Member States' and European Commission's Common Understanding of the

Commission **Implementing Decision** 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
(Decision 2011/850/EU)

Version of 15 March 2018

- As agreed with the Ambient Air Quality Expert Group in 30 January 2018 and 9 February 2018 -

European Commission
DG ENV
2018

Purpose

The Commission implementing decision of 12 December 2011 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 (2011/850/EU) (also known as IPR, the acronym for Implementing Provisions on Reporting) establishes rules regarding the Member States' obligations to report on the assessment and management of ambient air quality as well as the reciprocal exchange of information. This document gives detailed guidance and recommendations to those responsible for the air quality data reporting.

This document provides guidance on the requirements of those aspects of Annex I and Annex II of Decision 2011/850/EU where a need has been identified in contacts with Member States. For Annex II, there is moreover detailed guidance on completion of the schemata for the electronic submission of the data flows listed in Annex II of the IPR decision.

The main focus of this guidance is on reporting; for more information on the assessment of ambient air quality please see the Guidance on Assessment under the EU Air Quality Directives on the following link:

http://ec.europa.eu/environment/air/pdf/guidanceunderairquality.pdf

Table of Contents

Introduction

(A) Summary of relevant legal provisions

The EU Ambient Air Quality legislation consists of Directive 2008/50/EC and Directive 2004/107/EC (as amended by Commission Directive (EU) 2015/1480 of 28 August 2015).

Directive 2008/50/EC of 21 May 2008 on ambient air quality and cleaner air for Europe (AAQD) entered into force on 11 June 2008. It:

- Merged the previous framework and Daughter Directives (except for the Fourth Daughter Directive) into a single directive with no change to existing air quality objectives (e.g. daily limit value for PM_{10} of 50µg/m³ not to be exceeded more than 35 times a calendar year; annual limit value for PM_{10} of 40µg/m³; hourly limit value for NO_2 of 200µg/m³ not to be exceeded more than 18 times a calendar year, annual limit value for NO_2 of 40µg/m³ etc.);
- Set new air quality objectives for $PM_{2.5}$ (fine particles) including a limit value and exposure related objectives i.e. the exposure concentration obligation and the exposure reduction target;
- Created the possibility for time extensions of three years (PM_{10}) or up to five years (NO_2, benzene) for complying with limit values, provided certain conditions are met; the European Commission assesses whether the conditions are met and raises objections if not.

Directive 2004/107/EC (also known as "the Fourth Daughter Directive") is related to arsenic, cadmium, mercury, nickel and polycyclic aromatic hydrocarbons in ambient air.

Both directives lay down provisions for obtaining information on ambient air quality that support monitoring long-term trends and ensure that such information is made available to the public. Also, both provide that the kind of information and the timescales on which such information is to be made available by Member States (MS) are to be further defined through implementing measures.

Directive 2008/50/EC (Art. 27(3)) states that the provisions for the transmission of information and reporting should apply to information collected as from the beginning of the second calendar year after the entry into force of the implementing provisions, i.e. 1 January 2014. For reasons of consistency and simplification the application date of the implementing provisions should be the same for the pollutants listed in Directive 2004/107/EC. It also provides that Decision 97/101/EC (the Exchange of Information Decision, or EoI Decision) is to be repealed, also with effect from the beginning of the second calendar year following the entry into force of the implementing measures on transmission of information and reporting. Consequently, Airbase, which is the air quality information system maintained by the EEA through the European topic centre on Air pollution and Climate change Mitigation (ETC/ACM) that contains air quality data delivered annually under 97/101/EC (EoI Decision) is replaced by a new system provisionally called AQeRep. Historical data will be migrated from Airbase to the new system.

Commission Directive 2015/1480/EU amends and adapts some of the technical Annexes of Directives 2004/107/EC and 2008/50/EC in order to update them and to reflect the developments occurred since 2005, when Directive 2008/50/EC was proposed by the Commission. The amended rules concern reference methods, data validation and location of sampling points for the assessment of air quality.

Decision 2011/850/EU, known as the IPR Decision, applies from 1 January 2014. In other words, it will apply to air quality information collected by Member States as of January 2013 to be reported in 2014. The Decision repeals Commission implementing Decisions 2004/461/EC and 2004/224/EC as of 1 January 2014.

The air quality portal mentioned in Article 3 of Commission Decision 2011/850/EC is also an important source of information. The website is:
http://eeadmz1-cws-wp-air.azurewebsites.net/

While drafting the current document, it was assumed that the reader is familiar with the air quality directives and the Implementing Decision mentioned above, which are all available at http://ec.europa.eu/environment/air/index_en.htm.

The code lists presented in this guidance are managed externally by the EEA at http://dd.eionet.europa.eu/vocabularies/aq. The code lists may change in the future and so it is recommended to check the above mentioned portal for updated information.

(B) Overall time line for reporting under Decision 2011/850/EU

Legal reference:

Decision 2011/850/EU sets out the various reporting timelines for particular datasets in Articles 6, 7, 8, 10 and 13.

***

Submissions are organised in four separate “packages”:

- The first package consists of data flows B and C containing preliminary information on zones and assessment regimes which will be applied for the next coming year YY+1. The deadline for submission is 31 December of year YY.
- The second package consists of the assessment data for the previous year YY-1 with the associated data flows B, C, D, E1a and E1b on zones, assessment regimes, networks and stations as well as validated measurement and modelling results. This package must also include dataflow G concerning the attainment of environmental objectives during the year YY-1. The deadline for submitting this package is 30 September of year YY.

Please note that in addition to the historical information corresponding to the past years including YY-1, D must contain the most updated information on assessment methods.

- If exceedances are observed in year YY-2, the deadline for submitting the package with data flows H to K on plans and programs is 31 December of year YY.
- The third package consists of the preliminary (i.e., not fully verified) measurement data, also known as UTD (up-to-date) data (E2a). These data are transmitted hourly throughout the year via ftp. Ideally, all measured data should be submitted to ensure traceability. At a minimum, it is suggested that the Member States submit UTD data of the sampling points where measurement data is collected for the purpose of the assessment as indicated by Member States in Dataset C. Additionally, the UTD data should be consistent with Datasets E1a and G.
- The quality assurance checks use the preliminary Dataset C and the latest Dataset D to check the incoming UTD data. Therefore, the Member States are encouraged to update Dataset D as soon as anything regarding their assessment methods changes. For such updates, no justifications are needed. In any case, Member States *must* submit an up-to-date Dataset D by 30 September YY+1.

Please note that Dataset F has not to be transmitted as all statistics are computed by the EEA from the data transmitted in E1a.

A visual representation of the reporting timing for the various datasets is presented in Figure 1.

Please refer also to "Air Quality e-Reporting: Submission procedures for reporting to Eionet CDR", which is the source of Figure 1 below.
(http://www.eionet.europa.eu/aqportal/toolbox/submission/doc/AQ_IPR_submission_procedure2016_v3.pdf)

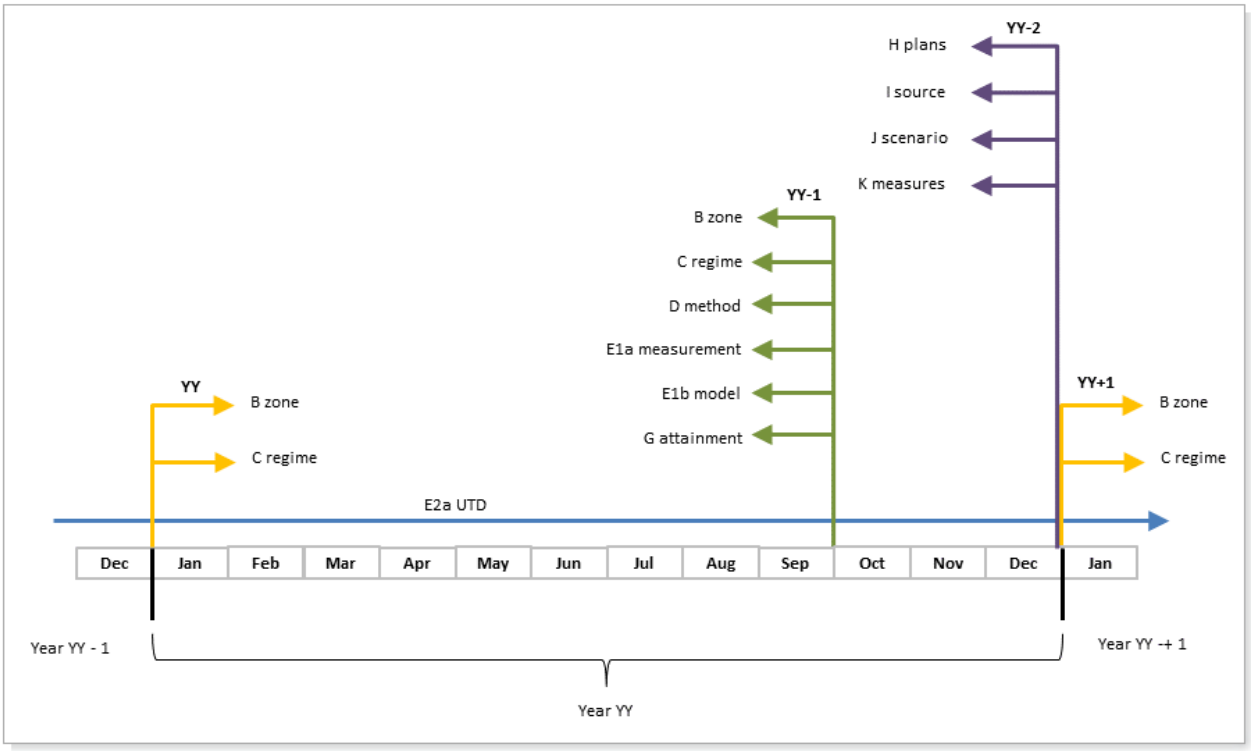


Figure 1: Timeline for Air Quality Directives reporting data flows relative to obligations presented in the Decision 2011/850/EU.

