforcement capacity, including through infringement procedures had made the AAQ Directives more effective than national legislation alone (20 out of 24 replies indicated this to be the case to a ‘large extent’ or ‘very large extent’).

Also representatives of **industry or business associations** (46 replies in total) had mixed views about whether national legislation could have achieved the same results as the AAQ Directives in reducing air pollution (21 out of 46 ‘agree’, versus 14 out of 46 ‘disagree’). They noted that the implementation of the AAQ Directives has resulted to ‘large extent’ or ‘very large extent’ in increased enforcement action at EU level (24 out of 46 replies) as well as at national level (20 out of 46 replies). Respondents from this group were less positive than other groups about the AAQ Directives having resulted in effective coordination between Member States (9 out of 46 felt that it did versus 7 out of 46 felt it did not, while 21 out of 46 opted for the middle ground reply).

A clear majority of **non-government organisations or scientific bodies** (52 replies in total) disagreed with the statement that national legislation could have achieved the same results as the AAQ Directives in reducing air pollution (37 out of 52 ‘disagree’). This group too noted the implementation of the AAQ Directives has resulted to ‘large extent’ or ‘very large extent’ in increased enforcement action at EU level (31 out of 52 replies) as well as at national level (22 out of 52 replies). They explicitly noted that EU enforcement capacity, including through infringement procedures, was more effective than national legislation alone (36 out of 52 agreed, of 28 to a ‘very large extent’, plus 8 to ‘a large extent’). Also, respondents from this group was particularly critical of the mechanisms in place to promote coordinated action in implementing the AAQ Directives between different levels of government (30 out of 52 replies) and between different ministries (34 out of 52 replies) in their respective Member States.

Fitness for purpose of the AAQ Directives as a whole

Open public consultation respondents were mixed in their views on the AAQ Directives being fit for purpose on protecting citizen's health and the environment from the harmful effects of air pollution. Some 25% answered 'yes' in addition to 22% who answered 'no', while a notable proportion (35%) did not answer and 17% were neutral. The reasons provided in support of the AAQ Directives being fit for purpose ranged from contributions in terms of increased awareness of air pollution, positive impacts on transboundary air pollution, contributions to improvements in health and better protection of the environment. Other respondents believed air quality would be worse in Europe without the AAQ Directives, and that they had set clear and binding objectives and defined Member State responsibilities.

Similarly, a significant share of *open public consultation* respondents (93 respondents) that described the AAQ Directives as not being fit for purpose, did so noting that they were not being strict enough. Of those, a notable share (45 respondents) mentioned the WHO Guidelines and the fact that the limits set in the Directives are lower than those recommended by the WHO. This comment was also raised by NGO representatives in the *stakeholder workshops* who called for better alignment with WHO Guidelines.

Generally, there was agreement that the AAQ Directives brought added value amongst stakeholders that commented on this issue (national authorities, local and regional authorities, NGOs, scientific or research organisations, industry). Differences in views were most notable when it comes to the added value of air quality standards and (legal) action taken by the European Commission. More specifically, while national authorities, local and regional authorities, NGOs and scientific organisations broadly commended the added value of the AAQ Directives in setting air quality standards and incentivising (legal) action which led to improvements in pollution levels, one industry representative raised concerns about EU infringement procedures and the fact that these were causing 'politically motivated (unrealistic and not science-based) measures'. Another notable aspect raised by one respondent (local authority) was related to the clarity of allocations of responsibilities between and across different levels of governance at national level.

5. Inclusion of the consultation results in the support study

Contributions made by stakeholders during the consultation activities have been an important input into the study supporting the fitness check. All stakeholder contributions have been analysed by the consultants and taken into account in evaluation of each criterion in the support study to the extent possible.

In general, the stakeholder comments broadly support the conclusion that the AAQ Directives continue to be relevant, are effective, efficient, coherent and bring EU added value; nonetheless, there are issues that require attention.

Annex 3: Methods and analytical models

This annex provides background to the support study design and how the more detailed evaluation subquestions addressed in the support study relate to the six evaluation questions presented in this Staff Working Document. This annex also provides a typology of costs and benefits, as well as the methods and analytical models applied to this exercise, and the limitations these carry.

1. Support study – ten evaluation sub-question

This fitness check was guided by a *Roadmap*²²² that outlined issues, looking in particular at the five evaluation criteria outlined in the Better Regulation agenda. This translated into five overarching evaluation questions, one each looking at the criteria of relevance, effectiveness, coherence and EU added value. A sixth evaluation question specifically looked at the effectiveness and efficiency of air quality monitoring.

To inform the responses to these six evaluation questions a separate support study analysed a total of ten more detailed evaluation sub-questions which were derived from the above. These ten more detailed evaluation sub-questions address the same criteria, but do so from different angles, also to allow cross-checks and further scrutiny in the support study that cannot be replicated in this Staff Working Document.

The support study also details the judgement criteria and indicators used to guide the analysis of the ten more detailed evaluation sub-questions. For the responses provided in this Staff Working Document the evidence collated under these evaluation (sub-) questions have been re-aggregated guided by Table A3.1.

Table A3.1 – Mapping the six evaluation questions of this SWD against the ten evaluation sub-questions addressed via the support study.

Criterion	Evaluation question (SWD)	Evaluation sub-question (support study)
Relevance	(1) Do the AAQ Directives still set appropriate objectives, address the most pressing air pollutants, and set meaningful standards to protect human health and ecosystems in accordance with evolving scientific understanding?	EQ1 - How relevant are the goals and objectives of the AAQ Directives to the needs of citizens; do the AAQ Directives still address the most relevant pollutants and set relevant standards and obligations to protect human health and the environment; are the AAQ Directives sufficiently adapted or adaptable to evolving technical and scientific progress, and which elements have become redundant in the light of key EU air quality priorities?

²²² https://ec.europa.eu/info/law/better-regulation/initiatives/ares-2017-3763998_en

Criterion	Evaluation question (SWD)	Evaluation sub-question (support study)
Effectiveness	(2) To what degree have the AAQ Directives acted as an incentive to implement effective measures to improve air quality, reach the EU air quality standards and thus reduce the adverse impacts of air pollution?	EQ2 - What factors have contributed to meeting the objectives of the AAQD or to failing to meet these objectives, in terms of: 1) defining common methods to monitor and assess air quality; 2) assessing ambient air quality in order to monitor trends; 3) establishing standards of air quality to achieve across the EU; 4) ensuring that information on air quality is made public; 5) maintaining good air quality, improving it where it is not good; to what level can these factors be attributed to provisions of the AAQ Directives?
Effectiveness and efficiency of air quality monitoring	(3) To what degree are the monitoring and reporting approaches mandated by the AAQ Directives (and their respective implementation) fit for purpose?	EQ3 - How efficient are monitoring, reporting and assessment regimes, what are the administrative costs to the Member States and to the Commission; taking account of the objectives and benefits of the directives is there evidence that they have caused unnecessary or excessive administrative burden?
		EQ4 - Where there are significant cost differences between Member States and/or between different sectors and/or as regards costs to stakeholders (including social costs as a consequences of poor implementation), what is causing them; and are the costs of compliance proportionate to the benefits brought by the directives?
Efficiency	(4) To what degree do the benefits of improved air quality justify the costs of improving air quality? Are there significant differences in costs (or benefits) between Member States, and if so, what is causing them?	EQ5 - What are the costs and benefits (monetary and non-monetary) associated with implementation of the AAQ Directives in the Member States, and in the EU; have the benefits (improved air quality) been achieved in a cost-effective manner and to what extent have costs been equitably distributed across different sectors?
		EQ6 - Has the implementation of the AAQ Directives supported or hampered EU competitiveness in the global economy; has the implementation of the AAQ Directives improved or been detrimental to economic, social and environmental sustainability?
		EQ7 - To what extent do the AAQ Directives complement or interact with other environmental policies that affect air quality, or that are affected by it, at EU level and at Member State level (such as the NEC Directive and IED Directive as well as EU climate legislation and policy); and how do these policies and legislation support or hamper the implementation of the EU air quality legislation?
Coherence	(5) Are the AAQ Directives coherent internally, with other EU Clean Air policies, with other EU legislation (e.g. on transport, energy, agriculture or nature protection), and with international commitments?	EQ8 - To what extent do the AAQ Directives complement or interact with sectoral policies that affect air quality, or that are affected by it, at EU level and at Member State level (such as energy, transport, agriculture, cohesion, fiscal policies); and how do these policies support or hamper the implementation of the EU air quality legislation?
		EQ9 - To which degree have the AAQ Directives, including common EU air quality standards and comparable air quality assessment, management and
EU added value	(6) To what degree have common EU air quality	EQ9 - To which degree have the AAQ Directives, including common EU air quality standards and comparable air quality assessment, management and

Criterion	Evaluation question (SWD)	Evaluation sub-question (support study)
	standards and comparable monitoring, reporting and assessment regimes enabled Member States to take successful action beyond what would have been possible without EU action?	information approaches enabled Member States and their competent authorities to take successful action to improve beyond what would have been possible without EU action?
		EQ10 -What has been the EU added value of the AAQ Directives, do the Directives and their means of implementation create synergies or overlaps with other Community objectives, and how has the distribution of responsibilities between EU, Member State, regional and local level impacted on air quality management?

2. Typology of costs and benefits²²³

In this fitness check, the following types of costs of the AAQ Directives have been distinguished:

Administrative costs and administrative burdens. Administrative costs result directly from fulfilling the Directives' requirements linked to monitoring and reporting activities. In line with Commission Better Regulation Toolbox, costs incurred by public authorities in meeting legal obligations to provide information (including reporting, monitoring and assessment needed to provide the information) are administrative costs. These costs can be referred to as the direct costs of the AAQ Directives, as they directly results from the requirements set in the Directives.

Note that administrative burdens are a sub-set of the administrative costs, as they stem from the part of the information gathering process which is done solely because of a legal obligation. Part of the information gathering would be done even in the absence of a legislation: some air quality monitoring was done even before the entry into force of the AAQ Directives – this is referred to as business-as-usual administrative costs. The fitness check distinguishes, to the extent the information is available from Member States, between administrative costs and administrative burdens.

Costs of the measures implemented in order to reduce emissions and therefore exposure to air pollutants and, indirectly, to fulfil the air quality standards. These measures and their associated costs are presented in the Support Study, Appendix F. These costs can be referred to as the indirect costs of the AAQ Directives, as they result from actions that are not directly required by the Directives but needed in order to fulfil the standards set in the legislation.

²²³ Support study informing this Fitness Check, Appendix F.

3. Modelling approach

In the analysis undertaken for assessing the efficiency of the AAQ Directives, modelling was used to provide quantitative estimates of both the health benefits brought by the implementation of the Directives and the social cost of their poor implementation (foregone benefits). For these two aspects of the analysis, the same modelling method was used, which is described below and in more extent in the Appendix F to the Support Study.

The model used is ALPHA-RiskPoll (ARP), developed by EMRC specifically for air policy scenarios assessment. The model is privately owned, though all technical details are public.²²⁴ The model has been used for several air policy analysis, by the European Commission, the EEA, the OECD, while specific national versions of the model are used in France and Sweden.

The model is structured around a logical and sequential impact pathway, going from pollution exposure to health benefits assessment. It can be applied at any scale for which exposure (population x concentration) data are available. The main external inputs to the model are therefore pollution concentration data, derived either from monitoring or from other models (e.g. CHIMERE).

The model uses response functions for health impact that follow the recommendations of the HRAPIE²²⁵ study carried out by WHO-Europe on behalf of the European Commission. Background data on incidence and prevalence of healthy conditions come from WHO sources. The model assesses health impacts through mortality (premature deaths) and morbidity effects (such as hospital admissions, incidence of bronchitis, lost work days).

The model has been extensively reviewed and debated since its development and it has been used extensively to provide benefits assessment of air policies,²²⁶ alongside the cost-effectiveness analysis of the GAINS model.

The modelling steps followed for both the estimation of the social costs of poor implementation of the AAQ Directives and the health benefits they have brought are the following (for each year between 2008 and 2016):

²²⁴ http://www.ec4macs.eu/content/report/EC4MACS_Publications/MR_Final%20in%20pdf/Alpha_Methodologies_Final.pdf

²²⁵ Health Response to Air Pollutants in Europe:
http://www.euro.who.int/_data/assets/pdf_file/0017/234026/e96933.pdf?ua=1

²²⁶ http://www.ec4macs.eu/content/report/EC4MACS_Publications/MR_Final%20in%20pdf/Alpha_Methodologies_Final.pdf

Steps	Sources and potential limitations
1. Identify the fraction of the population living in areas where concentrations of pollutants most widely exceeded (PM ₁₀ , NO ₂ , O ₃) are above the AAQ Directives limit values.	EEA data for each year (2008 to 2016)
2. Quantify extent of exceedance above limit values in each year to quantify: a) Reduction in exposure since 2008 for benefit estimates b) Residual excess exposure in each year for quantification of social costs of poor implementation	Quantification of exposure is reliant, for both quantification of benefits and costs of poor implementation, on the EEA's frequency distribution of exposure (see Support Study Appendix F). Based on this distribution, calculations are based on a change in average exceedance with benefits counted only for the population that has moved from exceedance to non-exceedance.
3. Attribute reduction in exposure to the AAQ Directives	Assumptions are made on this point, see section below on limitations and Support Study Appendix F1.7.
4. Quantify health impacts	HRAPIE recommendations and associated data as described in 2014 report on implementation of HRAPIE for the earlier review of the Thematic Strategy on Air Pollution.
5. Value health impacts	Uses same values as adopted for the review of the Thematic Strategy on Air Pollution.

