

## New challenges in the air



Metrology for Regulation, 23 October 2023

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Joint Research Centre

#### **Road map of presentation**

- Joint Research Centre
- New developments regarding air policy
- Proposals of AQUILA Working Groups for revision of air policy
- Standardisation (AAQ & IED)
- Outlook with view on possible future metrology needs in AQ





### Joint Research Centre, Clean Air & Climate Unit



ACTRIS/EMEP/GAW/ICOS Atmospheric Observatory & European Reference Laboratory for Air Pollution







### Ambient Air Quality Directive(s)

Overall aim: Reduce air pollution to levels which minimise harmful effects on human health and the environment; improve the monitoring and assessment of air quality, and to provide information to the public.





Directives - 2004/107/EC - 2008/50/EC

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#### **Air Quality Directives**

Limit and Target values for human health protection

Directive **2008/50/EC** (PM2.5/PM10, SO2, NO/NO2, Pb, O3, CO, C6H6; OC/EC, ions)

Directive **2004/107/EC** (As, Cd, Ni, BaP; Hg, PAH)







# Air Quality Revision of EU Rules



February 2023

European Commission Clean Air & Urban Policy Unit

### EU clean air policy works ... but ...

EU urban population exposed to air pollution above **EU standards from 2000 to 2018** 

EU urban population exposed to air pollution above WHO (2021) guidelines in 2018 / 2019



7 Source(s): EEA Europe's air quality status 2021 & https://www.eea.europa.eu/themes/air/health-impacts-of-air-pollution

### Different policy options (example: for PM<sub>2.5</sub>)



### **Comparing policy options**

All three options would render **significant health and environment benefits**, which outweigh the implementation costs by 2030 – albeit to varying degrees.

Table 17 – A Comparison of policy options on level of alignment with the WHO Air Quality Guidelines (2030)						
	•	Baseline	Policy Option I-3	Policy Option I-2	Policy Option I-1	Key criteria:
Air Quality	PM <sub>2.5</sub>	25 µg/m3	15 µg/m3	10 µg/m3	5 µg/m3	
standard	NO <sub>2</sub>	40 µg/m3	30 µg/m3	20 µg/m3	10 µg/m3	
Exposed	PM <sub>2.5</sub>	333 million	267 million	243 million	226 million	- • Achievability
> WHO levels	NO <sub>2</sub>	52 million	46 million	44 million	42 million	
Is the standard	achievable	For >99% of PM <sub>2.5</sub>	For 99% of PM <sub>2.5</sub>	For 94% of PM <sub>2.5</sub>	For 29% of PM <sub>2.5</sub>	
with available m	neasures? <sup>(a)</sup>	sampling points	sampling points	sampling points	sampling points	Mitigation costs
Key economic i	mpacts					
Mitigation	Central	0	€3.3 bn	<b>( €5.6 bn</b>	€7.0 bn	
costs	If corrected	0	€1.0 bn	€5.1 bn	€7.0 bn	<ul> <li>Gross benefits</li> </ul>
	for 'border					
	cell effect' (b)					
Gross	Low <sup>(c)</sup>	0	€32.4 bn	(€41.8 bn	€45.0 bn	• Benefit vs Cost
benefits	High <sup>(d)</sup>	0	€93.8 bn	€121.4 bn	€130.8 bp	
Net	Low <sup>(c)</sup>	0	€29.0 bn	€36.2 bn	€37.9 bn	
benefits	High <sup>(d)</sup>	0	€90.4 bn	€115.7 bn	€123.6 bn	<ul> <li>Health impact</li> </ul>
Benefit-cost	Low <sup>(c)</sup>	-	10:1	7.5:1	6.1	
ratio	High <sup>(d)</sup>	-	28:1	21:1	19:1	
Net GDP impact	t	+ /- 0%	+ 0.26 %	+ 0.38 %	+ 0.44 %	
Key health impacts <sup>(e)</sup>						
Annual prema-	Due to PM <sub>2.5</sub>	56 100	38% less	49% less	53% less	
ture mortality	Due to NO <sub>2</sub>	4 050	12% less	10% less	20% less	





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Commission

### What does our proposal improve?

### **Environment & health**

- Zero pollution objective at the latest by 2050
- Intermediate 2030 EU air quality standards
- Update of **other air quality metrics**, including more refined average exposure obligations
- Regular review mechanism