(1) Resubmission of data flows

Concepts

- For any resubmission (updated or corrected data file) a new normal submission process will have to be started (new envelope).
- For all resubmissions (except dataset D), Commission Implementing Decision 2011/850/EU, Article 5 requires Member States to describe the differences between the updated and original information and provide the reasons for the update (i.e. as per Commission Implementing Decision 2011/850/EU, Article 5). This can be done by including the required information in the relevant text field in the CDR envelope corresponding to the re-submitted data.

  Changes between the preliminary and the final Dataset C do not need to be justified.
- The following rules for resubmission must be respected:
  - for all data flows except E1a and E1b always redeliver the whole dataset and not only the modified/corrected part.
  - in case of correction of data flows E1a and/or E1b, redeliver either the complete dataset or the corrected part only.
- Like in the normal submission process, the resubmission of data flow G implies prior release of data flows B, C, D and E1a, if one or more of these had also to be resubmitted, to ensure coherence with the resubmitted G.

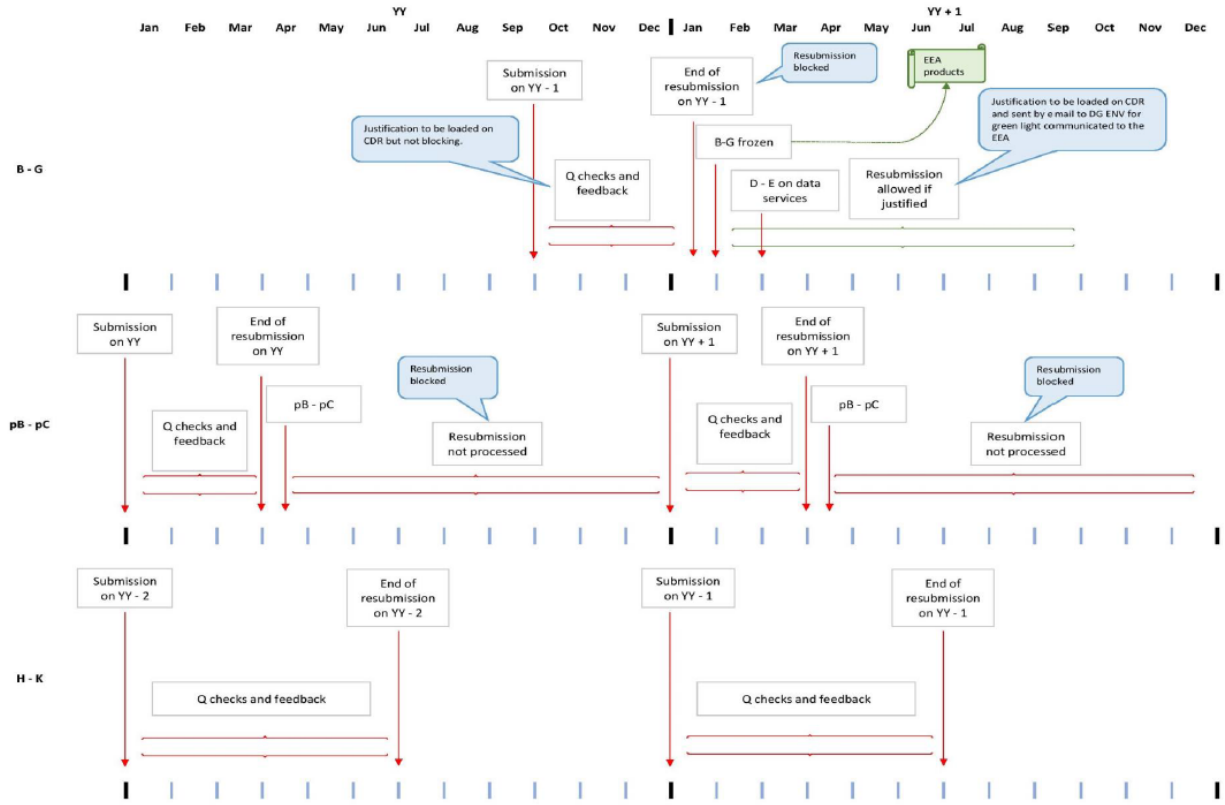


Figure 2: AQ eReporting cycle

(2) Justification for resubmissions

Following the provision of Art.5 of the Implementing Decision 2011/850/EU, all resubmissions must be accompanied by a justification explaining the reason for resubmitting as well as details on the modifications/correction done.

In case the resubmission follows a request for correction following the final verification done by the EEA/ETC-ACM, the justification for re-submission can simply refer to the feedback report produced earlier together with the correction request. In this case, the justification must be provided in the relevant text field in the CDR envelope corresponding to the data flow in question. The Commission shall acknowledge the receipt of the updated information.

In case of data re-submissions for data flows B to G done after the 15 January YY+1, the resubmission will only be released and processed by EEA after receiving confirmation from the European Commission that there are sufficient grounds for the re-submission. For these cases, the description of the differences between the updated and original information is always required and can be done by including the required information in the relevant textbox in the respective envelope with the re-submitted data flow.

For re-submissions of data flows B to G after the 15 January YY+1 (except Dataset D, see explanation above), Member States are kindly asked (if the administrative burden permits) to directly inform the

European Commission (ENV-AIR@ec.europa.eu) that a resubmission has been made. The Commission will then acknowledge by email the receipt of the new information to the MS. The envelope can then be released and processed into the AQ e-reporting databases.
Please note that the Commission might need to re-assess the content of any specific submission throughout the reporting year. If shortcomings on the information provided by the MS are then detected, the Commission will contact the MS by email to ask for further clarification

Part I

ANNEX I OF DECISION 2011/850/EU

(A) Data requirements

(1) Reporting of time

Legal reference:

Decision 2011/850/EU - ANNEX I - (A) Data requirements specifies in (1) Reporting of time:
"All time references shall be made available in accordance with the ISO standard 8601:2004(E) using the extended format (YYYY-MM-DDThh:mm:ss±hh:mm) that includes the information on difference from UTC (Coordinated Universal Time). The time stamp refers to the end of the measurement period."

***

Purpose and origin of the selected time reference format

In the past, misinterpretations of time references have led to different results when these values were placed within a database and aggregated. This was mainly caused by a lack of information on the time zone in which the values were reported or by using the beginning instead of the end of the measurement period.

Furthermore, there has been a call for harmonized environmental data to make better interdisciplinary (environmental) policy. This led to Directive 2007/2/EC (INSPIRE) followed by Commission Regulation (EC) No 1205/2008, which stated that ISO standard 8601:2004(E) has to be used for time references of meta data (Annex, Part B paragraph 5). However, Commission Regulation 1205/2008 did not oblige MS to use the most extended format of the ISO standard.

To avoid any confusion or misinterpretation, additional criteria have been set in Decision 2011/850/EC. This is why the extended format, which includes the information on the difference with UTC, will be used as the default for any value originating from measurement or modelling results. For all measurement and modelling data types the timestamp of the start time and end time of the observation shall be given in the ISO extended time format.

NOTE: Samples with irregular time intervals should always be reported with the start and the end of the measurement period.

(i) The extended format of time references according to ISO standard 8601:2004(E) and examples

The extended format of time references according to ISO standard 8601:2004(E) is defined as:

YYYY-MM-DDThh:mm:ss±hh:mm

where :

YYYY	represents the year
MM	represents the month
DD	represent the day
hh	represents the hour
mm	represents the minute
ss	represents the second
±hh:mm	represents the shift to UTC, so for CET it is +01:00

Note:

Summer time will not be used; i.e. Member States should report in local winter time with the corresponding time shift to UTC. Member States may also choose to report in another geographical time zone applicable to their territory. In all cases where time units are to be reported, the extended ISO 8601 format shall be used. In some cases, the use of CET is not appropriate, e.g. for Caribbean islands. In such cases the local time shall be used for calculation for the ozone environmental objective (e.g. AOT 40). In all cases, Member States must declare the time zone used for the aggregation

Hourly data in UTC => 2011-04-12T11:00:00Z
Hourly data in UTC+1 => 2011-04-12T11:00:00+01:00
Hourly data in UTC+2 => 2011-04-12T11:00:00+02:00

Midnight: The definition of "midnight" according to the same standard (ISO 8601:2004(E), paragraph 4.2.3) is as follows:

> "The complete representations in basic and extended format for midnight, in accordance with 4.2.2 (Local time), shall be expressed in either of the two following ways:
>
> | | Basic format | Extended format | |
> |---|---|---|---|
> | a) | 000000 | 00:00:00 | (the beginning of a calendar day) |
> | b) | 240000 | 24:00:00 | (the end of a calendar day) |
>
> The representations may have reduced accuracy in accordance with ISO 8601, paragraph 4.2.2.3 or may be designated as a time expression in accordance with 4.2.2.5 of the same ISO. To represent midnight the representations may be expanded with a decimal fraction containing only zeros in accordance with paragraph 4.2.2.4 of ISO 8601."

Both possibilities within the extended format can be used and are accepted by the EEA. In the case the format 24:00:00 is used, it is automatically converted into 00:00:00.

Example

2017-05-16 24:00:00 is converted into
2017-05-17 00:00:00

Table 1: Examples of time reference

Time reference	Time reference in IPR
12 April 1985 at 3 o'clock CET	1985-04-12T03:00:00+01:00
the midnight CET between 12 April 1985 and 13 April 1985	1985-04-12T24:00:00+01:00
the midnight CET between 30 April 1985 and 1 May 1985	1985-04-30T24:00:00+01:00
the midnight CET between 31 December 1985 and 1 January 1986	1985-12-31T24:00:00+01:00
21 June 2012 at 23 o'clock EET (Nicosia)	2012-06-21T23:00:00+02:00
27 November 2012 at 1 o'clock GMT (London)	2012-11-27T01:00:00Z

(ii) Other time references within 2011/850/EU

Decision 2011/850/EU requires more fields with a time reference. The list in Table 2 enumerates all time references within Decision 2011/850/EU other than the time references of dataset E.

