



BSI Standards Publication

**Ambient air — Methodology to assess  
the performance of receptor oriented  
source apportionment modelling  
applications for particulate matter**

---

## National foreword

This Published Document is the UK implementation of CEN/TS 17458:2020.

The UK participation in its preparation was entrusted to Technical Committee EH/2/3, Ambient atmospheres.

A list of organizations represented on this committee can be obtained on request to its committee manager.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

© The British Standards Institution 2021  
Published by BSI Standards Limited 2021

ISBN 978 0 539 04749 3

ICS 13.040.01

**Compliance with a British Standard cannot confer immunity from legal obligations.**

This Published Document was published under the authority of the Standards Policy and Strategy Committee on 31 January 2021.

### Amendments/corrigenda issued since publication

| Date | Text affected |
|------|---------------|
|------|---------------|

---

TECHNICAL SPECIFICATION  
 SPÉCIFICATION TECHNIQUE  
 TECHNISCHE SPEZIFIKATION

**CEN/TS 17458**

December 2020

ICS 13.040.01

English Version

**Ambient air - Methodology to assess the performance of  
 receptor oriented source apportionment modelling  
 applications for particulate matter**

Air ambient - Méthode d'évaluation de la performance  
 d'applications d'un système de modélisation de la  
 contribution des sources de particules en suspension  
 de type " récepteur-orienté "

Außenluft - Methode zur Erfassung der  
 Leistungsfähigkeit von Systemanwendungen zur  
 Quellenzuordnung

This Technical Specification (CEN/TS) was approved by CEN on 24 February 2020 for provisional application.

The period of validity of this CEN/TS is limited initially to three years. After two years the members of CEN will be requested to submit their comments, particularly on the question whether the CEN/TS can be converted into a European Standard.

CEN members are required to announce the existence of this CEN/TS in the same way as for an EN and to make the CEN/TS available promptly at national level in an appropriate form. It is permissible to keep conflicting national standards in force (in parallel to the CEN/TS) until the final decision about the possible conversion of the CEN/TS into an EN is reached.

CEN members are the national standards bodies of Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and United Kingdom.



EUROPEAN COMMITTEE FOR STANDARDIZATION  
 COMITÉ EUROPÉEN DE NORMALISATION  
 EUROPÄISCHES KOMITEE FÜR NORMUNG

**CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels**

## Contents

|  | Page      |
|--|-----------|
| European foreword.....   | 3         |
| <b>1 Scope.....</b>  | <b>4</b>  |
| <b>2 Normative references.....</b>   | <b>4</b>  |
| <b>3 Terms and definitions.....</b>  | <b>5</b>  |
| <b>4 Symbols and abbreviations.....</b>  | <b>7</b>  |
| <b>5 Fundamentals of the evaluation methodology.....</b>   | <b>8</b>  |
| <b>6 Arrays of tests.....</b>  | <b>9</b>  |
| <b>7 The performance assessment method.....</b>  | <b>9</b>  |
| 7.1 Evaluation data sets.....  | 9         |
| 7.2 Determination of the SCE reference values and their standard uncertainty.....  | 9         |
| 7.2.1 Consensus value from participants.....   | 9         |
| 7.2.2 Formulation of a consensus value from a synthetic data set.....  | 10        |
| <b>8 Performance indicators and other indicators.....</b>  | <b>10</b> |
| <b>8.1 Complementary indicators.....</b>   | <b>10</b> |
| 8.1.1 General.....   | 10        |
| 8.1.2 Apportioned pollutant mass.....  | 10        |
| 8.1.3 Number of identified sources.....  | 11        |
| <b>8.2 Similarity indicators.....</b>  | <b>11</b> |
| 8.2.1 General.....   | 11        |
| 8.2.2 Pearson product-moment correlation coefficient.....  | 12        |
| 8.2.3 Standardized Identity Distance (SID, Annex I).....   | 12        |
| 8.2.4 Weighted Distance (WD).....  | 12        |
| <b>8.3 Performance indicators.....</b>   | <b>13</b> |
| 8.3.1 General.....   | 13        |
| 8.3.2 z-scores for the average SCEs.....   | 13        |
| 8.3.3 RMSE <sub>u</sub> for the SCEs time series.....  | 14        |
| 8.3.4 Zeta-score for the uncertainty of the SCEs.....  | 14        |
| <b>Annex A (informative) Principle of receptor oriented models.....</b>  | <b>15</b> |
| <b>Annex B (informative) Recommended steps for SA studies with receptor oriented models.....</b>   | <b>16</b> |
| <b>Annex C (informative) Sources of uncertainty in receptor oriented models.....</b>   | <b>17</b> |
| <b>Annex D (informative) Array of tests for individual SA runs (Responsible: Practitioner).....</b>                                      | <b>18</b> |
| <b>Annex E (normative) Array of tests for intercomparisons (Responsible: Coordinator).....</b>   | <b>19</b> |
| <b>Annex F (normative) Calculation of the SCE reference values <math>X_{kt}</math> and <math>X_k</math> in real-world data sets.....</b> | <b>20</b> |
| <b>Annex G (informative) Robust average and standard deviation.....</b>  | <b>21</b> |
| <b>Annex H (informative) Acceptability range for complementary tests.....</b>  | <b>22</b> |
| <b>Annex I (informative) Geometric meaning of the Standardized Identity Distance.....</b>  | <b>23</b> |
| <b>Annex J (normative) Acceptability range for the similarity and performance tests.....</b>   | <b>25</b> |
| <b>Annex K (informative) Intercomparison organization and test reports.....</b>  | <b>26</b> |
| <b>Bibliography.....</b>   | <b>28</b> |