### **Governance & enforcement**

- Air quality plans to be more effective in **ending** and **preventing exceedances** of EU standards
- **Improved enforceability**: new provisions on access to justice, compensation and penalties
- More transboundary cooperation on air quality

### Monitoring & assessment

- Refined approach to air quality monitoring, increased use of air quality modelling
- Additional information on representativeness of sampling points, better inform air quality action
  - Monitoring **pollutants of emerging concern** (e.g. ultrafine particles, black carbon, ammonia)

### Information & communication

- More up-to-date air quality information
- Requirements for **air quality indices** to provide hourly reporting of available air quality data
  - Informing the public about possible health
     impacts and provide recommendations





### Environment & health: 'air quality standards'

#### EU air quality standards – 'long-term' averages (Annex I)

Pollutant	Period	Until 2030	As of 2030		WHO 'Guideline'
PM <sub>2.5</sub>	(calendar year)	25 µg/m³	10 µg/m³		5 µg/m³
PM <sub>10</sub>	(calendar year)	40 µg/m³	20 µg/m³		15 µg/m³
NO <sub>2</sub>	(calendar year)	40 µg/m³	20 µg/m³		10 µg/m³
SO <sub>2</sub>	(calendar year)	-	20 µg/m³		-
Benzene	(calendar year)	5 µg/m³	<b>3.4 μg/m</b> <sup>3</sup>		1.7 μg/m³
Pb (lead)	(calendar year)	0.5 μg/m <sup>3</sup>	0.5 μg/m³		0.5 µg/m³
As (arsenic)	(calendar year)	6 ng/m³	6.0 ng/m <sup>3</sup>		6.6 ng/m <sup>3</sup>
Cd (cadmium)	(calendar year)	5 ng/m³	5.0 ng/m <sup>3</sup>		5 ng/m <sup>3</sup>
Ni (Nickel)	(calendar year)	20 ng/m <sup>3</sup>	<b>20 ng/m</b> <sup>3</sup>		25 ng/m <sup>3</sup>
Benzo(a)Pyrene	(calendar year)	1 ng/m <sup>3</sup>	1.0 ng/m <sup>3</sup>		0.12 ng/m <sup>3</sup>
Ozone	(5yr avg AOT 40)	18.000 µg/m³ x h	18.000 µg/m³ x h	(target value)	-
Ozone	(5yr avg AOT 40)	6.000 µg/m³ x h	6.000 µg/m³ x h	(long-term obj.)	-



### Environment & health: 'air quality standards'

#### EU air quality standards – 'short-term' averages (Annex I)

Pollutant	Period	Until 2030	As of 2030		WHO 'Guideline'
PM <sub>2.5</sub>	(1 day)	-	<b>10 µg/m³</b> (-18d)		5 µg/m³ (-3d)
<b>PM</b> <sub>10</sub>	(1 day)	40 µg/m³ (-35d)	<b>20 μg/m³</b> (-18d)		15 µg/m³ (-3d)
NO <sub>2</sub>	(1 day)	-	<b>50 μg/m³</b> (-18d)		50 µg/m³ (-3d)
NO <sub>2</sub>	(1 hour)	200 µg/m³ (-18h)	<b>200 μg/m</b> ³ (-1h)		200 µg/m³ (-1h)
SO <sub>2</sub>	(1 day)	125 µg/m³ (-3d)	<b>50 μg/m³</b> (-18d)		40 µg/m³ (-3d)
SO <sub>2</sub>	(1 hour)	350 µg/m³ (-24h)	<b>350 μg/m</b> ³ (-1h)		-
CO	(1 day)	-	<b>4 mg/m³</b> (-18d)		4 mg/m <sup>3</sup> (-3d)
CO	(8 hour max)	10 mg/m <sup>3</sup>	10 mg/m <sup>3</sup>		10 mg/m <sup>3</sup>
Ozone	(3yr avg 8h max)	120 µg/m³ (-25d)	<b>120 µg/m³</b> (-18d)	(target value)	100 µg/m³ (-3d)
Ozone	(3yr avg 8h max)	120 µg/m³ (-3d)	<b>100 µg/m³</b> (-3d)	(long-term obj.)	100 µg/m³ (-3d)



### Monitoring & assessment: 'refined approach'





**Regime 1** - fixed sampling points shall be used and shall be supplemented by modelling to assess air quality.

**Regime 2** - fixed sampling points shall be used, but can be reduced by up to 50% under conditions (i.e. if there is sufficient modelling and/or indicative measurements).

