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COMMISSION IMPLEMENTING DECISION (EU) .../...
of XXX

laying down rules for the application of Directive (EU) 2024/2881 of the European Parliament and of the Council as regards technical details for modelling applications and determining the spatial representativeness of sampling points

(Text with EEA relevance)

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(Text with EEA relevance)

THE EUROPEAN COMMISSION,

Having regard to the Treaty on the Functioning of the European Union,

Having regard to Directive (EU) 2024/2881 of the European Parliament and of the Council of 23 October 2024 on ambient air quality and cleaner air for Europe¹, and in particular Article 8(7) thereof,

Whereas:

- (1) Directive (EU) 2024/2881 establishes air quality standards and air quality monitoring and reporting in order to ensure a high level of protection for human health and the environment.
- (2) Considering the advances in air quality modelling over the last decades, Directive (EU) 2024/2881 provides for a more prominent role for air quality modelling, including in relation to air quality assessment and determining spatial representativeness of sampling points.
- (3) Articles 8 and 23 of the Directive require Member States to undertake air quality assessments and to report the findings of those assessments to the Commission on an annual basis. To that end, Member States are allowed to use different methods, namely fixed measurements, indicative measurements, modelling applications, and objective estimations.
- (4) Points B.2(i), B.5, D.2 and D.10 of Annex IV to Directive (EU) 2024/2881 require Member States to determine and to publish information on the spatial representativeness of all sampling points.
- (5) The Commission is to set out rules concerning the technical details for modelling applications and the determination of the spatial representativeness of sampling points. In order to reflect current knowledge and good practices on air quality assessment and on determining the spatial representativeness of sampling points as provided in the technical support document on the use of modelling for various application domains under Directive (EU) 2024/2881², it is appropriate to set out such rules in the form of minimal technical requirements for the use of modelling applications, as well as minimum quality assurance criteria and validation principles for modelling

¹ OJ L, 2024/2881, 20.11.2024, ELI: <http://data.europa.eu/eli/dir/2024/2881/OJ>.

² Air quality modelling for air quality policy - Technical support document on the use of modelling for various application domains under the Ambient Air Quality Directive, April 2025, ISBN 978-92-68-27149-0.

applications used for air quality assessment and for determining the spatial representativeness of sampling points.

- (6) Points D.2, D.9 and D.10 of Annex IV to Directive (EU) 2024/2881 require Member States to assess the spatial representativeness of all sampling points at least every five years. That representativeness assessment is to be used in various situations as laid down in Article 8(4) and (5), Article 9(7) and Point B2.(i) of Annex IV to Directive (EU) 2024/2881. In order to ensure that the spatial representativeness of sampling points is determined in a comparable manner across Member States, it is appropriate to provide technical details on how to perform the spatial representativeness assessment. Therefore, it is necessary to set out the methods and the criteria for assessing the spatial representativeness of sampling points and to establish a step-by-step methodology for this assessment via measurements and modelling applications. Furthermore, in order to understand to which extent a zone is covered by the different areas of representativeness determined for sampling points, it is necessary to set out the methodology for producing a spatial representativeness area map at the zone level.
- (7) In point A of Annex V to Directive (EU) 2024/2881, it is recognised that the use of modelling applications and indicative measurements leads to higher uncertainty than fixed measurements. Therefore, it is appropriate to set out rules on how results from modelling applications and indicative measurements are to be taken into account when assessing air quality and how potential exceedances that are identified by those assessment methods can be verified. It is also necessary to provide rules on how Member States are to use modelling results to provide information on the spatial distribution of air pollutants concentrations, to identify potential hotspots in the zone, and to provide information on the modelled area of the exceedance.
- (8) In order to allow Member States sufficient time to adapt to the technical requirements laid down in this Decision, its application should be deferred. A period of two years from the date of adoption is considered appropriate and proportionate in view of the administrative and technical adjustments required.
- (9) The measures provided for in this Decision are in accordance with the opinion of the Ambient Air Quality Committee,

HAS ADOPTED THIS DECISION:

Article 1

Definitions

For the purposes of this Decision, the following definitions apply:

- (1) ‘area of interest’ means a part of the territory of a Member State targeted for a specific assessment of air pollutant concentrations by a modelling application;
- (2) ‘concentration interval’ means the range of the concentration levels of a given pollutant taking into account the maximum applicable uncertainty;
- (3) ‘central value’ means the modelled or measured concentration of a given pollutant around which the concentration interval is calculated.