4. Potential bias in the modelling, limitations:

There are several factors biasing the modelling results towards under-estimation of the AAQ Directives benefits:

- The benefits captured in the modelling only include health benefits, omitting benefits to natural ecosystems, agriculture, forestry and materials, which can be substantial.
- Not all health benefits are captured in the modelling. For instance, the effects of air pollution on mental health are not accounted for (even if there is growing evidence of those).²²⁷
- Benefits of reduced exposure are not limited to the area of exceedance as there is a spill over into surrounding areas. These additional benefits are not accounted for in the modelling.
- Benefits of reducing exposure do not cease once the limit values are reached but will grow as emissions are further reduced and / or kept below the standards, as required by the Directive requirement to maintain air quality when it is good. These are not accounted for in the modelling.

²²⁷ See for instance Psychiatry Research, vol.272, Feb 2019, p. 8-17.

- On the other hand, benefits of reduced exposure occur when the exceedance diminishes even when remaining above the standards, and this is not considered in the modelling.
- Possible co-benefits associated with air quality measures on other policy areas (in particular in transport and climate policies) are not accounted for.

These under-estimation bias are very likely to be much higher than the identified potential over-estimation bias, which relate to the following limitations in the modelling:

- the change in exposure also includes some effects of other pieces of legislation (e.g. Industrial Emission Directive, Euro Standards for vehicles) which were impossible to disentangle from the AAQ Directives effects. However, in many cases, at least part of the motivation to implement these other pieces of legislation is in response to the AAQ Directives, and thus the benefit achieved via these other legislation might also be (partially) attributed to the AAQ Directives.

It is therefore important to recognise that there are some uncertainties in the modelling results and that they should serve for broad order of magnitude but should definitely not be regarded as precise estimates.

Annex 4: Historical overview of air quality policy

The first European directives on air quality were adopted in the 1980s to establish limit and guide values for concentrations of a limited number of pollutants.

First generation of directives on air quality

Council Directive 80/779/EEC of 15 July 1980 on air quality limit values and guide values for sulphur dioxide and suspended particulates

Council Directive 85/203/EEC of 7 March 1985 on air quality standards for nitrogen dioxide

The experience in implementing the first directives showed that air quality assessment was incomplete, that the data on measurements were not comparable and that information provided to the public was insufficient. In 1996, a new Framework Directive was adopted. It established a first comprehensive legal framework for air quality assessment, management and setting of air quality standards. It was progressively put into operation via its daughter directives, dealing with different (sets of) pollutants.

Air Quality Framework Directive and its Daughter Directives

Council Directive 96/62/EC on ambient air quality assessment and management (**Air Quality Framework Directive**)

Council Directive 1999/30/EC relating to limit values for sulphur dioxide, nitrogen dioxide and oxides of nitrogen, particulate matter and lead in ambient air (**First Daughter Directive**)

Directive 2000/69/EC of the European Parliament and of the Council relating to limit values for benzene and carbon monoxide in ambient air (**Second Daughter Directive**)

Directive 2002/3/EC of the European Parliament and of the Council relating to ozone in ambient air (**Third Daughter Directive**)

Directive 2004/107/EC of the European Parliament and of the Council relating to arsenic, cadmium, mercury, nickel and polycyclic aromatic hydrocarbons in ambient air (**Fourth Daughter Directive**)

In addition:

Council Decision 97/101/EC establishing a reciprocal exchange of information and data from networks and individual stations measuring ambient air pollution within the Member States (EoI Decision)

Commission Decision 2004/461/EC laying down a questionnaire for annual reporting on ambient air quality assessment under Council Directives 96/62/EC and 1999/30/EC and under Directives 2000/69/EC and 2002/3/EC

Commission Decision 2004/224/EC laying down the obligation of Member States to submit within two years so-called Plans and Programmes for those air quality zones where certain assessment thresholds set in the Directives are exceeded

In 2005, under the 6th Environment Action Plan, the Commission adopted the Thematic Strategy on air pollution.²²⁸ It established targets for 2020 in terms of reductions of exposure of EU citizens to particulate matter and ozone and with a view of protecting ecosystems from acid rain, excess nitrogen nutrients and ozone. It also envisaged an update of existing ambient air quality legislation through simplification and merging of previous directives.

Hence, since 2008, the legislative framework for ambient air quality standards, assessments, management and reporting is reflected in two main acts, i.e. Directive 2008/50/EC and Directive 2004/107/EC.

Currently in force: Ambient Air Quality Directives

Directive 2008/50/EC on ambient air quality and cleaner air for Europe (**Ambient Air Quality Directive**), including the following elements:

- *The merging of most of existing legislation into a single directive (except for the Fourth Daughter Directive) with no change to existing air quality objectives*
- *New air quality objectives for PM_{2.5} (fine particles) including the limit value and exposure related objectives.*
- *The possibility to discount natural sources of pollution when assessing compliance against limit values.*
- *The possibility for time extensions of three years (PM10) or up to five years (NO₂, benzene) for complying with limit values.*

Directive 2004/107/EC of the European Parliament and of the Council relating to arsenic, cadmium, mercury, nickel and polycyclic aromatic hydrocarbons in ambient air (**Fourth Daughter Directive**)

Commission Directive (EU) 2015/1480 of 28 August 2015 amending several annexes to Directives 2004/107/EC and 2008/50/EC of the European Parliament and of the Council laying down the rules concerning reference methods, data validation and location of sampling points for the assessment of ambient air quality.

In addition:

Commission Implementing Decision 2011/850/EU laying down rules for Directives 2004/107/EC and 2008/50/EC of the European Parliament and of the Council as regards the reciprocal exchange of information and reporting on ambient air quality

Consolidates and updates Council Decision 97/101/EC, Commission Decision 2004/461/EC and Commission Decision 2004/224/EC

Between 2011 and 2013 the Commission conducted a review of the EU air policy which resulted in the adoption of the Clean Air Policy Package. As part of the package, the Commission proposed a Clean Air Programme for Europe,²²⁹ updating the 2005 Thematic

²²⁸ COM(2005)446. 'Thematic Strategy on air pollution'.

²²⁹ COM(2013)918. 'A Clean Air Programme for Europe'.

Strategy on Air Pollution in order to set new objectives for EU air policy for 2020 and 2030.

In 2015, the Ambient Air Quality Directives were updated by the Commission Directive (EU) 2015/1480, which amended several of their AAQ Directives' annexes as regards reference methods, data validation and the location of sampling points for the assessment of ambient air quality. These amendments were needed partly in order to clarify the existing criteria, but also to complement the criteria taking into account, among other things, the experience gained in implementing the Directive and most recent standards for the sampling and measurement of particulate matter.

In 2018, the Commission adopted the Communication 'A Europe that protects: Clean air for all'²³⁰ that provides national, regional and local actors practical help to improve air quality in Europe.

²³⁰ COM(2018)330. 'A Europe that protects: Clean air for all'.

Annex 5: Air pollutants, their sources and abatement measures

1. Overview of air pollutant impacts, main sources, and abatement measures

Pollutant	Effects and impacts	Main sources (EU-28)	Abatement measures (examples only)
Sulphur dioxide (SO ₂)	Exposure to SO ₂ can affect the respiratory system and the function of the lungs. SO ₂ can aggravate asthma and chronic bronchitis as well as increase the risk of infection. In addition, sulphur compounds have acidifying effects on soil and freshwater damaging plant and animal life.	<ul style="list-style-type: none"> • Energy production and distribution (51 %) • Energy use in industry (20 %) • Industrial processes and product use (17 %) 	<ul style="list-style-type: none"> • Installation of de-sulfurisation technologies in power generation and industry. • Increase the use of renewable energy in power generation. • Switch to lower-sulphur fuels. • Improve efficiency of energy production and use • Other BAT requirements for industrial processes
Nitrogen dioxide (NO ₂) - and - Nitrogen oxides (NO _x)	<p>NO₂ can increase symptoms of bronchitis and asthma, as well as lead to respiratory infections and reduced lung function and growth.</p> <p>NO_x are also ozone precursors and affect ecosystems by causing acidification and eutrophication.</p>	<ul style="list-style-type: none"> • Road transport (39 %) ^{1,2} • Energy production and distribution (17 %) • Commercial and households (14 %) <p>¹ <i>The relative contribution of traffic at ground-level is much higher.</i></p> <p>² <i>Of the total emitted NO_x from traffic, around 80% comes from diesel powered vehicles.</i></p>	<ul style="list-style-type: none"> • Better on-road engine technologies (including retrofitting of vehicles). • Reliable and clean public transport • Shift to walking and cycling (in cities) • Urban vehicle access regulations and low emission zones • Installation of de-NO_x technologies in industry and power generation.

Pollutant	Effects and impacts	Main sources (EU-28)	Abatement measures (examples only)
Particulate matter (PM _{2.5})	PM _{2.5} is capable of penetrating deep into lung passageways and entering the bloodstream causing cardiovascular, cerebrovascular and respiratory impacts.	<p>For primary PM_{2.5}:</p> <ul style="list-style-type: none"> • Commercial and households (56 %) • Road transport (11 %) • Industrial processes and product use (10 %) <p>In addition, SO₂, NO_x, NH₃ (ammonia)³ and VOCs for secondary PM_{2.5} in the atmosphere.</p> <p>³ Note that the main source for ammonia emission is agriculture (92%)</p>	<ul style="list-style-type: none"> • Substitution of dirty stoves and boilers, • Increase energy efficiency (of buildings) • City or district heating • Use of cleaner fuels • Use particle filters • Shift to walking and cycling (in cities) • Installation of abatement equipment at industrial facilities, e.g. fabric filters, electrostatic precipitators. <p><i>Plus all measures to reduce the precursor emissions of SO₂, NO_x or NH₃.</i></p>
Particulate matter (PM ₁₀)	Health effects of PM ₁₀ include respiratory and cardiovascular morbidity, such as aggravation of asthma, cardiovascular and respiratory diseases and lung cancer.	<ul style="list-style-type: none"> • Commercial and households (39 %) • Industrial processes and product use (19 %) • Agriculture (15 %) 	<ul style="list-style-type: none"> • All the above measures to reduce PM_{2.5} • Other BAT requirements for industrial processes • Ban of open burning of agricultural residuals
Carbon monoxide (CO)	CO can be harmful to humans by impairing the amount of oxygen transported in the bloodstream to critical organs.	<ul style="list-style-type: none"> • Commercial and households (48 %) • Road transport (20 %) • Energy use in industry (12 %) 	<ul style="list-style-type: none"> • Euro vehicle standards • Increase the use of renewable energy in power generation • Optimise combustion conditions
Benzene (C ₆ H ₆)	Benzene is carcinogenic in humans (IARC group 1) and has been associated with a range of acute and long-term adverse health effects and diseases.	<ul style="list-style-type: none"> • Road transport • Energy use in industry 	<ul style="list-style-type: none"> • Shift to cleaner vehicles and low-emissions vehicles

Pollutant	Effects and impacts	Main sources (EU-28)	Abatement measures (examples only)
Ozone (O ₃)	Exposure to O ₃ concentrations can cause breathing problems, trigger asthma, reduce lung function and cause lung diseases. O ₃ also affects ecosystems by damaging crops, forests and other vegetation.	Sources of O ₃ precursors NO _x , CO and VOCs include: <ul style="list-style-type: none"> • Road transport • Energy production and distribution 	<ul style="list-style-type: none"> • Reduce energy consumption through energy efficiency measures. • Reduce NO_x and particle concentrations (indirect effects) <i>Plus measures to reduce the precursor emissions of NO_x, CO or VOCs.</i>
Lead (Pb)	Lead can damage the nervous system, memory and responsiveness. Toxic metals like As, Cd, Ni and Pb also have severe impacts on ecosystems by causing problems to animals and plants through bioaccumulation.	<ul style="list-style-type: none"> • Energy use in industry (32 %) • Industrial processes and product use (29 %) • Road transport (17 %) 	<ul style="list-style-type: none"> • Adopt BAT requirements for industrial processes, in particular controls on dust emissions • Phase out / ban the use of leaded petrol. • Shift to zero and low-emissions vehicles. • Restrict or close older and more polluting industrial facilities.
Arsenic (As)	As is carcinogenic in humans (IARC group 1) and causes damage to the kidneys and negatively affects foetal development and the immune system.	<ul style="list-style-type: none"> • Energy use in industry (40 %) • Industrial processes and product use (25 %) • Energy production and distribution (22 %) 	<ul style="list-style-type: none"> • Adopt BAT requirements for industrial processes, in particular controls on dust emissions • Restrict or close older and more polluting industrial facilities.
Cadmium (Cd)	Cd is carcinogenic in humans (IARC group 1) and causes damage to the kidneys.	<ul style="list-style-type: none"> • Energy use in industry (29 %) • Industrial processes and product use (29 %) • Commercial, institutional and households (21 %) 	<ul style="list-style-type: none"> • Adopt BAT requirements for industrial processes, in particular controls on dust emissions in metal refining and smelting facilities. • Restrict or close older and more polluting industrial facilities.