Table 2: Other time references within Decision 2011/850/EU

Reference in Part II	Description	ISO 8601 Format
A.2.6.5	Resident population reference year	YYYY
A.2.7.1 A.2.7.2	Start and end date of the period the exceedance situation applies	YYYY-MM-DD
~~A.2.6.1~~	~~Resident population reference year~~	~~YYYY~~
A.6.4	Publication date	YYYY
B.5.1	Zone history: application start date	YYYY-MM-DD
B.5.2	Zone history: application end date	YYYY-MM-DD
H.3	Date when dataset was made available	YYYY-MM-DD
H.3.1	Start of the reporting	YYYY-MM-DDThh:mm:ss±hh:mm
H.3.2	End of the reporting	YYYY-MM-DDThh:mm:ss±hh:mm
H.4.5	Air Quality Plan: *Reference year of first exceedances*	YYYY
H.4.8	Air quality plan: date of official adoption	YYYY-MM-DD
I.2	Reference year for which source apportionment has been applied	YYYY
J.1.5	Attainment year for which the projection are developed	YYYY
J.1.6	Reference year from which the projections are started *(projection year)*	YYYY
K.2.7	Measure: time scale	see Code list *Time scale*

Reference in Part II	**Description**	**ISO 8601 Format**
K.2.11.2 K.2.11.3	Implementation planned start and end date	YYYY-MM-DD
K.2.11.4 K.2.11.5	Implementation actual start and end date	YYYY-MM-DD
K.2.11.7	Date when the measure is planned to take full effect	YYYY-MM-DD
D.5.1.4.1 D.5.1.4.2	Start and end date of measurement configuration	YYYY-MM-DD
D.5.1.6.6.1	Sampling time	see Code list *Time unit*
D.5.1.6.6.2	Sampling interval	see Code list *Time unit*
D.5.2.6.1	Station start date	YYYY-MM-DDThh:mm:ss±hh:mm
D.5.2.6.1	Station end date	YYYY-MM-DDThh:mm:ss±hh:mmD.5
D.5.3.4.1	Network start date	YYYY-MM-DDThh:mm:ss±hh:mm
D.5.3.4.2	Network end date	YYYY-MM-DDThh:mm:ss±hh:mmD.5
D.6.3.6.1	Sampling time	see Code list *Time unit*
D.6.3.6.2	Sampling interval	see Code list *Time unit*
D.7.3.2.1 D.7.3.2.2	Time reference: Start and end of modelling period	YYYY-MM-DDThh:mm:ss±hh:mm
E.5.1 E.5.2 F.4.6.1 F.4.6.2	Time reference: start and end date of UTD data (i.e. discontinuous) Time reference: start and end date of aggregation period	*No fixed period of average:* YYYY-MM-DDThh:mm:ss±hh:mm *Highest 8th hour mean:* YYYY-MM-DDThh:mm:ss±hh:mm *Daily average:* YYYY-MM-DD *Annual average:* YYYY *Winter average:* $YYYY_0$-10-01T00:00:00±hh:mm and $YYYY_1$-03-31T24:00:00±hh:mm ($YYYY_1=YYYY_0+1$) *AEI:* $YYYY_0$-01-01T00:00:00±hh:mm and $YYYY_1$-12-31T24:00:00±hh:mm (for $YYYY_1=YYYY_0+2$) *AOT40:* $YYYY_0$-05-01T00:00:00±hh:mm and

Reference in Part II	Description	ISO 8601 Format
		$YYYY_1$-07-31T24:00:00±hh:mm (for $YYYY_1$=$YYYY_0$+4)
G.4	Reporting year	YYYY-MM-DD
G.4.1	Reporting start date	YYYY-MM-DDThh:mm:ss±hh:mm
G.4.2	Reporting end date	YYYY-MM-DDThh:mm:ss±hh:mm

(2) Number of significant digits and rounding

Legal reference:

Decision 2011/850/EC, Annex I part A(2):
"Data should be made available with the same number of digits as they are used in the monitoring network. Rounding has to be the very last step of any calculation, i.e., immediately before comparing the result with the environmental objective and hast to be done only once. By default the [eReporting] system will perform rounding of the data made available where appropriate following the commercial rounding rules."

***

Assessment data regarding pollutant concentrations have to be compared to the environmental objectives (i.e. limit value, target value, etc.) in the same numeric accuracy as is used for the specification of the environmental objective in the Directive. For the pollutants without an environmental objective, rounding should be done according to the rules described in Table 3.

Table 3: Rounding rules for pollutants without an environmental objective

Value x	Number of decimals	Example : before rounding	Example: after rounding
$x \geq 10$	integer	17.83	18
$1 \leq x < 10$	1 decimal	2.345	2.3
$0.1 \leq x < 1$	2 decimals	0.865	0.87
$0.01 \leq x < 0.1$	3 decimals	0.0419	0.042
Etc…			

Since negative assessment data have to be compared to the "negative detection limit", Table 3 should apply to negative values as well.

Notes:
For compliance reporting (Dataset G) the legal requirement is to report with the same numeric accuracy as specified in the Directive (i.e., in the case of BaP this means no decimal digit) – nevertheless, Member States are encouraged to follow the good practice to provide at least *one*

decimal digit when providing aggregated data/information on exceedances in dataset G. For AQ assessment purposes the rounding rules in 2011/850/EU Annex I should be applied.

Examples

1) A PM_{10} daily value of 50.486 µg/m³ is rounded to 50 µg/m³ applying commercial rounding rules.

[Note: if commercial rules are not applied then many possibilities of rounding could be founded (see also ISO 31-0:1992 (E), Annex B (4)): e.g. rounding this value in a first step to one digit gives 50.5 µg/m³ and rounding in a second step 51 µg/m³. When comparing this value to the daily limit value of 50 µg/m^3 the result would be an exceedance. Thus it is important to follow the commercial convention.]

2) An ozone (O_3) hourly value of 180.49 µg/m^3 is rounded to 180 µg/m^3. .When comparing this value to the hourly information threshold of 180 µg/m^3 the result would be no exceedance.

3) An ozone (O_3) hourly value of 180.50 µg/m^3 would be rounded to 181 µg/m^3 . When comparing this value to the hourly information threshold of 180 µg/m^3 the result would be an exceedance of the information threshold.

4) A benzo (a) anthracene yearly value of 1.428 ng/m^3 would be rounded to 1.4 ng/m^3.
[Note: benzo (a) anthracene is a pollutant without an environmental objective therefore Table 3 shall be used]

(3) Equivalence

Legal reference:
-Directive 2008/50/EC, Annex VI, B
-Decision 2011/850/EU, ANNEX I part (A):
"When more than one assessment method is used at a specific location, data should be supplied using the assessment method exhibiting the lowest uncertainty at that specific location."

***
The status of the measurement configuration with regard to equivalence shall be declared with an appropriate demonstration of equivalence flag in dataflow D. For measurements for which reference methods are defined by Directive 2008/50/EC or 2004/107/EC, primary assessment data must be flagged accordingly within the measurement configuration metadata.

The possible flags are:
- equivalence demonstrated
- equivalence not demonstrated
- demonstration not necessary, reference method used
- demonstration not possible, no reference method defined by Directive
- equivalence testing in progress.

The code list can be found at: http://dd.eionet.europa.eu/vocabulary/aq/equivalencedemonstrated

When more than one assessment method is used in a specific location, all collected data may be reported. However, for the purpose of checking compliance with the environmental objectives, the IPR Decision states that the data derived from – among the assessment methods that use the reference method or a method that has been demonstrated to be equivalent – those methods exhibiting the lowest uncertainty at that specific location shall be used taking into account data capture rates. Determining the appropriate trade-off between uncertainty and data capture will require expert judgement. The method must thus be declared by the data provider rather than determined on the basis of outputs from prescribed aggregation routines.

(4) Standardisation

Legal reference:

-Directive 2008/50/EC, Annex VI, Part C:]
"For gaseous pollutants the volume must be standardised at a temperature of 293 K and an atmospheric pressure of 101.3 kPa. For particulate matter and substances to be analysed in particulate matter (e.g. lead) the sampling volume refers to ambient conditions in terms of temperature and atmospheric pressure at the date of measurements."
-Directive 2004/107/EC, Annex IV:
"For substances to be analysed in the PM10 fraction, the sampling volume refers to ambient conditions."
-Decision 2011/850/EC, Annex I:
"The provisions set out in Part IV of Annex IV to Directive 2004/207/EC and Part C of Annex VI to Directive 2008/50/EC should apply to the reciprocal exchange of information."

***

According to the requirements of the above legislation, the following rules must be followed:

- for gaseous pollutants the volume must be standardised at a temperature of 293 K and an atmospheric pressure of 101.3 kPa;
- for particulate matter and substances to be analysed in particulate matter the sampling volumes refer to ambient conditions in terms of temperature and atmospheric pressure at the date of measurement.

The same provisions are to be used for reporting and exchanging information on other pollutants. These temperature and pressure provisions are to be used for the calculation of the conversion factor between mass fraction and mass concentration.

When measurement results for gaseous pollutants are expressed in ppb, conversion between ppb and $\mu g/m^3$ should be performed by the Member State. The conversion is temperature-dependent and based on the ideal gas law. The mechanism is given below.

Use of ppb should be avoided because it is not a SI unit but a coefficient (10^{-9}). As an SI correlate, it is recommended to use nmol/mol, i.e. 10^{-9} elements of substance of interest per mole of gas mixture. The conversion to mass per unit volume of gas can then easily be performed as follows:

Mass of 1 nmol in µg : 1.10^{-9} x 10^{6} Mx, where Mx is the molar mass in grams.

Volume of 1 mol, V_0 (molar volume) in m^3: 22.414 10^{-3} m^3 at normal conditions T_0 = 273 K and P_0 = 101.3 kPa.