Article 2

Criteria for the use of modelling applications

When using modelling applications for air quality assessment and for determining the spatial representativeness area of sampling points, Member States shall ensure that such a modelling application fulfils the following criteria:

- (a) the modelling application is able to reproduce results with the same averaging periods as the limit or target values set out in Annex I to Directive (EU) 2024/2881('limit or target value');
- (b) the spatial resolution of the modelling application is such that the expected variability of pollutant concentrations in the atmosphere over the area of interest can be reproduced;
- (c) if the modelling application requires the use of input emissions data, such data:
 - (i) are, where possible, spatially gridded at a resolution that is in line with the spatial resolution of the modelling application;
 - (ii) are, where possible, vertically distributed in accordance with the release height of the source;
 - (iii) are, where possible, aligned with the temporal resolution of the modelling application;
 - (iv) are, where possible, aligned with the requirements of the modelling application in terms of chemical speciation;
 - (v) account for the relevant sources in the area of interest;
- (d) if the modelling application requires the use of meteorological data, such data is obtained either from observations or via a meteorological model which, where possible, has a similar spatial and temporal resolution to the modelling application and which ensures that the representativeness of the modelled period captures, where possible, inter-annual meteorological variability;
- (e) if the modelling application requires the use of background concentrations, those are aligned in terms of temporal resolution, spatial resolution, spatial extent, and detail in the chemical speciation with the modelling application requirements over the area of interest;
- (f) the modelling application is, to the extent possible, capable of capturing the following elements, specific to the area of interest:
 - (i) site-specific dispersion characteristics;
 - (ii) orographic boundary conditions;
 - (iii) meteorological conditions;
 - (iv) adverse climatic conditions;
 - (v) transboundary contributions;
- (g) the modelling application is quality assured and validated in accordance with the criteria set out in Article 3.

Article 3

Quality assurance and validation of modelling applications

1. Member States shall ensure modelling quality and validate modelling applications in accordance with the criteria laid down in this Article.
2. Where possible, all input datasets shall be quality controlled and assured before being used as input for a modelling application. Member States shall perform those quality checks before executing each modelling application.
3. Where possible, measurement data used to perform the validation of modelling applications shall have variability in terms of sampling-point locations to cover the relevant environments for a given pollutant over the area of interest.
4. Where the number of available sampling points used to calculate the modelling quality objective set out in Annex V to Directive (EU) 2024/2881 for each pollutant is less than 10, the modelling quality objective is deemed to be fulfilled when the modelling quality indicator is less or equal to 1 for all the available sampling points over the assessment area and period considered.
5. When evaluating modelling applications that incorporate the integrated use of models and measurements, only measurement data not used in the model and complying with the data quality objectives set out in Annex V to Directive (EU) 2024/2881 shall be used for the evaluation of whether the modelling quality objective is fulfilled. In such a case, Member States shall, where possible, evaluate modelling applications that incorporate the integrated use of models and measurements using the methodology set out in Annex II.
6. Where modelling applications are used for the determination of spatial representativeness areas of sampling points, such modelling applications shall fulfil the requirements set out in Point A of Annex V to Directive (EU) 2024/2881.

Article 4

Methods for assessing the spatial representativeness areas of sampling points

1. In all zones classified as above the assessment thresholds pursuant to Article 8(2) of Directive (EU) 2024/2881, Member States shall use either measurements in accordance with Article 6 of this Decision or modelling applications in accordance with Article 7 of this Decision or a combination of the two, to underpin the assessment of spatial representativeness areas of sampling points in those zones.
2. In all zones classified as below the assessment thresholds pursuant to Article 8(4) of Directive (EU) 2024/2881, where sampling points are used for the assessment of air quality, modelling applications or measurements or a combination of the two used in accordance with points D.1 and D.9 of Annex IV to Directive (EU) 2024/2881, shall be sufficient to underpin the assessment of spatial representativeness areas of sampling points.

Article 5

Criteria for assessing the spatial representativeness areas of sampling points

1. Member States shall assess the spatial representativeness area of sampling points in accordance with the provisions laid down in this Article.
2. Member States shall identify locations or areas with similar concentrations to those measured at a sampling point for a given pollutant using tolerance levels in accordance with Article 6(3) for measurements and tolerance levels in accordance with Article 7(2) for modelling applications.

For the purpose of the first subparagraph, the central value shall be selected as follows:

- (i) where measurements are used, the annual mean of the concentration measured at the sampling point is used as the central value to define locations with similar concentrations;
- (ii) where modelling applications are used, the annual mean of the concentration modelled for the sampling point location is used as the central value to define areas with similar concentrations.

Member States may use other metrics than the annual mean, such as relevant percentiles or seasonal averages, including hourly, eight-hour, daily, AOT40, and winter averages for pollutants with limit or target values established for metrics other than the annual mean. Where this is the case, the use of such other metrics shall be duly substantiated.

3. Member States shall refine the areas identified pursuant to paragraph 2 in accordance with the rules laid down in this paragraph.