Pollutant	Effects and impacts	Main sources (EU-28)	Abatement measures (examples only)
Nickel (Ni)	Nickel compounds are carcinogenic (IARC group 1) and cause damage to the kidneys and affecting foetal development and the immune system.	<ul style="list-style-type: none"> • Energy production and distribution (37 %) • Energy use in industry (17 %) • Commercial, institutional and households (16 %) 	<ul style="list-style-type: none"> • Adopt BAT requirements for industrial processes, in particular controls on dust emissions • Restrict or close older and more polluting industrial facilities.
Benzo[<i>a</i>]pyrene (BaP, C ₂₀ H ₁₂)	BaP is carcinogenic in humans (IARC Group 1) and is an indicator of the carcinogenic effect of the total polycyclic aromatic hydrocarbons (PAH).	<ul style="list-style-type: none"> • Industrial processes and product use (77 %) • Commercial and households (especially wood burning) (16 %) • Agriculture (6 %) • Energy production and distribution (1 %) 	<ul style="list-style-type: none"> • BAT requirements for industrial processes, in particular controls on dust emissions. • Reduce wood burning, e.g. reduce energy consumption, improve energy efficiency • Ban of open burning of agricultural residuals

Source: Adapted from COWI Support Study based on EEA Air Quality in Europe 2016, 2017 and 2018 Reports, and WHO Ambient (outdoor) air quality and health 2018.

Note: The data on the main sources responsible for different pollutants is from 2016 and extracted from the EEA Air Quality in Europe – 2018 report, and EEA 2018 report European Union emission inventory report 1990-2016 under the UNECE Convention on Long-range Transboundary Air Pollution (LRTAP). Data on the main sources responsible for NO₂ is based on the data concerning NO_x in the reports.

2. Examples of air pollution measures referred to in Directive 2008/50/EC

Directive 2008/50/EC in its Annex XV.B(3) lists a number of air pollution abatement measures for consideration at appropriate local, regional or national level for implementation in connection with the attainment of air quality objectives:

- reduction of emissions from stationary sources by ensuring that polluting small and medium sized stationary combustion sources (including for biomass) are fitted with emission control equipment or replaced;
- reduction of emissions from vehicles through retrofitting with emission control equipment. The use of economic incentives to accelerate take-up should be considered;
- procurement by public authorities, in line with the handbook on environmental public procurement, of road vehicles, fuels and combustion equipment to reduce emissions, including the purchase of:
 - new vehicles, including low emission vehicles,

- cleaner vehicle transport services,
 - low emission stationary combustion sources,
 - low emission fuels for stationary and mobile sources,
- measures to limit transport emissions through traffic planning and management (including congestion pricing, differentiated parking fees or other economic incentives; establishing low emission zones);
 - measures to encourage a shift of transport towards less polluting modes;
 - ensuring that low emission fuels are used in small, medium and large scale stationary sources and in mobile sources;
 - measures to reduce air pollution through the permit system under Directive 2008/1/EC, the national plans under Directive 2001/80/EC, and through the use of economic instruments such as taxes, charges or emission trading.

3. Source allocation of fine particulate matter PM_{2.5}

Source allocation illustrates that air pollution is the result of contributions from multiple sources of emissions, and originates from different geographical scales. The eight examples below (Figure A5.1) for the sources of fine particulate matter concentrations in cities – both primary and secondary fine particulate matter (PM_{2.5}) – correspond to the seven case studies illustrated in this fitness check (see Annex 11 to this SWD).

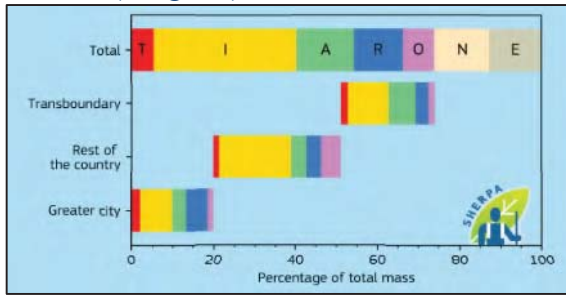
Air pollutant emissions originate from different human activities as well as from natural sources. The examples in Figure A5.1 distinguish between emissions from transport (T), industry (I), agriculture (A), residential (R), natural (N) or other sources (O), and emissions from outside the EU (E). Note that in addition to primary emissions of PM_{2.5}, also secondary PM_{2.5} is formed in the atmosphere from precursor pollutants, such as nitrogen oxides, sulphur oxides and ammonia from different sectors.

The resulting concentrations of air pollutants in a given location are the result of such emissions contributions of different origins: transboundary pollution, emission from other parts of the country, emissions in the immediate ‘commuting zone’ (where relevant), and emissions that occur in the respective location (city) itself.

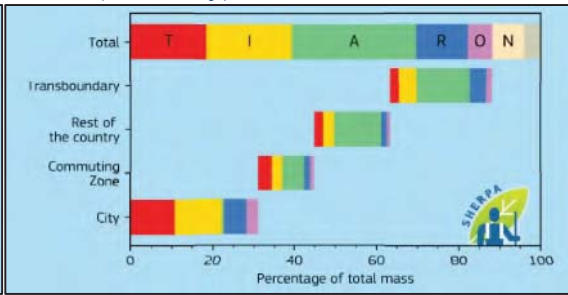
For details on the methodology used, please see the *Urban PM_{2.5} Atlas: Air Quality in European Cities* published by the Joint Research Centre.

This analysis indicates that (1) there are significant differences between cities when it comes to the dominant origins of PM_{2.5}, both regarding the dominant sectors and regarding the dominant geographical scale (city, rest of the country or transboundary) (2) for many cities, local actions at the city scale would be an effective means of improving air quality in that city, as well as having regional benefits; (3) for many cities, sectoral measures addressing agriculture have a clear benefit on urban air quality.

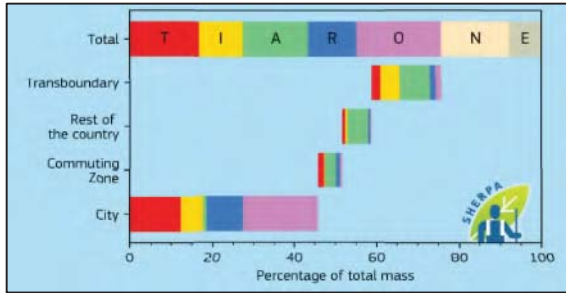
Plovdiv (Bulgaria)



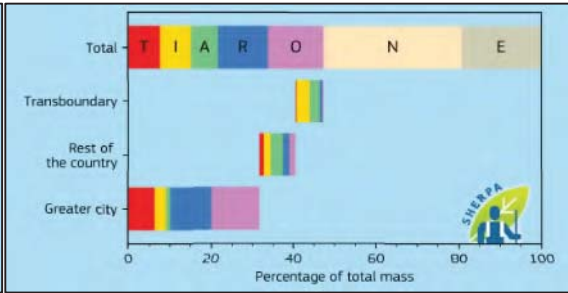
Berlin (Germany)



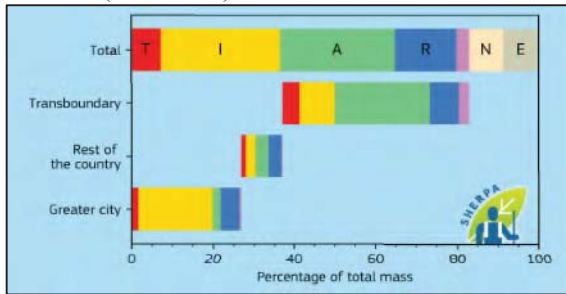
Dublin (Ireland)



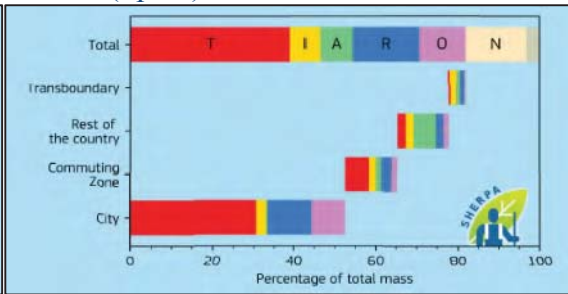
Palermo (Italy)



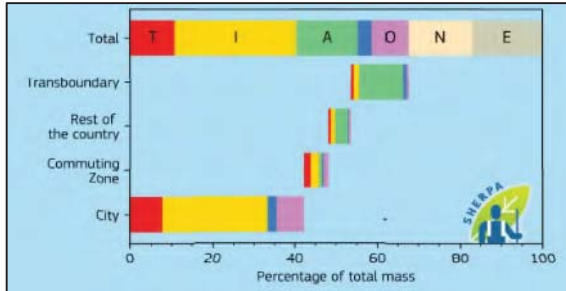
Kosice (Slovakia)



Madrid (Spain)



Stockholm (Sweden)



Malmö (Sweden)

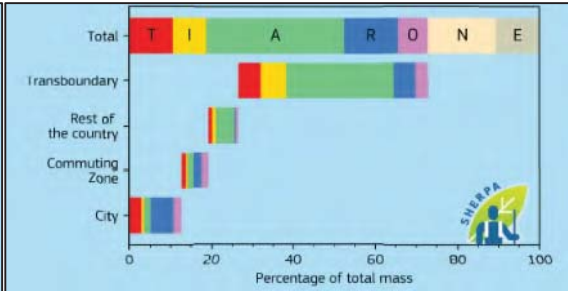


Figure A5.1 – Source apportionment and source allocation in 8 cities (examples)²³¹

²³¹ JRC (2017). ‘Urban PM_{2.5} Atlas: Air Quality in European Cities’.

Annex 6: Infringements and litigation under the AAQ Directives

1. EU Court proceedings against Member States for failure to fulfil obligations under ambient air quality legislation (2008 to 2018)

This section provides an overview of the cases referred to the Court of Justice of the EU on the basis of Article 258 TFEU (previously Article 226 TEC) during the evaluation period.

In a first wave of cases (2008 to 2012), the Commission initially decided to refer seven Member States to the Court of Justice of the EU due to exceedances of PM₁₀ limit values: Italy, Portugal, Slovenia, and Sweden, as well as Cyprus, France and Spain.

The decision was executed only against the first four of the above Member States. Judgements delivered by the Court of Justice of the EU in these four cases (see Table A6.1) confirmed the violations for a specific period in the past, but did not address the lack of appropriate measures to keep exceedance periods as short as possible.

The Commission saw a need to also address the absence or insufficiency of the measures dealing with the different sources of PM₁₀ pollution. Accordingly, the earlier decisions regarding the other three Member States (Cyprus, Spain and France) were not confirmed at the time, as the Commission considered necessary to review its strategy.

Table A6.1 – Period 2008 to 2012: Focus on breaches of limit values over a given period, based on Directive 1999/30/EC (i.e. former First Daughter Directive)

Member State	Case	Pollutant	Judgment
Italy	C-68/11	PM ₁₀	Infringement established (EU:C:2012:815)
Portugal	C-34/11	PM ₁₀	Infringement established (EU:C:2012:712)
Slovenia	C-365/10	PM ₁₀	Infringement established (EU:C:2011:183)
Sweden	C-479/10	PM ₁₀	Infringement established (EU:C:2011:287)

A second wave of infringements was initiated and resulted in a number of referrals to and judgments of the Court of Justice of the EU, in the period 2013 to 2018 (see Table A6.2).