**Regime 3** - assessment shall be based either on fixed sampling points modelling applications, indicative measurements, and/or objective-estimation techniques.





### Monitoring & assessment: 'new pollutants & supersites'

Article 4 includes **new definitions** (new BC, UFPs, objective estimation, spatial representativeness, rural background, supersite...)

Article 10 introduces monitoring supersites [...] on air pollutants of emerging concern such as UFPs, BC,  $NH_3$  or the oxidative potential of particulate matter. Also: Annex III and VII

Annex III & VII refer to monitoring of **ultrafine particles (UFP)** at locations where high concentrations of UFP are likely, such as at or close to airports, ports, roads, industrial sites or domestic heating.

Annex VII updates the list of **volatile organic compounds (VOC)** recommended for measurements that aim to improve the understanding of ozone formation and management.

#### The AQUILA Network





- Network founded in 2002.
- Comprises 37 National Air Quality Reference Laboratories.
- Observers from EU accession and EFTA countries, EEA, CEN, WHO, BIPM, RI-URBANS.
- Objective to provide technical support to the development and implementation of correct measurements under the EU air quality directives:
  - Providing expert judgement on matters regarding measurement strategy.
  - > Co-ordinating QA/QC activities at national and EU level, method development and validation.
  - Participating in standardisation activities.
  - Developing common research projects and pilot studies.
  - Organising training courses, workshops and conferences.
- Achievements & topics, e.g. contribution to development and validation of CRMs, guidance documents, QA/QC programmes, training uncertainty estimation, type approval, accreditation, equivalence testing, workshops on sensors, input to review of air policy.



### Seven AQUILA positions for the AQD revision (2021)

1) Network design/measurement strategy

#### 2) Data quality objectives

- 3) Indicative measurements/objective estimation
- 4) Update of reference methods and review of other references
- 5) Quality Assurance
- 6) Additional pollutants
- 7) Ozone precursors





#### 2. Data quality objectives (DQO)

- Combination of pollutants into one table.
- Annex DQO revision proposed: from absolute value to percentage.
- Proposal for DQO at lower concentrations (new WHO targets).
- Updated references for standards to be used for uncertainty evaluation.
- Proposal for revised data coverage.
- Guidance need: uncertainty of indicative measurements.

Need for reference materials at lower concentrations

	No. 11		1				
Α.	Data quality	objectives	tor	ambient	air	quality	assessment

	Sulphur dioxide, nitrogen dioxide and oxides of nitro- gen and carbon monoxide	Benzene	Particulate matter (PM <sub>10</sub> /PM <sub>2.5</sub> ) and lead	Ozone and related NO and NO <sub>2</sub>
Fixed measurements (1)				
Uncertainty	15%	25 %	25 %	15%
Minimum data capture	90 %	90 %	90 %	90 % during summer 75 % during win- ter
Minimum time coverage:				
- urban background and traffic		35 % (2)	1	20
<ul> <li>industrial sites</li> </ul>		90 %	-	
Indicative measurements				
Uncertainty	25 %	30 %	50 %	30 %
Minimum data capture	90 %	90 %	90 %	90 %
Minimum time coverage	14 % (4)	14 % (3)	14 % (4)	> 10 % during summer
Modelling uncertainty:				
Hourly	50 %	-0	11 <b></b> 12	50 %
Eight-hour averages	50 %	-	-	50 %
Daily averages	50 %	-	not yet defined	-
Annual averages	30 %	50 %	50 %	-
Objective estimation Uncertainty	75 %	100 %	100 %	75%

Member States may apply random measurements instead of continuous measurements for brazene, lead and particulare mater (if they can demonstrate to the Conmission that the uncertainty, including the uncertainty due to random sampling, meets the quality objective of 25 % and the time coverage is still larger than the minimum time coverage for indicative measurements. Random sampling must be evenly distinisted over the yar in order to avoid societies of the uncertainty due to random sampling, may be determined by the procedure laid down in ISO 1122 (2002) /th Quality — Determination of the Uncertainty of the Time Average of Air Quality Measurements.<sup>1</sup> If random measurements are used to assess the requirements of the PM<sub>4</sub>, limit value, the 90.4 percentile to be lower than or equal to 50 µg/m<sup>2</sup>) should be evaluated instead of the number of exceedances, which is highly influenced by data coverage.