The molar volume at other conditions, T_1 and P_1 , can be derived from the ideal gas law

$$\frac{p_0 \times V_0}{T_0} = \frac{p_1 \times V_1}{T_1}$$

$P_1 = P_0$ = 101.3 kPa
Thus the conversion can be derived with the following formula:

$$X\left[\mu g / m^3\right] = X\left[ppb\right] \times \frac{M_X}{V_0} \times \frac{T_0}{T_1} \times \frac{p_1}{p_0}$$

where : p_0 = 101.3 kPa
T_0 = 273 K
V_0 = 22.414 l/mol.

The conversion factors as described in the EN standards for various pollutants (T_1=293 K) are presented in Table 4. Conversion factors presented at least to this level of accuracy should be used in monitoring networks.

Table 4: Conversion factors

Pollutant	$M_{Pollutant}$ [g/mol]	Factor
NO_2	46,00449	1,912
NO	30,00546	1,247
O_3	47,99709	2,00
SO_2	64,05706	2,66
CO	28,00863	1,16
C_6H_6	78,10464	3,25

NOx is given as the sum of nitric oxide and nitrogen dioxide added as parts per billion and expressed as nitrogen dioxide in µg/m^3 as follows:

NO [ppb] + NO_2 [ppb] $\rightarrow$ NO_x (as NO_2) [ppb] $\rightarrow$ NOx (as NO_2) [µg/m^3]

that is:

NO_x (as NO_2) [µg/m^3]=NO_2[µg/m^3]+NO[µg/m^3]*1.912/1.247

The first step is the simple addition of NO and NO_2 in ppb. If the data is stored in µg/m³ the conversion to ppb has to be done beforehand.

(5) Provisions for $PM_{2.5}$

(i) Calculation of the Average Exposure Indicator (AEI)

Legal reference:

- Directive 2008/50/EC, Annex XIV (A),
- Decision 2011/850/EU, Annex I, (5).

***

Part A of Annex XIV of Directive 2008/50/EC defines that the AEI shall be assessed as a three-calendar year running annual mean concentration averaged over all sampling points established pursuant to Section B of Annex V of the Directive.

So the AEI for the reference year 2010 shall be the mean concentration of the years 2008, 2009 and 2010. However, where data are not available for 2008, Member States may use the mean concentration of the year 2009 or 2010 or the mean concentration of the years 2009, 2010 and 2011. Member States were obliged to inform the Commission of the chosen option.

To ensure transparent and unambiguous calculation of the reported AEI, the following procedure shall be observed:

- Select urban background stations according to 2008/50/EC Annex V B
- Calculate for each year a national average $PM_{2.5}$ concentration from the selected stations' unrounded annual means.
- Calculate the average over three years (the actual reporting year, and the two years before).
- Rounding should be done only at the last calculation step and NOT at any step in between. The commercial rounding rules apply in the same way as for other standards like limit values. Only when presenting the AEI-values, numbers should be rounded to one decimal.

These aggregation steps must be applied to data with numeric accuracy available in the monitoring network. Rounding must be done at the end of the aggregation procedure.

Any modification of the set of AEI monitoring stations and measurement configuration is strongly discouraged. The selection of the sampling points (and the assessment regimes) must be documented in dataset C.

The AEI shall be reported annually as a three year running mean.

Note:

The National Exposure Reduction Target (NERT) according to the Directive 2008/50/EC, Annex I, Section B will be established based on the first reporting of AEI. According to the Member States, difficulties were encountered in calculating the first AEI mainly because it was not possible to attain 90% data capture for all sites for various reasons (e.g. insufficient time to choose the monitoring sites and to install the equipment). Due to the importance of having a basis for establishing the NERT, AQUILA has produced guidance recommending how to deal with the AEI when minimum requirement for data capture is not fulfilled for some stations. Therefore, if minimum data capture was not achieved in the years needed to establish the baseline AEI, it is recommended to follow the procedure developed by AQUILA. [*see AQUILA, 2012*]. Other procedures/methods may be used provided that they are well documented [e.g., Spanish Royal Decret 102/2011].

(ii) Exposure concentration obligation

Legal reference: Directive 2008/50/EC, Annex XIV, C

***

The AEI for the year 2015 shall be the three-year running mean concentration averaged over all sampling points for the years 2013, 2014 and 2015. The AEI is used for establishing whether the exposure concentration obligation is met. The Average Exposure Indicator shall therefore be used for the reporting of exposure concentration obligation.

(iii) National Exposure Reduction Target (NERT)

Legal reference: Directive 2008/50/EC, Annex XIV, B

***

The NERT is relative to the first reporting of AEI (usually 2010). The national exposure reduction target depends on this first reported AEI.

Note:

AQUILA has recommended that the initial AEI concentration thresholds should be presented with one decimal (i.e. 8.5, 13.0, 18.0 and 22.0 µg/m^3). In order to be consistent, also the numerical accuracy of the AEI obtained in practice in a MS should be rounded to 1 decimal. The legal position is that the level of accuracy specified in the legislation is the relevant basis for comparison (see section Annex I (A)(2) Number of significant digits and rounding).

(B) Environmental objectives and reporting metrics

Legal reference:

Decision 2011/850/EC, Article 2:
'Environmental objective' means an ambient air quality objective to be attained within a given period, or where possible over a given period respectively or in the long term as laid down in Directives 2004/107/EC and 2008/50/EC.

***

A complete list of environmental objectives and reporting metrics compared with the Airbase list is published by the EEA at:

http://dd.eionet.europa.eu/vocabulary/aq/objectivetype/view

and

http://dd.eionet.europa.eu/vocabulary/aq/reportingmetric/view

Table 5: Environmental objective and reporting metrics as described in 2011/850/EU

Formula	**Protection target**	**Environmental Objective (Code[1])**	**Averaging period of assessments**	**Reporting Metric of environmental objective**	**Numerical values of the environmental objective (or allowed no. of exceedances)**
Pollutants for which up-to-date and validated data have to be reported					
NO_2	Health	LV	One hour	Hours in exceedance in a calendar year	200 µg/m³ (18)
		LVMT			
		LV	One Calendar year	Annual average	40 µg/m³
		LVMT			
		ALT	One hour	Three consecutive hours in exceedance (at locations representative of air quality over at least 100km² or an entire zone or agglomeration, whichever is smaller)	400 µg/m³
NO_x	Vegetation	CL	One Calendar year	Annual average	30 µg/m³

Formula	Protection target	Environmental Objective (Code[1])	Averaging period of assessments	Reporting Metric of environmental objective	Numerical values of the environmental objective (or allowed no. of exceedances)
PM_{10}	Health	LV	One day	Days in exceedance in a calendar year	50 µg/m³ (35) 90.4 percentile
		LV	One Calendar year	Annual average	40 µg/m³
		WSS[2]	One day	Deducted days in exceedance in a calendar year	n.a.
			One Calendar year	Deduction of annual average	n.a.
		NAT[2]	One day	Deducted days in exceedance in a calendar year	n.a.
			One Calendar year	Deduction of the annual average	n.a.
$PM_{2.5}$	Health	ECO	Three subsequent calendar years	Average Exposure Indicator: (calculation see Directive 2008/50/EC)	20 µg/m³
		ERT			in accordance with Annex XIV, Part B to Directive 2008/50/EC
		TV	One Calendar year	Annual average	25 µg/m³ (2010)
		LV			25 µg/m³ (2015)
		NAT		Deduction of the annual average	n.a.
SO_2	Health	LV	One hour	Hours in exceedance in a calendar year	350 µg/m³ (24)
			One day	Days in exceedance in a calendar year	125 µg/m³ (3)
		ALT	One hour	Three consecutive hours in exceedance (at locations representative of air quality over at least 100km² or an entire zone or agglomeration, whichever is smaller)	500 µg/m³

Formula	Protection target	Environmental Objective (Code[1])	Averaging period of assessments	Reporting Metric of environmental objective	Numerical values of the environmental objective (or allowed no. of exceedances)
		NAT[2]	One hour	Deducted hours in exceedance in a calendar year	n.a.
			One day	Deducted days in exceedance in a calendar year	n.a.
	Vegetation	CL	One Calendar year	Annual average	20 µg/m³
			Winter	Average value over the winter months, i.e. 1 October year x-1 to 31March year x	20 µg/m³
O_3	Health	TV	Maximum daily 8-hour mean	Days when maximum daily 8-hour mean exceeded the target value averaged over three years	120 µg/m³ (25)
		LTO	Maximum daily 8-hour mean	Days when maximum daily 8-hour mean exceeded the long term objective in one calendar year	120 µg/m³
		INT	One hour	Hours in exceedance in a calendar year	180 µg/m³
		ALT	One hour	Hours in exceedance in a calendar year	240 µg/m³
	Vegetation	TV	1 May to 31 July	AOT40 averaged over 5 years	18000 µg/m³·h
		LTO	1 May to 31 July	AOT40 averaged over 1 year	6000 µg/m³ ·h
CO	Health	LV	Maximum daily 8-hour mean	Days when maximum daily 8-hour mean exceeded the limit value	10 mg/m³
Pollutants for which only validated data have to be reported					
Benzene	Health	LV	One Calendar year	Annual average	5 µg/m³

Formula	Protection target	Environmental Objective (Code[1])	Averaging period of assessments	Reporting Metric of environmental objective	Numerical values of the environmental objective (or allowed no. of exceedances)
Pb	Health	LV	One Calendar year	Annual average	0.5 µg/m³
Cd	Health	TV	One calendar year	Annual average	5 ng/m³
As	Health	TV	One calendar year	Annual average	6 ng/m³
Ni	Health	TV	One calendar year	Annual average	20 ng/m³
B(a)P	Health	TV	One calendar year	Annual average	1 ng/m³

[1] LV: limit value, LVMT: Limit value plus margin of tolerance, TV: target value, LTO: long-term objective, INT: Information threshold, ALT: Alert threshold, CL: Critical level, NAT: Assessment of natural contribution, WSS: Assessment of winter sanding and salting, ERT: Exposure reduction target, ECO: Exposure concentration obligation;

[2] No up-to-date data is to be made available for NAT and WSS which are not environmental objective as such.