Table A6.2 – Period 2013 to 2018: Focus on persistent breaches of limit values and the lack of adequacy of the measures aimed at attaining compliance (based on Directive 2008/50, i.e. Ambient Air Quality Directive)

Member State	Case	Pollutant	Judgment
Bulgaria	C-488/15	PM ₁₀	Infringement established (EU:C:2017:267)
Bulgaria	C-730/19	SO ₂	<i>Pending case</i>
France	C-636/18	NO ₂	Infringement established (EU:C:2019:900)

Germany	C-635/18	NO ₂	<i>Pending case</i>
Hungary	C-637/18	PM ₁₀	<i>Pending case</i>
Italy	C-644/18	PM ₁₀	<i>Pending case</i>
Italy	C-573/19	NO ₂	<i>Pending case</i>
Poland	C-336/16	PM ₁₀	Infringement established (EU:C:2018:94)
Romania	C-638/18	PM ₁₀	<i>Pending case</i>
United Kingdom	C-664/18	NO ₂	<i>Pending case</i>

2. Infringement cases initiated by the Commission for non-compliance with ambient air quality legislation (2008 to 2018, and up to October 2019 for information)

This section provides an overview of the infringement cases initiated on the basis of Article 258 TFEU (previously Article 226 TEC) during the evaluation period, either for excessive NO₂ (Table A6.3), excessive PM₁₀ (Table A6.4), excessive SO₂ (Table A6.5), or related to monitoring shortcomings (Table A6.6).

Table A6.3 – Infringement cases for excessive nitrogen dioxide (NO₂)

Member State	Case no.	Current status
Austria	2016/2006	Letter of formal notice (February 2016)
Belgium	2016/2005	Additional letter of formal notice (November 2018)
Czechia	2016/2062	Letter of formal notice (July 2016)
Germany	2015/2073	Referral to Court (October 2018)
Denmark	2016/2080	Letter of formal notice (July 2016)
France	2015/2074	Judgment establishing infringement (Oct 2019)
Greece	2018/2361	Letter of formal notice (January 2019)
Spain	2015/2053	Decision to issue Referral to Court (July 2019)
Hungary	2016/2085	Letter of formal notice (July 2016)
Italy	2015/2043	Referral to Court (July 2019)
Luxembourg	2017/2101	Letter of formal notice (October 2017)
Poland	2016/2010	Letter of formal notice (February 2016)
Portugal	2015/2045	Letter of formal notice (May 2015)
United Kingdom	2014/4000	Referral to Court (October 2018)

Table A6.4 – Infringement cases for excessive particulate matter (PM₁₀)

Member State	Case no.	Current status
Austria	2008/2183	Closure (April 2015)
Belgium	2008/2184	Closure (September 2018)
Bulgaria	2010/2109	Letter of formal notice (Art. 260) following a judgment (November 2018)
Cyprus	2008/2185	Closure (February 2012)
Czechia	2008/2186	Additional reasoned opinion (March 2015)
Denmark	2008/2187	Closure (June 2010)
Estonia	2008/2188	Closure (May 2011)
France	2008/2190	Additional reasoned opinion (April 2015)
Germany	2008/2191	Additional reasoned opinion (November 2014)
Greece	2008/2192	Additional reasoned opinion (October 2014)
Hungary	2008/2193	Referral to Court (October 2018)
Italy	2008/2194 2014/2147	Closure (June 2013)** Referral to Court (October 2018)
Latvia	2008/2195	Additional reasoned opinion (July 2014)
Malta	2008/2197	Closure (September 2010)
Poland	2008/2199	Judgment establishing infringement (Feb 2018)
Portugal	2008/2200 2013/2135	Closure (June 2013)** Reasoned opinion (September 2014)
Romania	2009/2296	Referral to Court (October 2018)
Slovakia	2008/2201	Additional reasoned opinion (November 2014)
Slovenia	2008/2202 2012/2212	Closure (October 2011)** Additional letter of formal notice (April 2016)
Spain	2008/2203	Additional reasoned opinion (October 2014)
Sweden	2008/2204 2012/2216	Closure (October 2011)** Reasoned opinion (June 2015)
United Kingdom	2008/2205	Closure (February 2013)

** The case was closed due to a change of legal basis; a new case initiated to accommodate for this.

Table A6.5 – Infringement cases for excessive sulphur dioxide (SO₂)

Member State	Case no.	Current status*
Bulgaria	2009/2135	Referral to Court (October 2019)
Czechia	2009/2136	Closure (January 2010)

France	2007/2181	Closure (November 2010)
Italy	2007/2182	Closure (May 2009)
Poland	2009/2137	Closure (January 2011)
Portugal	2009/2138	Closure (May 2011)
Romania	2009/2337	Closure (November 2013)
Slovenia	2007/2183	Closure (November 2008)
Spain	2007/2180	Closure (June 2010)
United Kingdom	2007/2184	Closure (May 2008)

Table A6.6 – Infringement cases related to the monitoring network

Member State	Case no.	Current status
Romania	2017/2024	Letter of formal notice (June 2017)
Slovakia	2017/2116	Letter of formal notice (October 2017)

3. Selected case law of the Court of Justice of the EU related to the implementation of the AAQ Directives

C-237/07, Janecek (EU:C:2008:447)

Entitlement of a third party, whose health has been impaired, to have an action plan drawn up

The case involved a dispute between Mr Dieter Janecek and Bavaria, over excessive PM₁₀ pollution in the city of Munich. Mr Janecek filed a lawsuit, requesting an air quality plan to address the exceedances. The question was raised via a preliminary reference whether he would have such a right, based on the Air Quality Framework Directive (Directive 96/62/EC) applicable at the time.

The Court of Justice of the EU decided that where there is a risk that the emission limit values in respect of particulate matter PM₁₀ or alert thresholds may be exceeded, persons directly concerned must be in a position to require the competent national authorities to draw up an action plan. This applies even in cases where, under national law, those persons may have other courses of action available to them for requiring those authorities to take measures to combat atmospheric pollution.

Furthermore, Member States are obliged, subject to judicial review by the national courts, to take measures – in the context of an action plan and in the short term – that are capable of reducing to a minimum the risk that the emission limit values in respect of particulate matter PM₁₀ or alert thresholds may be exceeded.

C-404/13, *ClientEarth* (EU:C:2014:2382)

National courts' obligation to ensure an air quality plan is established in case of exceedances

Due to excessive nitrogen dioxide (NO₂) pollution in many zones in the UK, the NGO ClientEarth brought a claim in front of UK courts, seeking an order requiring the Secretary of State for the Environment, Food and Rural Affairs to revise the air quality plans to ensure that they demonstrate how conformity with the nitrogen dioxide limit values will be achieved as soon as possible. One of the questions raised via a preliminary reference was related to remedies that national courts must provide in cases like this one.

In its decision, building up on the *Janecek* judgement (see above), the Court of Justice of the EU decided that where a Member State has failed to comply with limit and target values under Directive 2008/50/EC, it is for the national court having jurisdiction, should a case be brought before it, to take, with regard to the national authority, any necessary measure, such as an order in the appropriate terms, so that the authority establishes the plan required by the directive in accordance with the conditions laid down by the latter.

As regards the content of the plan, while Member States have a degree of discretion in deciding which measures to adopt, those measures must, in any event, ensure that the period during which the limit values are exceeded is as short as possible.

C-723/17, *Craeynest* (EU:C:2019:533)

Locating sampling points and establishing exceedances

A number of residents of the Belgian Brussels-Capital Region and the environmental organisation ClientEarth were in dispute with the Brussels competent authorities as to whether an adequate air quality plan had been established for the Brussels zone. In that regard, the court in Brussels deciding on the dispute asked the Court of Justice of the European Union to give interpretation on the relevant provisions of Directive 2008/50/EC. It sought to clarify, first, the extent to which national courts may review the siting of sampling points and, second, whether the results from different sampling points may be averaged in order to assess compliance with the limit values.

Building up on the above case law, the Court of Justice of the EU decided that it is for a national court, hearing an application submitted for that purpose by individuals directly affected by the exceedance of the limit values from Directive 2008/50/EC, to verify whether the sampling points located in a particular zone have been established in accordance with the criteria laid down in that directive (i.e. that the sampling points are placed in areas where the highest concentrations occur) and, if they were not, to take all necessary measures in respect of the competent national authority, such as, if provided for by national law, an order, with a view to ensuring that those sampling points are sited in accordance with those criteria. Furthermore, in order to establish whether a limit value with an averaging period of one calendar year has been exceeded, it is sufficient that a pollution level higher than that value be measured at a single sampling point, and in that case the obligation to draw up an air quality plan is triggered.

3. Illustrative overview of clean air cases before national courts²³²

Austria: One of a number of lawsuits in Austria went to the Higher Administrative Court whose decision in October 2017 gave citizens a sound legal basis to demand measures to protect them from health hazards arising from air pollutants. The Higher Administrative Court with jurisdiction, ruled on 19 February 2018 that based on Aarhus Convention environmental NGOs can order a review of compliance with the legal provisions arising from EU environmental law.

Belgium: In a lawsuit by the NGO ‘ClientEarth’ and Brussels residents against the Brussels government, the court decided that environmental organisations and citizens have the right to demand appropriate measures to be implemented in the air quality plan. After the court asked for further guidance from the Court of Justice of the EU, the advocate general recommended the Court of Justice of the EU to rule that national courts are obliged to review monitoring stations and that an annual average above the legal limit at a single monitoring site is already to be regarded as exceedance.²³³

Czechia: The first complaint against the air quality plan in Ostrava was filed by the NGO ‘Frank Bold’ in 2016. In December 2017, the Supreme Administrative Court rejected the air quality plan as not being appropriate. In 2018, ‘Frank Bold’ filed another lawsuit against the Czech Ministry of Environment to claim effective steps to improve air quality in the cities Radvanice and Bartovice.

France: The NGO ‘Les Amis de la Terre’ with support of ‘ClientEarth’ brought a case against the French government. In its judgment of 11 July 2017 (n° 394254), the Conseil d’État departed sharply from its previous decisions, stated that the air quality directive sets an obligation of results and ordered the adoption of new and more effective air quality plans by 31 March 2018.

Germany: Since the first case in 2005, 35 cases have been brought to court by Deutsche Umwelthilfe, many of them with support from ClientEarth. In February 2018, the Federal Administrative Court ruled that health protection takes precedence over economic interest and thus cleared the way for diesel restrictions. Since January 2019, Stuttgart is the first German city with a valid driving ban zone for driving cars of the category Euro 4 and below.

Hungary: In November 2018, the Clean Air Action Group (CAAG) with support of ClientEarth, filed a complaint against the authorities of Hungary’s capital Budapest concerning the ongoing exceedance of the annual NO₂ and particulate matter limits in Budapest. They call for a concrete air quality plan to be drawn up and implemented.

²³² This illustrative overview reproduces a publication of Deutsche Umwelthilfe on legal actions for clean air, and is adapted from Deutsche Umwelthilfe (2019). ‘Legal Actions for Clean Air’. The full document is available at: https://www.right-to-clean-air.eu/fileadmin/Redaktion/Downloads/Right-to-Clean-Air_Europe_Backgroundpaper_2019_english_final.pdf

²³³ Note that the information on the case in Belgium is not up-to-date, given that the Court of Justice of the EU has delivered a judgment in the case in the meantime – for its contents, see Section 3 of this Annex under C-723/17, *Craeynest* (EU:C:2019:533).

Italy: In the European Commission's case against Italy, the Court of Justice of the EU ruled on 19 December 2012 that even drastic economic measures required to comply with air quality limit values can be demanded of member states if they are necessary to take account of the limit values.²³⁴

The Netherlands: Following a court ruling from September 2017 by the Court of The Hague, the Netherlands must take immediate action against air pollution. The environmental protection organisation 'Milieudefensie' achieved this success. The state was sentenced to concrete measures to comply with all European limit values in a 'foreseeable and demonstrable' manner.

Poland: In Poland, residents, supported by the NGO 'Frank Bold', are currently claiming their right to challenge air quality plans at the Constitutional Court. Although no ruling was passed at the time of writing, the increased pressure on the authorities has already led to considerably improved air quality plans.

Slovakia: In February 2017, a group of citizens from Bratislava and NGOs 'Cyklokoalicia' and 'ClientEarth', with the assistance of Via Iuris, took legal action against the Bratislava air quality plan. In November 2018, the Slovak Regional Administrative Court dismissed the air quality plan, saying it was vague and insufficient. The Municipality of Bratislava did not appeal the ruling and is now drafting a new plan that, according to the court's guidelines, must include effective measures to improve air quality in the city in the shortest possible time.

Spain: The environmental NGO 'Ecologistas en Accion' filed a lawsuit against the lack of an air quality plan addressing illegally high levels of ozone in the region Castilla y Leon. In particular, the court found that the lack of a national air quality plan could not excuse the failure to act of the regional authorities. On 19 October 2018, the High Court of Valladolid ordered to the Regional Government to prepare within one year an air quality plan to tackle levels of ozone in the region exceeding the EU target values.

Sweden: In 2008 the 'Swedish Society for Nature Conservation (SSNC)' brought a case against the city of Stockholm for failing to take measures included in its air quality plan. Despite a 2012 court ruling in SSNC'S favour, the lack of any effective remedy has allowed the city to continue to delay taking action.

United Kingdom: In February 2018 'ClientEarth' won for the third time against UK government. The High Court ruled that the court should have effective oversight of the UK government's next air quality plans. It means, for the first time ever, that 'ClientEarth' will be able to immediately bring the government back to court if it prepares an air quality plan which is unlawful.