The geographical area may include non-contiguous domains but shall be limited in its extension by the borders of the zone under consideration.

Locations at or near heavily trafficked roads in suburban or rural areas may be excluded from the areas identified for urban background sampling points even if concentrations in those areas fall within the tolerance interval calculated for the sampling point.

If the area identified for an urban or suburban background sampling point covers a wider area than the city or urban area in which the sampling point is located, the area identified may further be limited to the city or the urban area.

Locations where air quality assessment is not required pursuant to point A.2 of Annex IV to Directive (EU) 2024/2881 may be excluded from the identified area.

4. Member States shall consider source-related information to exclude locations from the areas identified and refined in accordance with paragraphs 2 and 3 that have significantly different pollution profiles or dispersion conditions. Member States shall exercise expert analysis to identify such locations.

Article 6

Use of measurements to assess the spatial representativeness areas of sampling points

1. Both fixed and indicative measurements may be used to assess the spatial representativeness areas of sampling points, as relevant.

2. When using indicative measurements to assess the spatial representativeness area of a sampling point, Member States shall ensure that the measurements are evenly distributed over the calendar year, and over the April-to-September period for ozone, and that certain periods of the year are not over- or under-represented.

When using only indicative measurements to assess the spatial representativeness area of a sampling point, Member States shall ensure that the number and spatial distribution of indicative measurements is such that the expected variability of pollutant concentrations can be reproduced.

The uncertainty of the indicative measurement for a specific pollutant may be the uncertainty established for modelling applications in Point A of Annex V to Directive (EU) 2024/2881 for the pollutant in question.

3. Member States shall identify locations with similar concentrations to the central value, as set out in Article 5(2), point (i), for a given pollutant in accordance with the methodology set out in this paragraph.

A tolerance level of 15 % of the central value or a minimum tolerance level as set out in Annex I, whichever is greater, shall be applied above and below the central value to calculate a concentration interval.

Values may be rounded to two significant digits when calculating the concentration interval referred to in the second subparagraph.

The measured concentration of the pollutant in question at a given sampling point location shall be compared to the concentration interval calculated in accordance with the second subparagraph.

When the measured concentration at a given sampling point location falls within the concentration interval calculated in accordance with the second subparagraph, that sampling-point location shall be included in the area identified in accordance with Article 5(2).

4. Member States may use modelling applications in accordance with Article 7 to also include areas in the vicinity of the locations identified in accordance with paragraph 3 of this Article in the spatial representativeness area of a sampling point.

Expert analysis, including but not limited to the assessment of location and source-related information in accordance with Article 5(3) and (4), may be applied to also include areas in the vicinity of the locations identified in accordance with paragraph 3 of this Article in the spatial representativeness area of a sampling point. Expert analysis may also be underpinned by measurement results from non-reference or non-equivalent measurement methods.

Article 7

Use of modelling applications to assess the spatial representativeness areas of sampling points

1. When using modelling applications to produce the spatial representativeness area of a sampling point, Member States shall prepare a map of the modelled concentrations of a given pollutant in the zone where the sampling point is located.

Member States shall ensure that modelling applications used to produce the map of modelled concentrations fulfil the criteria set out in Articles 3 and 4 of this Decision.

2. Member States shall identify areas with modelled concentrations similar to the central value, as set out in Article 5(2), point (ii), for a given pollutant in accordance with the methodology set out in this paragraph.

A tolerance level of 15 % of the central value or a minimum tolerance level as specified in Annex I, whichever is greater, shall be applied above and below the central value to calculate a concentration interval;

Values may be rounded to two significant digits when calculating the concentration interval referred to in the second subparagraph.

The modelled concentration at all areas shall be compared to the concentration interval calculated in accordance with the second subparagraph.

When the modelled concentration for an area falls within the concentration interval calculated in accordance with the second subparagraph, that area shall be included in the area identified in accordance with Article 5(2).

3. Member States may use expert analysis, including but not limited to the assessment of location and source-related information in accordance with Article 5(3) and (4) to assess the similarity of an area to a given sampling point.

Article 8

Methodology for producing a spatial representativeness area map in a zone

1. Member States shall produce a map that delineates the spatial representativeness areas of all sampling points for a given pollutant within a given zone in accordance with the methodology laid down in this Article.
2. When, following the methodology laid down in Articles 5 to 7, a location or an area is identified for the spatial representativeness area of more than one sampling point in the zone, Member States may include it in the spatial representativeness area of the sampling point which is most similar to the location or the area in question in accordance with paragraph 5 of this Article.
3. When, following the methodology laid down in Articles 5 to 7, a location or an area is identified for the spatial representativeness area of more than one sampling point in the zone, Member States shall:
 - (i) include that location or area in the spatial representativeness area of a sampling point that exceeds the relevant limit or target value and that is the most similar to the location or the area in question in accordance with paragraph 5, when both the concentration in the identified location or area, and the concentration measured at one or more sampling points for which the location or the area has been identified, exceed the relevant limit or target value;
 - (ii) not include that location or area in the spatial representativeness area of any of the sampling points, when the concentration in that identified location or area exceeds the limit or target value, but the measured concentrations at all the sampling points for which that location or area has been identified do not exceed the relevant limit or target value.
4. Where modelling applications are used, and in application of paragraph 3, point (ii), a location or an area is not included in the spatial representativeness area of any sampling point, Member States shall review the modelling application.