P) Distributed over the year to be representative of various conditions for climate and traffic.

One day's measurement a week at random, evenly distributed over the year, or eight weeks evenly distributed over the year.
 One measurement a week at random, evenly distributed over the year, or eight weeks evenly distributed over the year.

The uncertainty (expressed at a 95% confidence level) of the assessment methods will be evaluated in accordance with the principles of the CEN Guide to the Expression of Uncertainty in Measurement (ENV 13005-1999), the methodology of ISO 3723/1994 and the guidance provided in the CEN report 'air Quility — Approach to Uncertainty Estimation for Ambient Air Reference Measurement Methods' (RX 143772002B). The percentages for uncertainty in the above table are given for individual measurements averaged over the period condidered by the limit value for target value in the case of ozone), for a 95% confidence interval. The uncertainty for the fixed measurements shall be interpreted as being applicable in the region of the appropriate limit value (or target value in the case o coone).





#### 4. Update of reference methods and review of other references

2008/50/EC Annex IV and	VI
&	
2004/107/EC Annex IV:	

- Update all EN standards to most recent versions.
- Add references to OC/EC and ions standards.
- Add reference to automated PM measurement standard.
- Proposal to revise Guide to Demonstration of Equivalence.

EUROPEAN STANDARD NORME EUROPÉENNE	EN 12341
EUROPÄISCHE NORM	May 2014
ICS 13.040.20	Supersedes EN 12341:1998, EN 14907-200
Er	nglish Version
Ambient air - Standard gravi determination of the PM suspended	imetric measurement method for the $_{10}$ or PM <sub>2.5</sub> mass concentration of d particulate matter
Air ambiant - Méthode normalisée de mesurage gravémétrique pour la détermination de la concentration massique MP <sub>10</sub> ou MP <sub>13</sub> de matiere particulaire en suspension	Auteriuft - Gravimetrisches Standardmessverfahren für d Bestimmung der PM <sub>er</sub> -oder PM <sub>er</sub> -Massenkonzentration des Schwebstaubes
This European Standard was approved by CEN on 10 April 201	14.
CEN members are bound to comply with the CEN/CENELEC in Standard the status of a national standard without any alteratio standards may be obtained on application to the CEN-CENELE	ternal Regulations which stipulate the conditions for giving this European n. Up-to-date lists and bibliographical references concerning such national IC Management Centre or to any CEN member.
This European Standard exists in three official versions (Englis) under the responsibility of a CEN member into its own language status as the official versions.	h, French, German). A version in any other language made by translation and notified to the CEN-CENELEC Management Centre has the same
CEN members are the national standards bodies of Austria, Be Finland, Former Yugoslav Republic of Macedonia, France, Gen Lusembourg, Malia, Netherlands, Norway, Poland, Portugal, Ri Kingdom.	lgiam, Bulgana, Croatia, Cryprus, Czech Republic, Denmark, Estonia, many, Gresce, Hungary, Iceland, Insland, Italy, Labria, Lithuania, omania, Slovakia, Slovenia, Spain, Sweden, Swelzeniand, Turkey and United
	-eo
EUROPEAN COMM COMITE EUROP EUROPAISCHES	ITTE FOR STANDARDIZATEN ERI DE NORMALISATION KOMITEE FÜR NORMUNG





### 6. Additional pollutants

**Fine combustion particles**: eq BC or EC & Levoglucosan in urban areas and in other areas with a high amount of wood burning.

**Ammonia**: NH<sub>3</sub> monitoring in areas where high concentrations are expected and in areas where critical loads are exceeded.

**Ultra-fine particle number**: PNSD monitoring at urban super-sites, or PNC measurements as first technical step towards PNSD measurements.

Particulate matter oxidative potential: to be performed at urban sites under research projects.

Metals: expand the list of heavy metals to be monitored at sites where As, Cd, Pb and Ni are already monitored.