²³⁴ Note that the original publication of 'Deutsche Umwelthilfe' which this Annex reproduces lists a case related to Italy that is in fact Commission proceedings against Italy before the Court of Justice of the EU, and not citizen or NGO action before a national court.

Annex 7: Comparison of the situation in 2008 with 2018

1. Key air quality indicators for 2008 and 2018 (or latest available data)

Table A7.1 Comparison of the current situation with the situation prior to the AAQ Directives for selected key indicator (using the latest published data as proxy for 2018)

Key indicators ²³⁵	Prior to AAQ Directives	Current Situation (2017)
Air quality monitoring		
- Number of monitoring stations	More than 3 000 ^(a)	More than 4 000 ^(b)
- PM ₁₀ sampling points	2 694 (in 2008) ^(c)	3 117 (in 2017) ^(b)
- PM _{2.5} sampling points	540 (in 2008) ^(c)	1 536 (in 2017) ^(b)
- SO ₂ sampling points	2 114 (in 2008) ^(c)	1 579 (in 2017) ^(b)
- NO ₂ sampling points	3 140 (in 2008) ^(c)	3 102 (in 2017) ^(b)
Air quality standards		
- limit values established for:	6 pollutants (PM ₁₀ , NO ₂ , SO ₂ , Pb, CO, Benzene) ^(d)	7 pollutants (as before, plus PM _{2.5} - since 2015) ^(e)
- target values established for:	1 pollutant (O ₃) ^(d)	5 pollutants (O ₃ , plus As, Cd, Ni, BaP - since 2012) ^(e)
Number of air quality exceedances (share of air quality zones that report exceedances)		
- PM ₁₀ (daily limit value)	37 % (in 2008) ^{(f),(c)}	18 % (in 2017) ^(f)
- PM _{2.5} (annual limit value)	6 % (in 2008) ^{(f),(c)}	7 % (in 2017) ^(f)
- NO ₂ (annual limit value)	28 % (in 2008) ^{(f),(c)}	23 % (in 2017) ^(f)
- O ₃ (8-hours mean target value)	45 % (in 2008) ^{(f),(c)}	28 % (in 2017) ^(f)
- BaP (annual target value)	22 % (in 2008) ^{(f),(c)}	18 % (in 2017) ^(f)
- for all other pollutants	2% or less (in 2008) ^{(f),(c)}	1% or less (in 2017) ^(f)
Magnitude of air quality exceedances (highest level of exceedance reported)		
- PM ₁₀ (daily limit value)	280 days ^(h)	130 days ^(h)
- PM ₁₀ (annual limit value)	99 µg/m ³ ^(h)	64 µg/m ³ ^(h)
- PM _{2.5} (annual limit value)	42 µg/m ³ ^(h)	41 µg/m ³ ^(h)
- NO ₂ (annual limit value)	115 µg/m ³ ^(h)	84 µg/m ³ ^(h)

²³⁵ Sources:

- (a) SEC(2005)1132: ‘Thematic Strategy on air pollution’;
- (b) https://tableau.discomap.eea.europa.eu/t/Aironline/views/Content_stats/SPO-1year-npollutants;
- (c) ETC/ACC Technical paper 2010/1. ‘The state of the air quality in 2008’;
- (d) Directives 96/62/EC, 1999/30/EC, 2000/69/EC, 2002/3/EC;
- (e) Directives 2008/50/EC and 2004/107/EC;
- (f) Support study informing this Fitness Check, Table 6-6; based on EEA data;
- (g) <https://www.eea.europa.eu/data-and-maps/indicators/exceedance-of-air-quality-limit-3/assessment-4>;
- (h) Also see Figures 4a, 4b, 4c, respectively, for details per Member State; based on EEA data.

Urban population exposed to air pollution above selected limit or target values		
- PM ₁₀ (daily limit value)	23.9 % (in 2008) ^(g)	13.2 % (in 2016) ^(g)
- PM _{2.5} (annual limit value)	12.6 % (in 2008) ^(g)	5.5 % (in 2016) ^(g)
- NO ₂ (annual limit value)	12.3 % (in 2008) ^(g)	7.3 % (in 2016) ^(g)
- O ₃ (8-hours mean target value)	15.3 % (in 2008) ^(g)	12.4 % (in 2016) ^(g)
Air quality reporting and information		
- reporting of air quality data	via questionnaires and bespoke spreadsheets	via e-reporting (i.e. machine readable reporting formats)
- visits to EEA air quality website	ca. 100 000 visits (in 2008)	ca. 900 000 visits (in 2018)

2. Changes over time of the health impacts of air pollution

The 2018 EEA annual air quality report presented the long-term evolution of exposure of the European population to fine particulate matter (PM_{2.5}) concentrations from 1990 to 2016, based on a range of different datasets. These datasets included methodological differences but all of them were based on a combination of observed data and modelled results. Based on this the report assumes with confidence that the risk associated with air pollution has, at least, halved in the period 1990 to 2015; but the report also indicates that the reductions have been larger in the 1990s than after 2000 (see Figure A7.1).²³⁶



Figure A7.1 – Premature deaths due to exposure to PM_{2.5} in Europe over the period 1990 to 2016 for various datasets of PM_{2.5} concentration

²³⁶ EEA Report 12/2018. 'Air quality in Europe – 2018 report'.

Annex 8: The 2018 Clean Air Outlook

Key findings of relevance for the AAQ Directives

In 2013, when the Clean Air Policy Package (comprising the Clean Air Programme for Europe²³⁷ and the NEC Directive proposal²³⁸) was adopted, it was announced that the underpinning modelling analysis would be updated regularly via a regular report on air quality in Europe. Accordingly, the First Clean Air Outlook was published in June 2018.²³⁹ It was supported by several modelling studies that also provided indication of the extent to which, by delivering on a wider set of air and climate legislation, Member States would move towards lower air pollution levels.²⁴⁰

The modelling analysis underpinning the First Clean Air Outlook primarily shows, based on cost-effectiveness optimisation, the extent of the additional measures that Member States would need to take to attain their emissions reductions commitments for 2030, as set in the NEC Directive. Most Member States would have to take additional measures, at least for some pollutants,²⁴¹ which would lead them to just achieve their commitments. However, some Member States would already over-achieve their emissions reductions commitments set in the NEC Directive, without additional measures.

This is due to the joint effect of the implementation of the legislation limiting emissions sources (e.g. Ecodesign Directive, Industrial Emissions Directive, Medium Combustion Plant Directive), of the measures taken in view of the climate and energy 2030 targets and of the synergies in the reduction of some pollutants (some measures aimed at one pollutant actually also reduce others, at no cost). Member States in this category, which would over-achieve their NEC Directive emissions reduction commitments, would also see an improvement in their air pollutants concentration levels moving them closer to WHO Guidelines values.

Overall, at EU level, the modelling analysis projects larger emissions reductions than required by the NEC Directive for 2030,²⁴² and therefore also higher health benefits,²⁴³

²³⁷ http://ec.europa.eu/environment/air/clean_air/index.htm

²³⁸ COM proposal which became Directive 2016/2284/EU.

²³⁹ COM(2018)446. 'The First Clean Air Outlook'.

²⁴⁰ In particular relevance here:
http://ec.europa.eu/environment/air/pdf/clean_air_outlook_overview_report.pdf and
http://ec.europa.eu/environment/air/pdf/clean_air_outlook_economic_impact_report.pdf

²⁴¹ 14 Member States would have to take additional action to reach SO₂; 13 for NO_x; 15 for PM_{2.5}; 25 for VOC and 26 for NH₃.

²⁴² 7% over-achievement for SO₂, 9% for NO_x, 13% for PM_{2.5} and 8% for VOC. There is no over-achievement projected for NH₃.

provided all the synergies and interactions described above take place. The modelling also projects that, in the most positive case of all synergies between policies being reaped, the share of EU population exposed to PM_{2.5} concentrations over the WHO Guidelines value would decrease from 88% in 2005 to 13% in 2030.

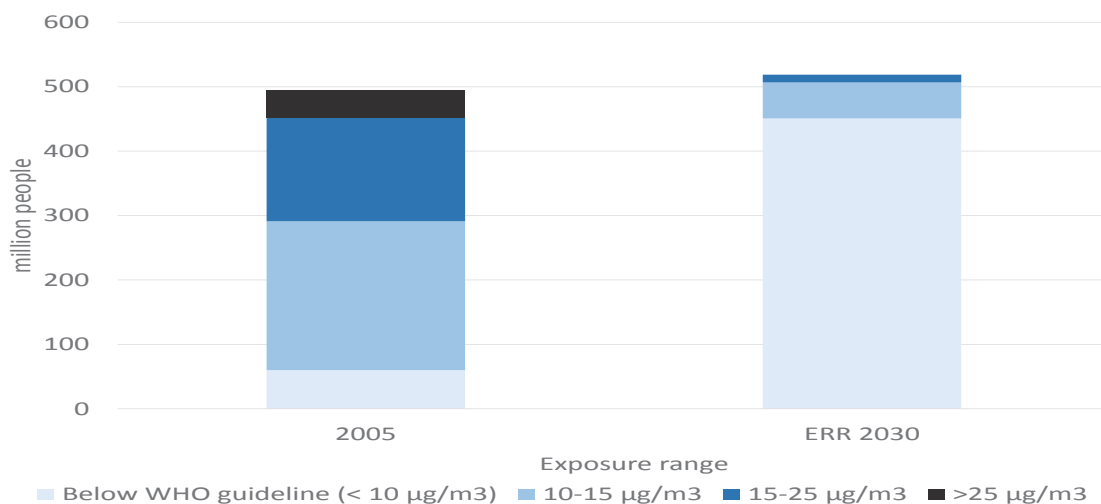


Figure A8.1 – Distribution of population exposure in the EU-28 to PM_{2.5} levels in 2005 and 2030 (Note: ERR 2030 depicts the results of a model-based projection that assumes all emission reduction commitments under the NEC Directive are indeed delivered)²⁴⁴

However, this EU-level result hides disparities in pollutants concentrations, across and within Member States, leading to some regions in EU still overpassing the WHO Guidelines values in the 2030 modelling results. In these parts of EU, even with the implementation of all cost-effective measures available to meet the NEC Directive commitments, additional measures (hence not cost-effective although technically feasible under the modelling framework) would still be needed to reach WHO Guidelines values.

Two areas in Europe are expected to face continued exceedances of WHO Guidelines value for PM_{2.5}, i.e., Northern Italy and Southern Poland. Source apportionment analyses for these areas indicate that, after implementation of all measures that are required to meet the emission reduction commitments under the NEC Directive, secondary particles formed in the atmosphere in the presence of ammonia will still contribute about half of the WHO Guidelines value for PM_{2.5}, despite the expected reductions in NH₃ emissions. Another large fraction of remaining ambient PM_{2.5} is expected to be due to primary emissions of particles from the residential combustion of solid fuels, i.e., predominantly wood stoves in Italy, and coal and wood stoves in Poland. However, it should be noted

²⁴³ By 2030, premature deaths would drop by 54% in relation to 2005, compared to the 52% of the 2013 Commission proposal for the Clean Air Policy package.

²⁴⁴ IIASA (2018). Progress towards the achievement of the EU’s air quality and emissions objectives. https://ec.europa.eu/environment/air/pdf/clean_air_outlook_overview_report.pdf

that also this analysis confirms that with the technical measures available, the WHO Guidelines value for PM_{2.5} could be reached at almost all stations.

In any event, measures are not always chosen based on cost-effectiveness only, with social and political considerations often playing a significant role. The modelling analysis shows that the cost-effectiveness criteria would lead to a shift in the cost-sharing away from the economic sectors that have already implemented several cost-effective measures (e.g. road transport) towards sectors where many cost-effective measures are still available (e.g. agriculture).

However, if the choice of actual measures follows other than cost-effectiveness considerations only, this would increase the overall cost and/or hamper the attainment of the reduction commitments, with impacts on the pollutants concentrations levels.

Annex 9: Air quality policy and other European institutions

Summaries of recent input of other institutions to air quality policy

1. European Court of Auditors Special Report no. 23/2018: ‘Air pollution: Our health still insufficiently protected’²⁴⁵

11 September 2018

In this audit, the European Court of Auditors assessed whether EU actions to protect human health from air pollution have been effective. To do this, it examined whether (i) the AAQ Directive was well designed to tackle the health impact of air pollution; (ii) Member States’ effectively implemented the Directive; (iii) the Commission monitored and enforced implementation of the Directive; (iv) air quality was adequately reflected in other EU policies and adequately supported by EU funds; and (v) the public has been well informed on air quality matters.

The European Court of Auditors concluded that EU action to protect human health from air pollution had not delivered the expected impact. The significant human and economic costs have not yet been reflected in adequate action across the EU.