5. The similarity between sampling points and between a sampling point and a modelled area referred to in paragraphs 2 and 3 shall be assessed in terms of sampling point type, location characteristics, relevant emission sources, and concentration levels.
6. Once the spatial representativeness area of all sampling points in a zone for a given pollutant is assessed in accordance with the provisions laid down in Articles 4 to 8, Member States shall produce the map of spatial representativeness areas of the sampling points referred to in paragraph 1 of this Article.

The map of spatial representativeness areas shall be produced using data for the most recent year available within the last five years.

Member States shall review the spatial representativeness area map, at least following each review performed in accordance with point D.9 of Annex IV to Directive (EU) 2024/2881, and also when there are relevant changes to the monitoring network or substantial changes in the pollution sources or in the meteorology of the zone.

Article 9

Use of indicative measurements for air quality assessment

1. When performing indicative measurements, Member States shall use measured concentrations for air quality assessment and for providing information on the spatial distribution of air pollutants when they show an exceedance of a limit or target value.
2. When performing indicative measurements, Member States may use measured concentrations for air quality assessment and for providing information on the spatial distribution of air pollutants when there is no exceedance of a limit or target value.
3. When compliance with the hourly, daily eight-hour and daily limit or target values is assessed via indicative measurements, Member States may use the corresponding percentile for the calculation of exceedance statistics.

Article 10

Use of modelling results for air quality assessment

1. Member States shall use modelled concentrations for air quality assessment in the following situations:
 - (i) when both the modelled concentration at a location covered by the spatial representativeness area of a sampling point and the sampling point's measurement show an exceedance of a limit or target value;
 - (ii) when the modelled concentration at a location that is not covered by the spatial representativeness area of a fixed measurement sampling point is above the assessment threshold and below the limit or target value and the Member State chooses not to perform at least one additional measurement, the spatial representativeness area of which covers the modelled location.
2. Member States shall not use modelled concentrations for air quality assessment when they fail to show an exceedance of a limit or target value at a location or an area covered by the spatial representativeness area of a measurement sampling point showing an exceedance of the given limit or target value.

3. Member States may use modelled concentrations for air quality assessment in any situation not covered by paragraphs 1 and 2.
4. Member States shall use modelling results to provide information on the spatial distribution of air pollutants concentrations, to identify potential hotspots in the zone, and, if applicable, to provide information on the modelled area of the exceedance, unless any of the following conditions are fulfilled:
 - (i) modelled concentrations of air pollutants show an exceedance of a limit or target value at a location covered by the spatial representativeness area of a fixed measurement showing no exceedance of the given limit or target value, and modelled concentrations do not lie within the concentration interval defined by the uncertainty range of the fixed measurement;
 - (ii) modelled concentrations of air pollutants show no exceedance of a limit or target value at a location covered by the spatial representativeness area of a measurement showing an exceedance of the given limit or target value.
5. Where Member States choose to perform additional measurements in the situation referred to in paragraph 1, point (ii), those measurements shall be established within two calendar years after the modelling if they are fixed measurements, and within one calendar year after the modelling if they are indicative measurements. The additional measurements shall cover at least one calendar year in accordance with the minimum data coverage requirements set out in point B of Annex V to Directive (EU) 2024/2881.
6. When calculating the concentration interval of the fixed measurement for the purpose of paragraph 4, point (i), Member States shall use a value that equals the applicable maximum uncertainty of fixed measurements for the given pollutant set out in Annex V to Directive (EU) 2024/2881 above and below the value of the fixed measurement concentration.
7. When Member States do not use modelling results pursuant to paragraphs 2 and 4, they shall review their modelling application. That review shall assess whether the modelling application is fit for purpose and shall be completed no later than one year after the modelling application that triggered the review was carried out.

Article 11

Entry into force and application

This Decision shall enter into force on the twentieth day following that of its publication in the *Official Journal of the European Union*.

This Decision shall apply from [Publications Office: insert the date = 24 months from the date of entry into force of this Decision].

Done at Brussels,

For the Commission
The President
Ursula VON DER LEYEN