## European foreword

This document (CEN/TS 17458:2020) has been prepared by Technical Committee CEN/TC 264 “Air quality”, the secretariat of which is held by DIN.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

According to the CEN/CENELEC Internal Regulations, the national standards organisations of the following countries are bound to announce this Technical Specification: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Currently in preview, click buy full version.

## 1 Scope

The European Directive on ambient air quality and cleaner air for Europe (2008/50/EC; AQD) identifies different uses for modelling: Assessment, planning, forecast and source apportionment (SA). This document addresses source apportionment modelling and specifies performance tests to check whether given criteria for receptor oriented source apportionment models (RM) are met. The scope of the tests set out in this document is the performance assessment of SA of particulate matter using RM in the context of the European Directives 2004/107/EC and AQD, including the Commission Implementing Decision 2011/850/EU of 12 December 2011. The application of RM does not quantify the spatial origin of particulate matter; hence, this document does not test spatial SA.

This document addresses RM users: practitioners of individual source apportionment studies as well as participants and organizers of source apportionment intercomparison studies. This document is suitable for the evaluation of results of a specific SA modelling system with respect to reference values (a priori known or calculated on the basis of intercomparison participants' values) in the following application areas:

- Assessment of performance and uncertainties of a modelling system or modelling system set up using the indicators laid down in this document.
- Testing and comparing different source apportionment outputs in a specific situation (applying an evaluation data set) using the indicators laid down in this document.
- QA/QC tests every time practitioners run a modelling system.

It should be noted for clarity that the procedures and calculations presented in this document cannot be used to check the performance of a specific SA modelling result without having any a priori reference information about the contributions of sources/source categories.

**NOTE** The application of this document implies that the intercomparison is organized and coordinated by an institution with the necessary technical capabilities and independence; the definition of which is beyond the scope of this document.

The principles of RM are summarized in Annex A. An overview of uncertainty sources and recommendations about steps to follow in SA studies are provided in Annex B and Annex C. For further information about SA methodologies, refer to e.g. [1; 2; 3].

There are methodologies different from RM which are widely used to accomplish SA, e.g. source oriented models. These other methodologies cover aspects of SA which are required in the AQD and are not addressed by RM (e.g. allocation of pollutants to geographic emission areas). Performance assessment of such methodologies is out of the scope of this document.

## 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 15226:2015, *Statistical methods for use in proficiency testing by interlaboratory comparison*