(C) Pollutants with monitoring requirements

Legal references:

Directive 2008/50/EC, Article 2:
'pollutant' shall mean any substance present in ambient air and likely to have harmful effects on human health and/or the environment as a whole;

***

(1) Pollutants with monitoring requirements referred to in Directive 2004/107/EC and 2008/50/EC

A complete list of pollutants is published by EEA at URL:

http://dd.eionet.europa.eu/vocabulary/aq/pollutant/view

while in Table 6 the list of pollutants as described in IPR Decision 2011/850/EU and referred to in Directives 2008/50/EC and 2004/107/EC is presented.

Table 6: Pollutants with monitoring requirements as described in 2011/850/EU

Airbase code	Pollutant formula	Pollutant name	Measurement unit
Gaseous inorganic pollutants			
1	SO_2	Sulphur dioxide	µg/m³
8	NO_2	Nitrogen dioxide	µg/m³
9	NOx[1]	Nitrogen oxides	µg/m³
7	O_3	Ozone	µg/m³
10	CO	Carbon monoxide	mg/m³
Particulate Matter (PM)			
5	PM_{10}	PM_{10}	µg/m³
6001	$PM_{2.5}$	$PM_{2.5}$	µg/m³
$PM_{2.5}$ Speciation			
1047	SO_4^{2-} in $PM_{2.5}$	Sulphate in $PM_{2.5}$	µg/m³
1046	NO_3^- in $PM_{2.5}$	Nitrate in $PM_{2.5}$	µg/m³
1045	NH_4^+ in$PM_{2.5}$	Ammonium in $PM_{2.5}$	µg/m³
1771	elem. C in $PM_{2.5}$	Elemental Carbon in $PM_{2.5}$	µg/m³
1772	org. C in $PM_{2.5}$	Organic Carbon in $PM_{2.5}$	µg/m³
1629	Ca^{2+} in $PM_{2.5}$	Calcium in $PM_{2.5}$	µg/m³
1659	Mg^{2+} in $PM_{2.5}$	Magnesium in $PM_{2.5}$	µg/m³
1657	K^+ in $PM_{2.5}$	Potassium in $PM_{2.5}$	µg/m³
1668	Na^+ in $PM_{2.5}$	Sodium in $PM_{2.5}$	µg/m³
1631	Cl^-in $PM_{2.5}$	Chloride in $PM_{2.5}$	µg/m³
Heavy Metals			
5012	Pb in PM_{10}	Lead in PM_{10}	µg/m³
5014	Cd in PM_{10}	Cadmium in PM_{10}	ng/m³
5018	As in PM_{10}	Arsenic in PM_{10}	ng/m³
5015	Ni in PM_{10}	Nickel in PM_{10}	ng/m³
Heavy Metals Deposition			
7012	Pb deposition	wet/total Pb deposition	µg /(m².day)
7014	Cd deposition	wet/total Cd deposition	µg /m².day)
7018	As deposition	wet/total As deposition	µg /(m².day)
7015	Ni deposition	wet/total Ni deposition	µg /(m².day)
7013	Hg deposition	wet/total Hg deposition	µg /(m².day)
Mercury			
4013	Metallic gaseous Hg	elemental gaseous Mercury	ng/m³
4813	Total gaseous Hg	Total gaseous Hg	ng/m³
653	Reactive gaseous Hg	reactive gaseous Mercury	ng/m³
5013	Hg in PM_{10}	Mercury in PM_{10}	ng/m³
Polycyclic Aromatic Hydrocarbons			
5029	B(a)P in PM_{10}	Benzo(a)pyrene in PM_{10}	ng/m³

Airbase code	Pollutant formula	Pollutant name	Measurement unit
		(aerosol)	
5610	Benzo(a)anthracene	Benzo(a)anthracene in PM_{10}	ng/m³
5617	Benzo(b)fluoranthene	Benzo(b)fluoranthene in PM_{10}	ng/m³
5759	Benzo(j)fluoranthene	Benzo(j)fluoranthene in PM_{10}	ng/m³
5626	Benzo(k)fluoranthene	Benzo(k)fluoranthene in PM_{10}	ng/m³
5655	Indeno(1,2,3,-cd)pyrene	Indeno(1,2,3,-cd)pyrene in PM_{10}	ng/m³
5419	Dibenzo(a,h)anthracene	Dibenzo(a,h)anthracene in PM_{10} (aerosol)	ng/m³
5763	Dibenzo(a,h)anthracene	Dibenzo(a,h)anthracene in PM_{10} (air+aerosol)	ng/m³
5480	Benz(b,j)fluoranthene	Benz(b,j)fluoranthene in PM_{10}	ng/m³
Polycyclic Aromatic Hydrocarbons Deposition			
7029	B(a)P	Benzo(a)pyrene deposition	µg /(m².day)
611	Benzo(a)anthracene	Benzo(a)anthracene deposition	µg /(m².day)
618	Benzo(b)fluoranthene	Benzo(b)fluoranthene deposition	µg /(m².day)
760	Benzo(j)fluoranthene	Benzo(j)fluoranthene deposition	µg /(m².day)
627	Benzo(k)fluoranthene	Benzo(k)fluoranthene deposition	µg /(m².day)
656	Indeno(1,2,3,-cd)pyrene	Indeno(1,2,3,-cd)pyrene deposition	µg /(m².day)
7419	Dibenzo(a,h)anthracene	Dibenzo(a,h)anthracene deposition	µg /(m².day)
7380	Benzo(b,j,k)fluoranthene	Benzo(b,j,k)fluoranthene deposition	µg /(m².day)
Volatile Organic Components			
20	C_6H_6	Benzene	µg/m³
428	C_2H_6	Ethane	µg/m³
430	C_2H_4	Ethene (ethylene)	µg/m³
432	$HC{\equiv}CH$	Ethyne (acetylene)	µg/m³
503	$H_3C\text{-}CH_2\text{-}CH_3$	Propane	µg/m³
505	$CH_2{=}CH\text{-}CH_3$	Propene	µg/m³
394	$H_3C\text{-}CH_2\text{-}CH_2\text{-}CH_3$	n-butane	µg/m³
447	$H_3C\text{-}CH(CH_3)_2$	2-methylproprane (i-butane)	µg/m³
6005	$H_2C{=}CH\text{-}CH_2\text{-}CH_3$	1-butene	µg/m³
6006	$H_3C\text{-}CH{=}CH\text{-}CH_3$	trans-2-butene	µg/m³
6007	$H_3C\text{-}CH{=}CH\text{-}CH_3$	cis-2-butene	µg/m³
24	$CH_2{=}CH\text{-}CH{=}CH_2$	1,3-butadiene	µg/m³
486	$H_3C\text{-}(CH_2)_3\text{-}CH_3$	n-pentane	µg/m³
450	$H_3C\text{-}CH_2\text{-}CH(CH_3)_2$	2-methylbutane (i-pentane)	µg/m³

Airbase code	Pollutant formula	Pollutant name	Measurement unit
6008	$H_2C=CH-CH_2-CH_2-CH_3$	1-pentene	µg/m³
6009	$H_3C-HC=CH-CH_2-CH_3$	2-pentene	µg/m³
451	$CH_2=CH-C(CH_3)=CH_2$	2-methyl-1,3-butadiene (isoprene)	µg/m³
443	C_6H_{14}	n-hexane	µg/m³
316	$(CH_3)_2-CH-CH_2-CH_2-CH_3$	2-methylpentane (i-hexane)	µg/m³
441	C_7H_{16}	n-heptane	µg/m³
475	C_8H_{18}	n-octane	µg/m³
449	$(CH_3)_3-C-CH_2-CH-(CH_3)_2$	2,2,4-trimethylpentane (i-octane)	µg/m³
21	$C_6H_5-CH_3$	Toluene	µg/m³
431	$C_6H_5-C_2H_5$	Ethyl benzene	µg/m³
464	m,p-$C_6H_4(CH_3)_2$	m,p-xylene	µg/m³
482	o-$C_6H_4-(CH_3)_2$	o-xylene	µg/m³
6011	$C_6H_3(CH_3)_3$	1,2,4-trimethylbenzene	µg/m³
6012	$C_6H_3(CH_3)_3$	1,2,3-trimethylbenzene	µg/m³
6013	$C_6H_3(CH_3)_3$	1,3,5-trimethylbenzene	µg/m³
32	THC(NM)	total non-methane hydrocarbons	µg/m³
25	HCHO	Methanal (formaldehyde)	µg/m³

[1] NO_x or the sum of NO and NO_2 measured at the same monitoring site can be reported. To be reported as µg NO_2 /m³.

(2) Pollutants not listed in Directive 2004/107/EC and 2008/50/EC

Legal reference:

Decision 2011/850/EU - ANNEX I (C) provides:
"A list including further pollutants on which Member States shall have reciprocal data exchange, as available, is kept by the European Environment Agency and is made available at the portal."

***

The complete up-to-date list of pollutants (RDF data model) is published by the EEA at:

http://dd.eionet.europa.eu/vocabulary/aq/pollutant/view

(3) Units of Measurement

Legal reference: Decision 2011/850/EU - ANNEX I , (B) and (C). The measurement units are presented in Table (B) "Environmental objectives and reporting metrics" and Table (C) "Pollutants with monitoring requirements" of Annex I of Decision 2011/850/EU.

***

Table 6 above and the complete list of pollutants compared with the Airbase list published by the EEA (below) contain also the units of measurement to be used:

http://dd.eionet.europa.eu/vocabulary/aq/observationunit/view

ANNEX II OF DECISION 2011/850/EU

(A) Common Data types

Article 5 of Decision 2011/850/EU in conjunction with Annex II, Part A.

The description of the different fields for the common data types are given in the second part of this guidance, also called "schemata".