- The EU’s air quality standards were set almost twenty years ago and some of them are much weaker than WHO Guidelines and the level suggested by the latest scientific evidence on human health impacts.
- While air quality has been improving, most Member States still do not comply with the EU’s air quality standards and were not taking enough effective action to sufficiently improve air quality. Air pollution can be underestimated as it might not be monitored in the right places. Air quality plans – a key requirement of the Ambient Air Quality Directive – often did not deliver expected results.
- The Commission faces limitations in monitoring Member States’ performance. Subsequent enforcement by the Commission could not ensure that Member States complied with the air quality limits set by the Ambient Air Quality Directive. Despite the Commission taking legal action against many Member States and achieving favourable rulings, Member States continue to frequently breach air quality limits.
- Many EU policies have an impact on air quality, but, given the significant human and economic costs, we consider that some EU policies do not yet sufficiently well reflect the importance of improving air quality. Climate and energy, transport, industry, and agriculture are EU policies with a direct impact on air quality, and choices made to implement them can be detrimental to clean air. The European Court of Auditors noted that direct EU funding for air quality can provide useful support, but funded

²⁴⁵ https://www.eca.europa.eu/Lists/ECADocuments/SR18_23/SR_AIR_QUALITY_EN.pdf

projects were not always sufficiently well targeted. It also saw some good projects – particularly some projects supported by the LIFE programme.

- Public awareness and information has a critical role in addressing air pollution, a pressing public health issue. Recently, citizens have been getting more involved in air quality issues and have gone to national courts, which have ruled in favour of their right to clean air in several Member States. Yet, the Ambient Air Quality Directive protects citizens' rights to access to justice less explicitly than some other environmental Directives. The information made available to citizens on air quality was sometimes unclear.

The European Court of Auditors made recommendations to the Commission aimed at improving air quality. Its recommendations cover more effective actions which should be taken by the Commission; the update of the Ambient Air Quality Directive; the prioritisation and mainstreaming of air quality policy into other EU policies; and the improvement of public awareness and information.

2. Opinion of the European Economic and Social Committee on the 'Clean air for all' Communication of the Commission²⁴⁶

12 December 2018

In its exploratory opinion on the Commission Communication 'Clean air for all', the European Economic and Social Committee (EESC) reached the following conclusions.

The EESC considers that it is imperative to reduce pollution in the commercial, institutional, household and transport sectors. The institutions and Member States must set a good example here, and more support programmes must be set up to help individuals shift to clean, modern and more energy efficient forms of heating.

The additional legislative measures proposed by the European Commission to remedy certain problems, such as 'Dieselgate', or action taken against Member States which have failed to comply with current rules on air pollution are a step in the right direction and the EESC endorses this approach.

The EESC firmly believes that the new environmental and transport regulations must be flanked by economic support measures to promote innovation and the development of new clean technologies, such as fuel cells, electric cars and alternative heating and ventilation systems.

International cooperation is crucial for combating pollution and climate change, and the EESC welcomes the broad consensus among Member States on meeting the Paris Agreement objectives. The exchange of good practices in this area and the Green

²⁴⁶ NAT/751-EESC-2018-03845.

Diplomacy Network are very important. Furthermore, specific measures are needed to reduce pollutants in the Member States in order to meet the Agreement's targets.

3. Conclusions of the Council of the European Union on the European Court of Auditors Special Report no. 23/2018 on air pollution²⁴⁷

20 December 2018

In its conclusion of 20 December 2018, the Council of the European Union welcomed the Special Report No 23/2018 by the European Court of Auditors entitled ‘Air pollution: Our health still insufficiently protected’, taking note of the conclusions and recommendations contained in that report. It also acknowledged that these conclusions and recommendations are timely and an important contribution for the ongoing fitness check of the Ambient Air Quality Directives.

Citizens’ health is still affected by air pollution, which remains the biggest environmental risk to health in the Union causing more than 400 000 premature deaths each year and the significant human and economic costs have not yet been reflected in adequate action across the Union.

The Council stressed that air quality has significantly improved over the past decades with the adoption of Union air quality standards with the Ambient Air Quality Directives as major drivers of such improvements. Admittedly, however, not all goals of the Ambient Air Quality Directives have been fully met.

The Council emphasised the need for further effective air quality measures and coherent legislation across Union policies and for an enhanced emphasis on and prioritisation of air quality policies therein. It is also important to design and align other sectoral policies such as energy, agriculture, spatial planning and transport and make the necessary investments to contribute to reducing air pollution as the benefits of air quality policies greatly exceed their implementation cost.

The Council also welcomed that the Commission is performing a fitness check of the Ambient Air Quality Directives and it invited the Commission to consider a revision of the existing legal framework in order to enable a more efficient and effective implementation and enforcement of air quality provisions. It also advised to take the latest scientific evidence on human health impacts into account and to take the WHO Guidelines into consideration.

²⁴⁷ Conclusions of the Council of the European Union no. 14794/18, 20 December 2018.

4. Joint report on air quality by the European Organisation of Supreme Audit Institutions (EUROSAI)²⁴⁸

30 January 2019

This joint report was prepared by 15 supreme audit institutions (SAIs) from EU Member States and neighbouring countries, i.e. the national audit offices in Albania, Bulgaria, Estonia, Georgia, Hungary, Israel, Kosovo, Northern Macedonia, Moldova, the Netherlands, Poland, Romania, Slovakia, Spain and Switzerland, together with the European Court of Auditors.

The joint audit uncovered wide discrepancies between the 15 countries covered by the audit. At one end of the scale was Estonia, which was found to comply with all the relevant standards. At the other end were Poland and Bulgaria, two countries that the European Commission recently brought before the European Court of Justice on account of their continued failure to meet the limit values.

Based on the findings of the joint audit, the participants make the following six recommendations:

1. prepare and implement air quality plans;
2. measure the effectiveness of action taken;
3. improve coordination between governments and executive agencies;
4. collect relevant data and perform cost-benefit analyses;
5. improve monitoring systems;
6. raise public awareness of the problem.

5. European Parliament resolution on the Commission Communication ‘A Europe that protects: Clean air for all’²⁴⁹

13 March 2019

In its resolution on the ‘Clean air for all’ Communication, the European Parliament i.a. urged the Commission to act without delay on PM_{2.5} by proposing the introduction of more stringent compliance values for these particles in EU air quality legislation, as recommended by the World Health Organization. It also urged the Commission to assess and review the legislation only on the basis of robust, up-to-date, independent and peer-reviewed scientific evidence.

The European Parliament expressed regret that, despite being competent for air pollution, DG Environment’s objectives are often undermined by policies and interests coming out of other departments. It also supported the continuation of the Clean Air Dialogues between the Commission and Member States.

²⁴⁸ <https://english.rekenkamer.nl/publications/reports/2019/01/30/joint-report-air-quality>

²⁴⁹ European Parliament resolution on ‘A Europe that protects: Clean air for all’ (2018/2792(RSP)).

The European Parliament expressed regret that the criteria for locating sampling points to measure pollutants leave Member States a certain amount of leeway and risk not achieving the aim of representativeness and it called on the Commission to analyse the impact this leeway has on the comparability of samples and its direct consequences.

The European Parliament called for various measures to reduce air pollution from the transport (focussed on urban areas and vehicle emissions, and also referring to shipping), agriculture (particulate matter, ammonia and methane), energy sector (welcoming commitments made to phase out coal) - as well as highlighting the need to address indoor air pollution. It furthermore highlighted air pollution science and research needs as well as funding considerations.

6. Study for the European Parliament: ‘Sampling points for air quality’^{250,251}

March 2019

A study carried out on request by the Committee on the Environment, Public Health and Food Safety, Policy Department for Economic, Scientific and Quality of Life Policies of the European Parliament assessed whether the criteria for the monitoring and assessment of air quality laid down in the AAQ Directives allow for a harmonised and consistent implementation of the AAQ Directives throughout the EU.

It analysed the criteria for the location of monitoring sites in five Member States²⁵² to identify ambiguous provisions that might lead to different assessments of air pollution exposure. Furthermore, the study investigated differences in exposure and exposure trends in the selected Member States and provides an overview of measures implemented to improve air quality and of information provided to the public.

The study concluded that most of the requirements of the AAQ Directives are fulfilled in the air quality zones analysed in this study. However, the information available does not allow an analysis of whether the pollution hotspots have been identified in all zones and Member States. It also pointed to a number of ambiguities in the provisions of the AAQD that can lead to different interpretations

The study offered a number of specific recommendations, including a need for clearer provisions for the identification of highest concentrations and general population exposure, for clarification of ambiguities in criteria of and guidance for the siting of sampling points, for more obligatory modelling to complement fixed monitoring, and for an increase in the required minimum number of PM_{2.5} sampling points.

²⁵⁰ Nagl, C., Spangl, W., Buxbaum, I., Sampling points for air quality, Study for the Committee on the Environment, Public Health and Food Safety, Policy Department for Economic, Scientific and Quality of Life Policies, European Parliament, Luxembourg, 2019.

²⁵¹ [http://www.europarl.europa.eu/RegData/etudes/ATAG/2019/631058/IPOL_ATAG\(2019\)631058_EN.pdf](http://www.europarl.europa.eu/RegData/etudes/ATAG/2019/631058/IPOL_ATAG(2019)631058_EN.pdf)

²⁵² Based on a representative selection of sampling points in Austria, Germany, France, Italy, and Poland.

Annex 10: Evolving public perceptions on air quality

Overview of Eurobarometer surveys and the most recent results

1. Overview of conducted Eurobarometer surveys

Over the evaluation period there have been three Eurobarometer surveys carried out on the topic of air quality.

- Flash Eurobarometer 360 (2013) – ‘Attitudes of Europeans towards air quality’;
- Special Eurobarometer 468 (2017) – ‘Attitudes of European citizens towards the environment’ with a focus on air pollution, and
- Special Eurobarometer 497 (2019) – ‘Attitudes on air quality in the EU’.

The two Special Eurobarometer survey in 2017 and 2019 relied on gathered public opinion from face-to-face interviews at home and in the native language of the interviewees. In 2017, some 27,881 EU citizens from different social and demographic categories were interviewed, whereas in 2019 there were 27,565 interviews conducted following the same methodology.

The Flash Eurobarometer published in 2013, based on interviews carried out in 2012, relied on a different method, with interviews by telephone (fixed-line and mobile phone) carried out with some 25,525 European citizens in 2012.

The next section provides an overview of the results of the 2019 Special Eurobarometer, reflecting the current view of EU citizens on air quality.

2. The 2019 Special Eurobarometer: Attitudes on Air Quality in the EU

Overall conclusions from the 2019 Special Eurobarometer²⁵³

Overall, the results of this survey reveal that air quality is a serious concern for European citizens who feel that the situation has deteriorated in the last ten years, and who are calling for more actions at all levels to tackle a problem that is perceived to be growing.

Citizens do not feel well-informed, and they feel that air quality is deteriorating

A majority of Europeans still **do not feel informed** about air quality issues in their countries (54%), as was the case in the previous Eurobarometer Flash conducted 2012. This is the case in 20 of the 28 European Union Member States.

While Europeans do not feel well-informed, most of them say that **air quality has deteriorated** in the last ten years (58%). They are now even more likely to say this than

²⁵³ Conclusion as appear in European Commission (2019). Special Eurobarometer 497: ‘Attitudes of Europeans towards air quality’.

they were in 2017, with an 11-percentage point increase observed. In 19 Member States, more than half of the respondents agree. The less they feel informed, the more they feel air quality has deteriorated in the last 10 years.

Concerns about **the health and environmental consequences** due in part or mostly to air quality issues were tested. Most Europeans think that respiratory diseases (90%), cardio-vascular diseases (89%), and asthma and allergy (90%), and acidification and eutrophication (82%) are serious problems in their countries.

Despite the fact that a majority of respondents have taken some action to reduce harmful emissions, they still believe that not enough is being done and that actions should be carried out at a more global level.

While Europeans feel concerned about air quality issues, they believe that **not enough is being done** to address these issues. Around half of the respondents think that farmers (49%) and households (52%) are not doing enough. An even larger proportion of respondents think that car manufacturers (64%), energy producers (65%) and public authorities (66%) are not doing enough.

Despite the fact that a majority of respondents think that households should do more, seven in ten respondents have carried out **at least one action to reduce harmful emissions into the air**. This has increased by eight percentage points since 2017 and is one of the most positive results measured in this survey. This increase is mostly due to the increased proportion of respondents who say **they have replaced older energy-intensive equipment with new equipment with a better energy rating**, which represents 41% of the respondents (+9 percentage points since 2017). The more informed respondents feel about air quality, the more likely they are to have taken actions to address this issue.

The most effective measure to address air quality issues according to respondents is **stricter pollution controls on industrial and energy-producing activities**. This is mentioned by 44% of the respondents and is the first answer in 25 Member States. Their preferred level of action is the **international level** (72%) followed by the European and national levels (both 50%). The international level is the main level of action mentioned in 24 Member States. A significant proportion of the respondents believe that actions should be carried out at all levels (28%): international, European, national and regional levels.