Hydrogen sulfide ( $H_2S$ ) or total reduced sulphur compounds (TRS): monitoring of  $H_2S$  or TRS in areas where people live close to known sources of  $H_2S$ .

Nitro-PAHs and Pesticides: monitoring where high concentrations are expected.





### 7. Ozone precursors

Proposal to consider

- Current CEN efforts to standardise VOC measurement techniques.
- Monitoring objective -> time resolution -> measurement technique.
- Establish better link to European and international assessment programmes.
- Do not exclude new/advanced measurement techniques for detection of non-target compounds/emission sources.
- DQO: best method performance for considered sampling and analytical method.
- Proposal for table with ~45 compounds grouped into "chemical families" (aldehydes, aromatics, terpenes, ....).





#### **New Pollutants and Supersites**

The proposal for a revised Air Quality Directive (October 2022) follows most AQUILA proposals (concerning the new pollutants and super-sites).

Future work for AQUILA:

Super-sites:

- develop criteria,
- find solutions to combine routine and research,
- available infrastructure of the monitoring networks.

New pollutants (UFP, eBC, ox. potential, NH3, nitric acid, levoglucosan):

- check for available standards,
- feasibility for networks,
- costs and resources,
- alternative measurements/equivalent methods,
- develop QA/QC measures,
- support transfer from research level to routine level.





### **Ambient Air Quality Standardisation Requests**

\* Standardisation Request M/561 (VOC/ozone precursors) from June 2019

\* The 2022 annual EU work programme for European standardisation (published in February 2022)

<u>**Ref 14:**</u> Ambient air quality - Performance of sensor-based systems measuring air pollution Develop validated test standard(s) to evaluate the performance of sensor-based systems measuring air pollution. *The standard will evaluate if sensor-based systems comply with the data quality objectives in Directive 2008/50/EC.* 

Ref 15: Ambient air quality – modelling-based assessments

Develop standards ensuring that modelling-based assessments of air quality are objective, reliable and comparable, and of sufficient quality to generate reliable information about concentrations of air pollutants in ambient air.

<u>**Ref 16:**</u> Ambient air quality - measurement methods for monitoring polycyclic aromatic hydrocarbons in ambient *Develop standards for the reference methods for measuring concentrations in ambient air of polycyclic aromatic hydrocarbons.* 

Advancing on mandates for PAH, sensors and modelling quality objectives: Adoption of Commission Implementing Decision on standardisation request (foreseen for 2024)



### IED Standardisation mandates 1/2

Pollutant/Parameter	AUWP	State of play
Automated measurement method for gaseous hydrogen chloride in waste gases	2012	Mandate M/513*
Quantitative measurement of fugitive / diffuse VOC emissions from industrial sources	2012	Mandate M/514*
Long-term sampling of PCDDs/PCDFs and dioxin-like PCBs	2022	Mandate M/588 adopted in October 2022
Long-term sampling and measurement of mercury using sorbent traps	2022	Mandate under discussion
Measurement of formaldehyde	2022	Mandate under discussion

**NB: AUWP = Annual Union Work Programme for Standardisation** 

\* Standards published

Info kindly provided by Mr Siefridt (06/2023) DG Environment, Unit C.4 - Industrial Emissions & Safety



### IED Standardisation mandates 2/2

Pollutant/Parameter	AUWP	State of play
Measurement of ammonia	2018	Mandate preparation has not yet started
Measurement of chlorine and chlorine dioxide	2018	Mandate preparation has not yet started
Measurement of hydrogen fluoride/total gaseous fluorides	2018	Mandate preparation has not yet started

The mandates need to be reintroduced in future AUWP

Info kindly provided by Mr Siefridt (06/2023) DG Environment, Unit C.4 - Industrial Emissions & Safety



#### Outlook

Input from AQUILA was sent to European Commission end of 2021. Revised uncertainties at WHO interim and guideline levels was submitted summer 2022.

Proposal for revised EU ambient air quality legislation presented on 26 October 2022.

On-going discussions in Parliament and Council.

Estimate: 2024/2025 adoption of new Ambient Air Quality Directive?

Possible future need of reference materials at lower air concentrations, new reference materials and/or reference methods for equivalent black carbon, elemental carbon, levoglucosan, ammonia, nitric acid, ultra-fine particles and PM oxidative potential.



# Thank you

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