(B) Information on zones and agglomerations (Article 6)

Legal references:

-Article 4 of Directive 2008/50/EC
-Article 6 of Decision 2011/850/EU in conjunction with Annex II, Part B.

***
After the end of the calendar year, where changes are made to the delimitation and the type of zones and agglomerations, the Member States shall inform the Commission thereof (Art 6.3 of Commission Implementing Decision). In this case, the finally validated data shall be made available with datasets B to G by 30 September of the following year – and it is best practice to include documentation about the changes made within the respective envelope together with the re-submitted data flow and to made the Commission aware of those changes (ENV-AIR@ec.europa.eu with in cc aqipr.helpdesk@eionet.europa.eu). **In case of a significant change to the boundary for a zone**, **a new identifier for that zone has to be provided.** Member States may also indicate that there have been no changes to the information previously made available.

Air quality zones have to be delineated in a GIS (Geographic Information System) format representing the spatial extent encoded in GML. This can be a single polygon or - in case of discontinuous representativeness area - aggregated polygons or exclusions. The individual polygons are each defined as a list of coordinates; this type includes geometry specification (geodetic coordinate reference system). The latter should be used only in case of discontinuous air quality zones. On a voluntary basis, the relevant Local Administrative Unit codes should be provided. Where the area of the zone is large and is consistent with administrative boundaries at a higher level (NUTS codes etc.) these may be used for efficient declaration of the boundary of a zone.

It is up to the Member States' discretion as to whether to include territorial waters in their zones and agglomerations or not.

The complete code lists are published on the portal at:

Zone type: http://dd.eionet.europa.eu/vocabulary/aq/zonetype/view

NUTS : http://dd.eionet.europa.eu/vocabulary/common/nuts/
LAU2: http://dd.eionet.europa.eu/vocabularies

Air quality atlas (maps of air quality zones): http://ec.europa.eu/environment/air/quality/zones.htm

Note:
Member States shall not change the delimitation of the air quality zones subject to time extension without prior approval from the Commission as mentioned in the respective Decisions.

(1) Zone code (Decision Annex II, B(3))

Legal references:

Article 6 of Decision 2011/850/EC

***
A unique unambiguous code of the zone has to be generated by the Member State and used for the reporting. As mentioned before, when there is a change of boundary for a zone, a new identifier (i.e. new code) for that zone has to be provided.

The zone code consists of the ISO 3166-1 country code followed by any unique combination of numbers or letters selected by the Member State

The ISO 3166-1 country code is available at:
http://www.iso.org/iso/country_names_and_code_elements

(C) Information on the assessment regime (Article 7)

Legal references:

-Article 4 of Directive 2004/107/EC
-Article 5 of Directive 2008/50/EC
-Article 7 of Decision 2011/850/EU
all define the "assessment regime".

***
Guidance on assessment can be found at
http://ec.europa.eu/environment/air/pdf/guidanceunderairquality.pdf

The complete code lists are published on the portal at:

http://dd.eionet.europa.eu/vocabulary/aq/assessmentthresholdexceedance

and

http://dd.eionet.europa.eu/vocabulary/aq/assessmenttype/

(1) Classification of zones in relation to assessment thresholds

Legal references:

-Article 5 of 2008/50/EC and Article 4 of 2004/107/EC specify that Air Quality (AQ) zones shall be classified in relation to assessment thresholds on, at a minimum, a 5-year cycle, and more frequently in the event of significant changes in activities relevant to the ambient concentrations.
-Article 7 of Decision 2011/850/EU states that MS shall make available the information on the assessment regime to be applied for each zone and pollutant in the following calendar year.

***
The objective of an assessment regime is to benchmark the levels of pollutants with environmental objectives and based on these levels establish a proportionate regime or system for the assessment and management of air quality going forward. An assessment regime may include a variety of assessment types:

- Fixed measurement
- Indicative measurement
- Modelling
- Objective Estimation

or a combination of these.

The selection of the assessment type will depend upon the observed pollution levels in relation to the Assessment Thresholds specified in Annex II of 2008/50/EC and Annex I of 2004/107/EC.

Where for a given pollutant a certain environmental objective (e.g., limit value or target value) is clearly more stringent than the others (e.g. the annual mean NO_2 metric vs. the 1-hour NO_2 metric), the Lower Assessment Threshold /Upper Assessment Thresholds should be applied based on the stricter metric (i.e. in this case the annual mean) as a conservative indicator of levels and scope of public health exposure assessment required.

Where the stringency of LV metrics is not easy to differentiate, e.g., for PM10, the assessment should be performed for both metrics and the worst exceedance status chosen from each assessment on a zone by zone basis.

Table 7: Assessment regime options allowed based on preliminary assessment of pollutant levels

Pollutants	**Pollution level[1]**	**Considered period[2,3]**	**Assessment regime**
SO_2, NO_2, NO_x, PM_{10}, $PM_{2.5}$, Pb, C_6H_6, CO As, Cd, Ni, BaP	Pollution level > UAT	At least three of the previous five years	Fixed measurements shall be used, possibly supplemented by modelling techniques and/or indicative measurements.
SO_2, NO_2, NO_x,	Pollution level ≤ UAT	At least three of the	Fixed measurements may be

PM_{10}, $PM_{2.5}$, Pb, C_6H_6, CO As, Cd, Ni, BaP	and > LAT	previous five years	combined with modelling techniques and/or indicative measurements.
SO_2, NO_2, NO_x, PM_{10}, $PM_{2.5}$, Pb, C_6H_6, CO As, Cd, Ni, BaP	Pollution level ≤ LAT	At least three of the previous five years	Modelling techniques or objective estimation techniques are sufficient.
O_3	Pollution level > LTO	Any of the previous five years of measurement	Fixed measurements shall be used, possibly supplemented by modelling techniques and/or indicative measurements.

[1] UAT: upper assessment threshold; LAT: lower assessment threshold; LTO: long term objective

[2] When insufficient data are available for the previous three or five years, Member States may combine measurements campaigns of shorter duration during the period of the year and at locations likely to be typical of the highest pollution level with results obtained from information from emission inventories and modelling to determine exceedances of the upper and lower assessment threshold (see also Article 9 and Annex II, B of 2008/50/EC)

[3] The location of the maximum observed annual concentration does not need to be the same over the considered period, i.e., different sampling points might be measuring the highest concentration in different years.

Assessment must be carried out in accordance with the Guidance on Assessment under the EU Air Quality Directives that can be found at:
http://ec.europa.eu/environment/air/pdf/guidanceunderairquality.pdf

(2) Data Submission

The preliminary Assessment Regime dataset (Dataset C) is applicable for a specific calendar year and in accordance with Article 7.2 of Decision 2011/850/EU, must be reported before the end of the previous year (i.e. a forward looking submission made by 31 December for the forthcoming year). Member States may indicate that there have not been any changes to the information previously made available. Reclassification/review of zones status based on a new 5-year period or in the event of significant changes in activities will require a full resubmission of the Assessment Regimes dataset. The finally validated dataset shall be made available – together with datasets D to G – by 30th September of the following year, i.e., backward-looking to the year before (Art. 6.3).

All information about the assessment regime shall be provided for each zone and for each pollutant using the list of information set out in Part C of Annex II of the Decision 2011/850/EU. The information to be provided shall be the result of an assessment done by the MS and will not be automatically generated by the routines of the EEA Portal.

Documentation of the classification of zones in relation to the assessment thresholds should be made available to the Commission and public through a link; i.e., the procedure for determining

whether a zone is below the lower assessment threshold, between the lower and upper thresholds, or above the upper threshold, shall be documented and made available through a link.

(D) Information on the assessment methods (Articles 8 and 9)

Sub-sections (1), (2), (3) and (4) of this section provide guidance on fixed measurement, indicative measurement, modelling and objective estimation respectively. Sub-section (5) covers guidance on Data Quality Objectives which is relevant to all of the above.

(1) Fixed measurement information (Decision Annex II D(ii))

Legal reference:

Decision 2011/850/EU - ANNEX II - (D) Information on the assessment methods , (ii) "Fixed measurement Information" describes the information to be made available by the Member States (mandatory or voluntary).
Decision 2011/850/EU, Article 2:
(1) 'Station' means a location where measurements and/or samples are taken at one or more sampling points at the same site within an area of some 100 m².
(2) 'Network' means an organisational structure performing assessment of ambient air quality by measuring at one or more stations.

***

The information on monitoring stations (under D.5.2) has to be provided for each monitoring station. Each monitoring station may have several different measurement configurations (sampling points), which are pollutant-specific. The information on measurement configurations (data field D.5.1) shall therefore be provided for each measurement configuration that is being operated at a station.

The competent bodies, e.g., monitoring networks, which are responsible for station maintenance and Quality Assurance /Quality Control (QA/QC) procedures are nominated by the Member States.

More detailed guidance is provided on specific points of Decision Annex II D (ii) below; the numbering reflects the numbering of points in the IPR Annex itself.

(i) EoI station code (Decision Annex II D(ii), item 4)

Legal reference:

Decision 2011/850/EU, ANNEX II - (D) Information on the assessment methods; point (4) mentions 'station code' as one of the pieces of information that MS should report.

***

A unique unambiguous code of the Station has to be generated by the Member State and used for the reporting. The previous rules used for AIRBASE shall be used for the generation of this code.

The IPR station code has the format structure CCXXXXX, where
<CC> : the ISO 3166-1 country code;
<XXXXX> : any unique combination of numbers or letters selected by the Member State

The ISO 3166-1 country code is available at:
http://www.iso.org/iso/country_names_and_code_elements

Note:
At present, two types of station codes exist which are identical in format but have different characters as a suffix. The two types are those for reporting to AQeReporting (Airbase type station code), and those for reporting to EMEP and the EBAS database. The format is a 2 character ISO country code, 4 digit sequence number per country and "A" (indicating AIRBASE type code) or R for EBAS.