Respondents want more actions on air quality standards at the EU level despite low awareness of the existing EU air quality standards

A minority of Europeans have heard of the **EU air quality standards** (31%). Except in Slovenia (51%), less than half of the respondents say they are aware of them. A large majority of the respondents who have heard of them, however, say that they **should be strengthened** (63%) [see Figure A10.1]. In all but five Member States, more than half of the respondents are of this opinion. Finally, more than seven in ten respondents think that the **EU should take additional measures to address these issues** (71%). This is the case in all Member States surveyed [see Figure A10.2].

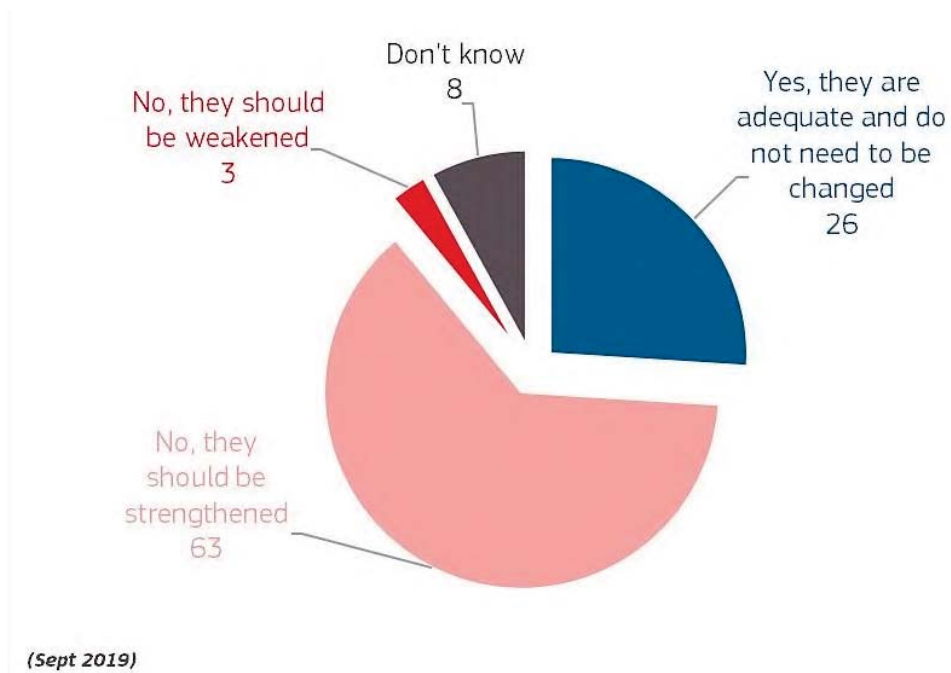


Figure A10.1: Replies to the question ‘Do you believe the existing EU air quality standards are adequate or not?’ (% - EU).
Source: Special Eurobarometer 497 (2019).

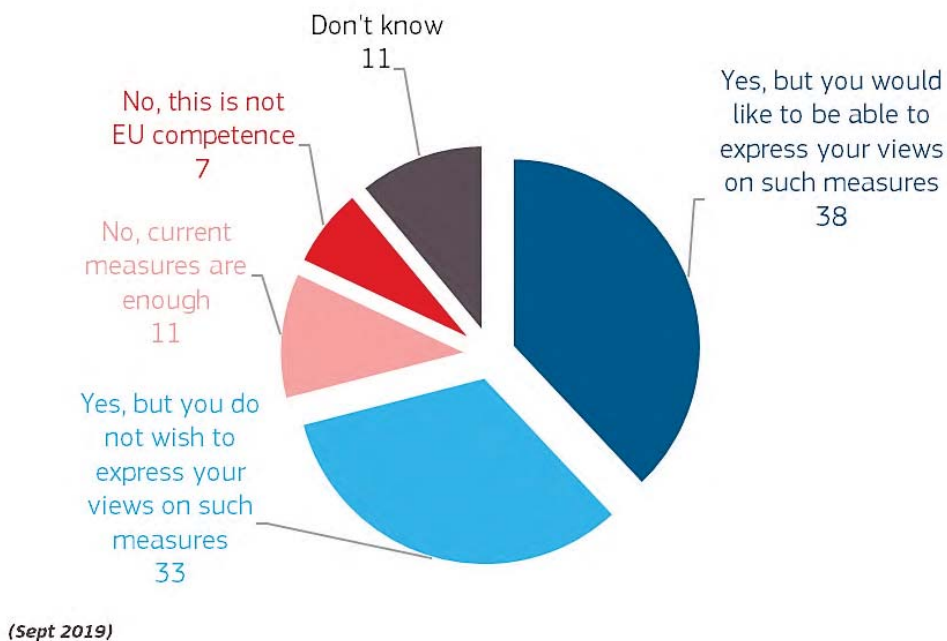


Figure A10.2: Replies to the question ‘Do you think the EU should propose additional measures to address air quality related problems in Europe?’ (% - EU).
Source: Special Eurobarometer 497 (2019).

Annex 11: Summaries of the seven case studies

Seven case studies have been carried out for the purpose of gathering more in-depth information for some of the evaluation questions. The main purpose of the case studies was to examine, in more detail, the situation regarding the experience and lessons learnt in the implementation of the AAQ Directives.

The case studies include a more detailed review of implementation and integration successes and problems, the costs of implementation and of non-implementation of the legislation and the administrative burden of implementation and opportunities for improving implementation without compromising the integrity of the purpose of the AAQ Directives. As such, the case studies complement the information gathered through other sources, such as desk review, targeted questionnaire, open public consultation, interviews, focus groups and stakeholder workshops (see section 4 of this SWD).

The focus for detailed case studies have been selected to include examples in Member States based on the following criteria:

- the level of compliance, including at least one Member State which is largely compliant and one which is not;
- the level of progress in addressing air quality issues: one Member State which has made high levels of progress and one Member State which has had poor progress in addressing air quality issues;
- at least one Member State that is faced with ongoing infringement proceedings and at least one that is not;
- ensuring a geographical balance, between northern and southern as well as eastern and western Member States;
- ensuring coverage of different scales of agglomerations and population density;
- at least one Member State with a higher level of economic development, and least one country with a lower level of economic development and funding for air quality;
- at least one Member State with a federal and at least one Member State with a centralized governance structure;
- there should be an availability of evidence in the Member State.

Based on the above criteria, the following seven Member States were selected: Bulgaria, Germany, Ireland, Italy, Slovakia, Spain and Sweden.

The seven case studies follow the same template and consistent methodology and questions. At the same time, each case study is unique and provides different insights into the country specific challenges and best practices in relation to the implementation of the AAQ Directives. Each case study is focusing on the implementation of the AAQ Directives and then on a specific topic or geographical area, in particular:

- **Bulgaria** with focus on air quality zone Plovdiv Agglomeration
- **Germany** with focus on Berlin Agglomeration
- **Ireland** with focus on public information provision
- **Italy** with focus on the Sicily region

- **Slovakia** with focus on Kosice region
- **Spain** with focus on Madrid
- **Sweden** with focus on rural environment and ecosystem impacts

The case studies relied on extensive desk research of relevant documents, 40 in-depth interviews with relevant national authorities (central, regional and local), representatives of businesses and business associations, representatives of NGOs, environmental and municipalities' associations, research institutions and health foundations.

Air quality continues to be a source of concern across all selected Member States although some variations exist depending on the situation in the specific country. Overall, the case studies find that the AAQ Directives are relevant in terms of their objectives and in terms of responding to current needs. Broadly speaking, the type of pollutants regulated by the AAQ Directives are relevant and there are some variations in terms of the types of pollutants relevant for different Member States.

However, some findings suggest that important pollutants which are a source of concern in certain Member States are not regulated by the AAQ Directives (e.g. black carbon, ammonia, ultrafine particles). Furthermore, the provisions related to the air quality standards are considered to be relevant across all country case studies but, in some instances, the need for more stringent air quality standards was noted.

Table A11.1 – Assessment of relevance of the AAQ Directives in the case studies²⁵⁴

Bulgaria	<p>Air quality is considered to have deteriorated in the past 10 years by 59% of the respondents to Special Eurobarometer 468 (2017).</p> <p>The AAQ Directives are assessed to address the needs at national level (e.g. in terms of monitoring of air quality, provision of information and planning of measures).</p> <p>The AAQ Directives are considered to target relevant pollutants but the limit values do not sufficiently reflect specific local, climate or social conditions.</p>
Germany	<p>Air quality is considered to have deteriorated in the past 10 years by 29% of the respondents to Special Eurobarometer 468 (2017).</p> <p>The AAQ Directives are assessed to address the needs at national level and are considered to be essential (in particular the monitoring and assessment and the limit values)</p> <p>Pollutants regulated by AAQ Directives remain relevant and there is a need to further focus on pollutants with a high effect on human health (e.g. PM_{2,5}, ultrafine particles).</p>
Ireland	<p>Air quality is positively regarded by citizens as only 17% of Irish citizens consider that air quality has deteriorated in the last 10 years, while 33% suggest that it has improved, according to Special Eurobarometer 468 (2017)</p> <p>The AAQ Directives provisions are considered to be relevant, in particular limit values; there is also evidence that the regulatory framework should be expanded to include PM₁.</p>

²⁵⁴ Based on: support study informing this Fitness Check, Appendix I.

Italy	<p>A majority of citizens responding to Special Eurobarometer 468 (2017) perceived air quality as having deteriorated in the past 10 years (61% of respondents).</p> <p>The AAQ Directives provisions have been and remain relevant, in particular in relation to air quality plans and limit values which are important to mitigate the negative effects of air pollution.</p>
Slovakia	<p>Air quality is a source of concern for 43% of respondents to Special Eurobarometer 468 (2017) that consider air quality in Slovakia remained the same over the past 10 years and a similar amount considered it has deteriorated.</p> <p>The objectives of the AAQ Directives, in particular those related to the availability of information to the public and monitoring of long-term trends were considered to be relevant.</p> <p>There are different views amongst stakeholders in terms of the air quality standards and whether the existing air quality standards are too lenient.</p>
Spain	<p>Air quality is a concern for Spanish citizens, with 68% of respondents of Special Eurobarometer 468 (2017) considering air quality in the country to have deteriorated over the past 10 years.</p> <p>The current AAQ Directives provisions were considered to be relevant, but findings suggest that the AAQ Directives should be stricter with new pollutants added and stronger limits imposed.</p>
Sweden	<p>Air quality continues to be a concern in Sweden, as Special Eurobarometer 468 (2017) indicates that 46% of respondents perceived air quality stayed the same in the past 10 years and 24% that it has deteriorated.</p> <p>Air quality standards imposed by the AAQ Directives are relevant but the Swedish legislation goes beyond the values imposed in the AAQ Directives and a need to set a daily limit for PM_{2.5} was indicated.</p>

The case study findings indicate that the selected Member States have monitoring and assessment networks that are generally in line with the requirements of the AAQ Directives.

Table A11.2 – Air quality monitoring in the case studies²⁵⁵

Bulgaria	Responsibility of the local authorities together with the ministry of environment: comprises 48 monitoring stations: 30 fixed automated measuring, 5 differential optical absorption spectroscopy, and 9 stations for manual sampling).
Germany	Responsibility of the German states and the Environment Agency (Umweltbundesamt): Air quality is measured in 650 monitoring station throughout Germany.
Ireland	Responsibility of EPA and local authorities; the monitoring network meets the requirements of the AAQ Directives but some rural and urban areas are left without assessment.

²⁵⁵ Based on: support study informing this Fitness Check, Appendix I.

Italy	Responsibility of the regions and autonomous provinces (regional/local) and the Italian National Institute for Environmental Protection and Research – ISPRA (national). Improvements of the monitoring network planned under Sicily's Operational Programme.
Slovakia	Responsibility of the Slovak Hydrometeorological Institute and local authorities. Monitoring network had 34 monitoring stations (2007). In 2016, the monitoring network had 38 stations. Shortcomings in the monitoring in terms of number of sampling points.
Spain	Responsibility of the autonomous communities and municipalities: 600 fixed measurement stations at national level.
Sweden	Responsibility of the Swedish EPA (rural) and municipalities (urban). Each municipality monitors NO _x , SO _x , CO, PM ₁₀ , PM _{2.5} , benzene, BaP, As, Cd, Ni, Pb. Swedish EPA monitors PM _{2.5} , NO ₂ , SO ₂ , O ₃ .

Some Member States provide real-time data on air quality through a variety of tools but the quality of the information is of varying levels (see examples in the table below). This is supported also by the findings from the European Court of Auditors, which flagged some good practices in this regard and pointed out that the quality and availability of public information on air quality in the Member States was not always found to be clear or useful for the citizens regarding the health impacts and measures to take to mitigate risks.²⁵⁶ Also, the study found that Member States, regions and cities defined air quality indices differently, resulting in different assessments of the same air quality, somewhat compromising the credibility of the information provided

Table A11.3 – Information to the public in the case studies²⁵⁷

Bulgaria	Daily bulletin on exceedances on air quality Quarterly bulletins on air quality Common SMS system for exceedances and alert thresholds Information boards and information on websites of municipalities
Germany	Website of the German Environment Agency (UBA) Annual Report of the German Environment Agency (UBA) Dedicated websites of federal states

²⁵⁶ European Court of Auditors Special Report on Air Pollution. See section 1 of Annex 9 to this SWD.