European (Airbase) codes are generated by Member States. The station code will need to be generated by EMEP if a station is also to be used for reporting to EMEP, so that it ends in an R.
If a monitoring station or sampling point is moved to a different location, it needs to be given a new code/identifier.

(ii) Name of the monitoring station (Decision Annex II D(ii), item 5)

Legal reference:

Decision 2011/850/EU, ANNEX II - (D) Information on the assessment methods, point (5) mentions 'Name of the monitoring station' as one of the pieces of information that MS should report.

***

The name of the station should be the same as used for national reporting and for providing information to the public.

In Table 8 some examples for station names are given. It is recommended that the station names should be unambiguous and remain unchanged over time.

Table 8: Recommendation for station names

Type of location	Recommended name	Examples
urban areas	name of the town or municipality + name of street, place or significant location nearby	Berlin Frankfurter Allee Wien Stephansplatz Bristol St. Pauls Datteln Bahnhof
suburban areas	name of the town or municipality + name of district, suburb, street, place or significant location nearby	Innsbruck Sadrach Duisburg-Bruckhausen Modena - Castelfranco
small settlements (with only one monitoring site)	name of municipality	Mistelbach Fulda
rural stations	either name of nearby village name of mountain, landscape area	Illmitz Westerland Jungfraujoch

Not recommended station names (examples from AirBase):

- Vague information about the location within a town (e.g. “Centre”, “North”).
- Inappropriate station code in the station name, which can cause confusion (e.g. DENW132: Siegen Haardter Berg)
- Abbreviations of locations (e.g. “Reading HC")
- -Landscape and street names referring to large areas, which give no detailed information about the location (e.g. “Spessart”, “Dunkelsteinerwald”)
- Name of town missing in case of urban stations: (e.g. “University”, “Rautatienkatu”, “Giulio Cesare”)
- An abbreviation of the town name giving insufficient information (e.g. “Pha10-Pocernicka” for a station in Prague, “HH Billstedt” for a station in Hamburg)
- Only a town name in case of agglomerations or large towns (e.g. “Glasgow”)
- No information about the location (e.g. “Exeter traffic”, “Glasgow kerbside”)
- Number instead of location (e.g. “Castrop-Rauxel 6”, “Copenhagen/1257”, “London 1”)
- Station code instead of station name (e.g. RO21101)
- Meaningless abbreviations (e.g. “R.D.S.”)

Such names should be avoided.

(iii) Equivalence (Decision Annex II D(ii), item 13)

Legal reference:

-Directive 2008/50/EC, Annex 6, B
-Decision 2011/850/EU, ANNEX I, part A.3

***

Non-reference measurement methods can also be used provided they respect provisions for equivalence set out in the Directives (see for example 2008/50/EC, Annex VI). A Commission Working Group on Equivalence prepared a document describing principles and methodologies to be used for the demonstration of the equivalence of alternative (non-reference) measurement methods to the reference methods described by the EN Standard methods. The Ambient Air Quality Committee established under Directive 2008/50/EC has endorsed an updated version of the guidance for the implementation of the Directive 2008/50/EC. The guidance and the corresponding tool are available:

http://ec.europa.eu/environment/air/quality/legislation/assessment.htm

Note:
In exceptional cases, if PM_{10} concentrations are measured with two different instruments at one site, (e.g., tapered element oscillating microbalance with filter dynamic measurement system (TEOM – FDMS) and TEOM + correction) and if the data from TEOM-FDMS are missing then, it is possible to replace the missing data by corrected TEOM data provided that both methods have been demonstrated to be equivalent to the reference method. Note that the responsibility to do this lies with the Member States.

(iv) Evaluation of representativeness (Decision Annex II D(ii), item 17)

Legal reference:

-Decision 2011/850/EU, ANNEX II - (D) Information on the assessment methods lists the "Evaluation of representativeness" as information that MS should report, if available.

***

There is as no definition of the spatial representativeness of monitoring stations in the AQ legislation yet. FAIRMODE is in the process of developing tools for its quantitative assessment: http://fairmode.jrc.ec.europa.eu/cca.html

In 2007, a study was conducted for the Commission by the UBA Austria to investigate ways of facilitating a more harmonized approach to the classification of monitoring stations. The report can be found at:
http://ec.europa.eu/environment/air/quality/legislation/pdf/report_uba.pdf.

A paper of Joly and Peuch (2011) described another method based only on the past time series of the measured pollutant.

The evaluation of representativeness will be further evaluated in the framework of the collaboration between AQUILA/FAIRMODE. Once this analysis is concluded, a final recommendation will be included in this guidance.

(v) Local and regional dispersion situation (D.5.2.11 of Part II)

The data field Local Dispersion Situation describes the location of the station in relation to nearby buildings. The description of local dispersion situations refers to ground level. The height of the air inlet above ground level is described elsewhere in dataset (D).

A complete code list is published by EEA at:

http://dd.eionet.europa.eu/vocabulary/aq/dispersionlocal

Table 9: Recommendations for assessing the local dispersion situation

Street canyon	Continuous/compact buildings along both sides of the street over more than 100 m. Average ratio of height of buildings to width of street > 0,5. (for this purpose "street" means the distance between the two facades of the buildings opposing each other, so including any pavements, gardens, etc.)
Detached buildings or one-sided compact buildings	Detached buildings on both sides of the street. Compact buildings on one side of the street, few buildings on the other side. Forest or groups or large trees in a surrounding of some 10 m
Open terrain	Flat area without large buildings or large trees in a surrounding of several 10 m
Elevated terrain	Summit, slope or saddle. Relative altitude of the station of at least some 10 m related to surroundings of some 100 m. Monitoring stations located on towers or high buildings are not considered as “elevated”.

The data field Regional Dispersion Situation describes the topographic situation on a scale of several kilometres. A complete code list is to be found at:

http://dd.eionet.europa.eu/vocabulary/aq/dispersionregional/view

Table 10: Recommendation for assessing the regional dispersion situation

Plane terrain	Flat area on a scale of several 10 km with relative altitudes less than 100 m
Hilly terrain	Area with relative altitudes between 100 and 300 m on a scale of several 10 km
Mountainous terrain – slope	Area with relative altitudes between 300 and 1000 m on a scale of some 10 km. Slope characterizes locations neither on valley bottom not on ridge, summit or pass
Mountainous terrain – ridge, pass or summit	Area with relative altitudes between 300 and 1000 m on a scale of some 10 km.
High alpine terrain	Area with relative altitudes above 1000 m on a scale of some 10 km, not located at the bottom of a valley or basin
Valley in hilly terrain	Bottom of a valley (relative altitude less than 100 m) in hilly terrain
Valley in mountainous terrain	Bottom of a valley (relative altitude less than 100 m) in mountainous or alpine terrain
Basin in hilly terrain	Bottom of a basin (relative altitude less than 100 m) in hilly terrain. A basin is characterized as flat or hilly terrain on a scale of 5 to some 10 km surrounded by hilly or mountainous terrain.
Basin in mountainous terrain	Bottom of a basin (relative altitude less than 100 m) in mountainous terrain.
Basin partly surrounded by mountains	Bottom of a basin (relative altitude less than 100 m) located at the border of mountains, surrounded by alpine or mountainous terrain on one side and flat or hilly terrain on the other side.
Coast with plane terrain in interior	Marine coast with plane or hilly terrain (see above) in its interior
Coast with mountainous terrain in interior	Marine coast with mountainous or alpine terrain (see above) in its interior

(vi) Type of network (D.5.3.3 of Part II)

The data field Type of Network refers to the description of the spatial scale that the network covers, to be selected from the Code list Network Type.
The complete Code list is published on the portal at:

http://dd.eionet.europa.eu/vocabulary/aq/networktype/view

Table 11: Type of networks

Local	designed for the observation of single emission sources
Urban	designed at the spatial level of an agglomeration or conurbation
Regional	designed at the spatial level of an administrative unit of some 1000s to some 10.000s km²
National (Entire country)	designed at national level
Other	e.g. networks comprising monitoring sites in more than one country; networks targeted at special ecosystem monitoring.

(vii) Station classification in relation to prominent emission sources (Decision Annex II D(ii), item 22)

Legal reference:

Decision 2011/850/EU, in ANNEX II - (D) Information on the assessment methods lists the "Classification of station in relation to predominant emission sources relevant for the measurement configuration for each pollutant" as one of the pieces of information that MS should report.

***

Table 12 includes recommendations as regards the classification of station in relation to dominant emission sources as defined in the Exchange of Information (97/101/EC). The complete code list is published on the portal at:

http://dd.eionet.europa.eu/vocabulary/aq/stationclassification

Table 12: Station classification in relation to predominant emission sources in accordance with the macro scale siting criteria

Traffic	Located in close proximity to a single major road.
Industrial	Located in close proximity to a single industrial source or industrial area. A wide range of industrial sources can be considered here, including ➢ thermal power generation ➢ district heating plants ➢ refineries ➢ waste incineration/treatment plants, dump sites ➢ mining, including gravel, oil, natural gas ➢ airports ➢ ports
Background	Any location with is neither to be classified as “traffic” or “industrial”. Located such that its pollution levels are representative of the average exposure of the general population (or vegetation and natural ecosystems) within the type of

	area under assessment. The pollution level should not be dominated by a single source type (e.g. traffic), unless that source type is typical within the area under assessment. The station should usually be representative of a wider area of at least several square kilometres

* This table is recommended by the SCREAM document - Assessment of siting criteria, clasifications and representativeness of air quality monitoring stations

Other types of available information, e.g. photos, shall be made available through a Member State's web link.

(viii) Main emission sources (Decision Annex II D(ii), item 23)

Legal reference:

Decision 2011/850/EU, in ANNEX II - (D) Information on the assessment methods lists the "Main Sources" as a piece of information that MS should report, where available.