²⁵⁷ Based on: support study informing this Fitness Check, Appendix I.

Ireland	<ul style="list-style-type: none"> Air Quality Index for Health (AQIH) Periodic Air Quality bulletins and reports Citizen engagement and citizen science Historical data on air quality publicly accessible Real-time localised particulate matter monitoring data
Italy	<ul style="list-style-type: none"> Websites of regions containing air quality information Forecasting tool providing real time data (48-72 hours forecast) Annual Report on Quality of the Urban Environment, ISPRA Spatial maps using modelling Notification during pollution peaks (SMS or email) Data series that are downloadable for analysis
Slovakia	<ul style="list-style-type: none"> Website providing air quality and exceedances information (Slovak Hydrometeorological Institute and district offices) Near real-time data on concentrations on the website (most recent hourly and daily values) Annual Report on air quality
Spain	<ul style="list-style-type: none"> Website providing information (Ministry of Environment) Smartphone app
Sweden	<ul style="list-style-type: none"> Website providing air quality information (EPA) Datasets with air quality measurements Annual Reports Information on air quality provided by municipalities

The case studies also addressed the issue of costs of the implementation and the costs of non-implementation of the AAQ Directives in the Member States. Data on the costs of implementation and the costs of non-implementation of the AAQ Directives was difficult to find; this is primarily due to the limited number of studies at national level looking into these aspects.

Table A11.4 – Costs of implementation in the case studies²⁵⁸

Bulgaria (national)	<ul style="list-style-type: none"> Monitoring (of environment): EUR 1.9 million Air quality plans: EUR 1.5 million (approx. EUR 50 000 per plan) Air quality measures: EUR 156.8 million
Germany	No data available for this case study

²⁵⁸ Based on: support study informing this Fitness Check, Appendix I.

Ireland (Dublin)	Monitoring (infrastructure): EUR 160 000 (since 2008) EPA annual capital replacement cost: EUR 380 000 per year EPA annual staff cost for AAQ Directives: EUR 493 000 per year Dublin City Council monitoring infrastructure capital cost: EUR 160 000 Dublin City Council monitoring infrastructure operating cost: EUR 15 000 per year Costs of time spent by the relevant persons involved in making measurements, calculations, predictions or estimations in Dublin: EUR 300 000 per year Total annual costs (EPA and Dublin Council): EUR 1 806 735
Italy	Monitoring (varies across regions): between EUR 20 000 – EUR 32 000 per station (approx. EUR 5 million per year for all stations) Monitoring (maintenance): EUR 300 000 per year
Slovakia	Ministry of Environment: estimated in the range of EUR tens of millions per year Monitoring (operating): EUR 1.2 million per year
Spain	Plan AIRE implementation: EUR 600 000 Monitoring network maintenance (national): variable according to area (between EUR 100 000 and over EUR 1 million) Contracts with laboratories: EUR 30 000 per year.
Sweden	EPA budget for AAQ: EUR 400 000 per year (approx. EUR 200 000 to EUR 300 000 for AAQ Directives). Total estimated annual cost for all fixed measurements (EUR): EUR 1 859 490 Modelling (regional background concentrations of O ₃ , NO ₂ , SO ₂) annual cost: EUR 65 000 Reference laboratory quality check of data: EUR 50 000

Table A11.5 – Costs of non-implementation in the case studies²⁵⁹

Bulgaria	Health related external costs: EUR 3 billion per year (2010) Premature deaths: 14,200 (PM), 640 (NO ₂), 350 (O ₃) (2015) Total costs (health and non/health) due to traffic pollution: EUR 612 to EUR 778 million (2016)
Germany	No data was available for this case study.
Ireland	No data was available for this case study.
Italy	No data was available for this case study.

²⁵⁹ Based on: support study informing this Fitness Check, Appendix I.

Slovakia	Health related external costs: EUR 3 billion per year (2010) Direct economic costs: 1.3 million workdays lost due to sickness, for healthcare of above EUR 10 million per year (income adjusted, 2010), and for agriculture (crop losses) of EUR 35 million per year (2010). Premature deaths: 5 160 (2014)
Spain	Costs of road pollution (both health and non-health related): between EUR 3 916 million and EUR 4 836 million
Sweden	Health related external costs: EUR 3 billion per year (2010) Premature deaths: 7 600 (2015) Socio-economic costs: EUR 5.4 billion (2015)

The majority of the selected Member States made use of EU funding to improve air quality to varying degrees.

Table A11.6 – Use of EU funding to fund air quality improvements (examples from the case studies)²⁶⁰

Bulgaria	Cohesion policy funds: under OP Environment 2007-2013, adjacent measures (e.g. waste management, public transport) which also supported air quality objectives Cohesion policy funds: under OP Environment 2014-2020 specific objective <i>Reducing ambient air pollution by lowering the quantities of PM₁₀ and NO_x</i> (EUR 50 million)
Germany	ERDF: 6 programmes related to air quality 2014-2020 (EUR 92.3 million). LIFE: use of funding to finance 30 projects related to air quality.
Ireland	Horizon 2020: iSCAPE project LIFE Programme includes air quality and emissions as a thematic priority
Italy	ERDF: Air quality priority (priority code 47) for the 2007-2013 period (EUR 25.4 million) ERDF: Air quality priority (priority code 83) for the 2014-2020 period (EUR 30.7 million) EAFRD: Rural Development programmes include funding for reducing agricultural emissions LIFE Programme: PREPAIR Project (EUR 10 million – EU); OPERA
Slovakia	ESF: environmental investments for the 2007-2013 period (EUR 1.82 billion) ESF: environmental investments for the 2014-2020 period (EUR 215 million)
Spain	ERDF: OP ‘Actions to improve the environment in cities’ including air quality measures (EUR 24 million)
Sweden	LIFE Programme: supported air quality actions (e.g. CLEANTRUCK project)

The allocation of responsibilities in relation to air quality is split between the national, regional and local level across selected Member States, as illustrated in the table below.

²⁶⁰ Based on: support study informing this Fitness Check, Appendix I.

Broadly speaking, the central governance (Ministry of Environment or Environmental Protection Agency) is responsible for the regulation and supervision of air quality.

Monitoring and assessment is devolved at regional and local level in all Member States with the oversight of the national authorities. Air quality plans are generally the responsibility of local and regional levels.

The case studies highlighted that, in some cases, difficulties in effective coordination amongst different levels of government within Member States can be noted. The issue of coordination seems to arise especially when different levels of governance are involved (e.g. local-central, local-regional). This is due to the fact that in some instances, air quality plans contain measures that fall in the remit of responsibility of other national or regional authorities. Such situations can lead to a decreased effectiveness and added value of air quality plans

Table A11.7 – Examples of instances of coordination (or lack of coordination) of air quality plans measures identified in the case studies²⁶¹

Bulgaria	<p>Central level: Instances of good coordination between national authorities (ministries) were found (e.g. coordination of Ministry of Environment with Ministry of Labour, Ministry of Transport). However, further coordination can be sought in relation to energy (Ministry of Energy).</p> <p>Local/regional level: Coordination between local and central level is insufficient. For example, 25 Bulgarian municipalities have signed the Covenant of Mayors and prepared Sustainability Energy Action Plans. Of those, two have signed also the Mayors Adapt initiative and are expected to prepare Sustainable Energy and Climate Action Plans (SECAPs). Even though some of these municipalities also have air quality problems, links between the SEAPs/SECAPs and the municipal air quality plans are hardly found. In addition, the municipalities rarely update their SEAPs and thus do not take advantage of the available guidance on how to integrate different policy concerns in their SEAPs. Few municipalities in Bulgaria have a Sustainable Urban Mobility Plan (SUMP) but in general air quality has not been a focus area of those plans. Air quality plans could also be integrated or linked with municipal/urban/regional level planning e.g. in the area of land use and spatial planning.</p>
Italy	<p>Central level: Instances of good coordination between national authorities (ministries) were found (e.g. 2013 Action Plan). Coordination has also improved as a result of the work of a coordination body that prepared national guidelines to avoid regional fragmentation.</p> <p>Local/regional level: Coordination on air quality plans at local level has improved and has spurred coordination with mobility plans, rural development and energy efficiency initiatives. The plans have strengthened coordination between regional and municipal levels and among municipal governments.</p>

²⁶¹ Based on: support study informing this Fitness Check, Appendix I.

Ireland	<p>Central level: Coordination between authorities at central level is found. For example, coordination has taken place when it comes to the setup of the National Clean Air Strategy.</p> <p>Local/regional level: Strong and productive culture of collaborative partnership working between the Irish authorities and institutions at subnational level. This has facilitated the integration of air quality objectives into a broad range of linked policy areas including urban planning and climate change, suggesting that the AAQ Directives have been cohesive with other areas of policy.</p>
Spain	<p>Central level: Coordination between authorities has taken place but can be further improved in particular between authorities responsible for air quality and authorities responsible for transport measures.</p> <p>Local/regional level: Coordination between authorities at local and regional level can be further improved. The coherence of the governance structure imposes difficulties when it comes to the implementation of measures to improve air quality that can fall in the remit of responsibility of authorities other than those at local level that are drafting the air quality measures.</p>
Slovakia	<p>Central level: Coordination between the authorities at central level has taken place when it comes to the Strategy for the Improvement of Air Quality in Slovakia.</p> <p>Local/regional level: Allocation of responsibilities and the somewhat limited coordination between different actors constituted a major barrier to the effective implementation of the AAQ Directives in Slovakia and in the Košice region. While, in principle, it is possible to elaborate effective measures for the air quality plans, it is not always possible to see them materialise. For example, the authorities in Slovakia may be well aware that a city bypass would likely improve air quality, but in practice it would be difficult to get such a bypass built because the district office, elaborating the measure, does not have the powers necessary to make the development decision.</p>
Sweden	<p>Central level: The central authorities coordinate in the adoption of strategic framework.</p> <p>Local/regional level: Coordination in terms of air quality plans between the local and central level can be further improved in some cases. In particular when it comes to the implementation of air quality plans certain measures that are included in the plans are in the remit of responsibilities of national authorities which makes it difficult to ensure their implementation. For example, air quality plans may require a reduction of pollutants in the proximity of national roads but the regulation of national roads is in the area of responsibility of the National Roads Administration. This imposed certain challenges in terms of translating measures into reality. In recent years cooperation has improved and the National Roads Administration has taken measures to secure air quality.</p>

Annex 12: Overview of costs and benefits identified

<i>Overview of costs and benefits identified in the evaluation²⁶²</i>		
Type of costs and benefits	Definition / subset	Estimates
Cost of air pollution (for EU)	Cost of air pollution (total)	EUR 330 and 940 billion per year <i>(based on source IA for Clean Air Programme, 2013)</i> EUR 730 billion in 2015 <i>(based on OECD)</i>
	Cost of poor implementation of AAQ Directives (foregone benefits)	EUR 240 billion for period 2008 to 2016 <i>(based on Support Study)</i>
Costs of all measures that result in air quality improvements	This includes costs of measures taken for other than air purposes	EUR 70 to 80 billion per year <i>(based on Amman et al, 2017)</i>
	Cost of measures directly linked to AAQ Directives	Estimate of Plovdiv agglomeration: EUR 25 million over period 2011 to 2015 <i>(based on case study in the Support Study)</i>
Health Benefits of measures taken to respond to AAQ Directives	This is only a small subset of overall benefits	EUR 50 billion for 2008 to 2016 <i>(based on Support Study)</i>
Administrative costs of AAQ Directives	Cost linked to the legal obligation to provide information (includes monitoring, reporting and assessment)	Per capita administrative costs of all air quality monitoring and reporting estimated EUR 0.14 and 0.98 per year, based on data from 8 Member States <i>(based on Support Study)</i> Ex ante estimate: EUR 24 000 per monitoring station, broadly in line with case study findings (which pointed to between EUR 7 500 and EUR 70 000, depending on Member State) <i>(based on Thematic Strategy on Air Pollution, and case studies in the Support Study)</i> . Annual cost for the EEA estimated at EUR 760 000 for period 2014 to 2016 <i>(based on Fitness Check Reporting & Monitoring)</i>
	Administrative burden (subset of administrative costs stemming specifically from the AAQ Directives)	Per capita estimate: EUR 0.12 to 0.38 per year, based on data from 3 Member States <i>(based on Support Study)</i>

²⁶² Note that methodologies differ for the different estimates; these should therefore not be compared (see section 5.3 and Annex 3 to this SWD for context and limitations).