***

Contributions of a source below 3 % may be labelled as not significant. The main emission source(s) can be selected from the code list "Main Emission Sources".
The complete code list is published at:

http://dd.eionet.europa.eu/vocabulary/aq/emissionsource/view

The Nomenclature For Reporting (NFR) has been developed under the UNECE Convention on Long-range Transboundary Air Pollution (CLRTAP) to ensure the standardised reporting of emission inventory data from Parties. The NFR reporting structure is closely aligned with the Common Reporting Format (CRF) used for reporting of greenhouse gases to the United Nations Framework Convention on Climate Change (UNFCCC), and takes into account additional specific air pollution sources. The NFR format was defined within the 2009 Emission Reporting Guidelines (ECE/EB.AIR/97) agreed under the Convention. Revised 2014 Reporting guidelines have been adopted for application in 2015 and subsequent years. The document is a revised version of the 2009 Guidelines for Reporting Emission data under the Convention. Annexes for the revised 2014 reporting guidelines are available here:
http://www.ceip.at/fileadmin/inhalte/emep/2014_Guidelines/Annexes_revised_150708.zip

In addition to the NRF emission categories, two “source” types have been introduced which represent contributions not originating from identifiable sources: “Secondary” and “Long-range transport”. For both, neither a sectoral nor a spatial source attribution is possible.

Table 13: Main emission sources

Main Emission Source	UNFCCC NFR category	Description
Energy	1.A.1	1. Energy /A. Fuel Combustion /*1. Energy* Industries
Industry	1.A.2 2.	1. Energy /A. Fuel Combustion /*2. Manufacturing Industries and Construction* 2. Industrial Processes /A. Mineral Products, B. Chemical Industry, C. Metal Production, D. Other Production
Transport	1.A.3	1. Energy /A. Fuel Combustion/*3. Transport*
Domestic	1.A.4 1.A.5	1. Energy /A. Fuel Combustion/4. Other Sectors 1. Energy /A. Fuel Combustion/5. Other
Fugitive emissions	1.B	1. Energy / B. Fugitive Emissions from Fuels /*1. Solid Fuels, 2. Oil and Natural Gas*
Agriculture	4.	4. Agriculture /A. Enteric Fermentation, B. Manure Management, C. Rice Cultivation, D. Agricultural Soils, E. Prescribed Burning of Savannas, F. Field Burning of Agricultural, Residues, G. Other
Solvents	3.	3. Solvent and Other Product Use
Waste	6.	6. Waste /A. Solid Waste Disposal on Land, B. Waste-water Handling, C. Waste Incineration, D. Other
Secondary		Secondary pollutants originating from precursors , the sources of which are distributed over a large area.
Long-range transport		Transport over distances of several 100 km, originating from sources which are distributed over a large area.
Other		

(ix) Requirements on the accuracy of coordinates (Decision Annex II D(ii), item 26)

Legal reference:

Decision 2011/850/EU, in ANNEX II - (D) Information on the assessment methods; point 26 lists 'Geographical coordinates: longitude, latitude and altitude of monitoring station' as information that MS should report.

***

It is recommended to give the station coordinates in degrees-minutes-seconds, with the second in one decimal, which corresponds with about 3 meters in north-south direction and 1.3 to 2.3 meters in east-west direction depending on the latitude. If the coordinates are given in degree-decimal notation, it is recommended to give this in at least four decimals (corresponding to an accuracy of about 10 meters) but preferably five decimals (corresponding to an accuracy of about 1 meter).

Member States are recommended to use the European Terrestrial Reference System 1989 or subsequent updates (substitution by the World Geodetic System 1984 is accepted for a transitional period i.e. to 2020). The spatial reference system used has to be reported.

(x) Classification of the Area (Decision Annex II D(ii), item 28)

Legal reference: Decision 2011/850/EU, ANNEX II - (D) Information on the assessment methods lists the "Classification of the area" as one of the information MS should report.

***

The data field Classification of the Area describes the location with respect to distribution/density of building. The code list is at:

http://dd.eionet.europa.eu/vocabulary/aq/areaclassification/view

Table 14: Criteria for area classification

Urban area	Continuously built-up urban area meaning complete (or at least highly predominant) building-up of the street front side by buildings with at least two floors or large detached buildings with at least two floors. With the exception of city parks, large railway stations, urban motorways and motorway junctions, the built-up area is not mixed with non-urbanised areas.
Suburban area	Largely built-up urban area. 'Largely built-up' means contiguous settlement of detached buildings of any size with a building density less than for 'continuously built-up' area. The built-up area is mixed with non-urbanised areas (e.g. agricultural, lakes, woods). It must also be noted that 'suburban' as defined here has a different meaning than in every day English i.e. 'an outlying part of a city or town' suggesting that a suburban area is always associated to an urban area. In our context, a suburban area can be suburban on its own without any urban part.
Rural area	All areas, that do not fulfil the criteria for urban or suburban areas, are defined as "rural" areas. The rural area could be further subdivided to indicate the distance to the nearest built-up urban area: • Rural – near city: area within 10 km from the border of an urban or suburban area; • Rural – regional: 10-50 km from major sources/source areas; • Rural – remote: > 50 km from major sources/source areas.

The distances given here are only indicative. The border in this case should be understood as the factual delimitation of the built-up area, not the administrative border.

These definitions are based on the distribution/density of buildings. However, other elements such as population density, size of the area and land-use information can be taken into consideration when classifying the area.

The different area types are mutually exclusive. A single area cannot be classified by two or more types.

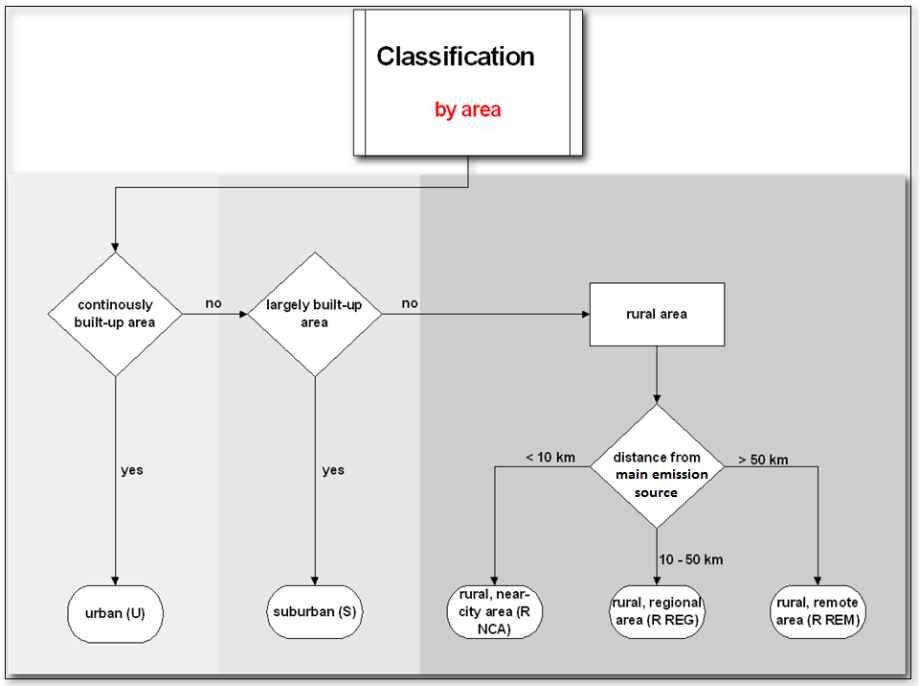


Figure 3: Classification of stations in relation to the area

(2) Indicative measurement and validation procedure

Legal reference: Decision 2011/850/EU, Article 9, paragraph 4 and Annex II D (iii)

***

Information about indicative measurement shall include at least the following:

- the measurement method applied;
- the sampling points and the coverage area;
- the validation method;
- the documentation of data quality.

Information and guidance on the use of indicative measurements can be found in the Guidance Report on Preliminary Assessment under EC Air Quality Directives (Van Aalst et al., 1998) and several more recent publications (Gerboles et al., 2005, Buzica et al., 2008, Plaisance et al., 2008, Hafkenscheid et al., 2009 etc).

Example:

Reporting the annual average of NO_2 using passive samplers [from Gerboles et al, 2005]

The last column of Table 15 is an extract from a scientific paper published in a peer reviewed journal. The work was not performed with the aim of reporting the results through the schemata. Therefore, not all the fields are appropriate in this case. Nevertheless, it is presented here as an example regarding the possible use of passive samplers as an indicative measurement. Details of some elements are described in Table 15 which we believe will help Member States understand what kind of information is needed in case of using passive samplers.

Table 15: Example of Dataset D for reporting annual average of NO2 using passive samplers

Reference	Description	Example
D.6.2	Description of the method	NO_2 Palmes diffusion tubes consists of an acrylic tube open at one end and stainless steel meshes coated with triethanolamine (TEA) at the closed end. A modification of the traditional Palmes diffusion tube by fitting a membrane at the open end of the tube is used. NO_2 diffuses through the air in the tube and is trapped as nitrite ion on TEA. It is then retained for subsequent quantitative analysis. The colorimetric method is used.
D.6.3.3	Measurement description	Passive sampler
D.6.3.3.1	Measurement type	Passive sampler (Palmes type)
D.6.3.3.2.1	Measurement method (see code list)	Other, colorimetry at 540 nm
D.6.3.3.4.1	Sampling method (see code list)	Passive adsorbent
D.6.3.3.6.1	Analytical technique description (see code list)	Colorimetry
D.6.3.5.1	Detection limit	1.4
A.12.2	Unit of detection limit	µg/m^3
D.6.3.4	Demonstration of equivalence	Not necessary when use in zones below the upper assessment threshold. If used in the zones above the upper assessment threshold, then the demonstration of equivalence is necessary
D.6.3.4.1	Equivalence with reference method demonstrated (see code list)	Equivalence demonstrated
D.6.3.4.2	Link to demonstration of equivalence report	http://publications.jrc.ec.europa.eu/repository/handle/111111111/773
D.6.3.5.2	Documentation of Traceability and	Estimation of uncertainty: please see chapter 5.3 Uncertainty calculation in:

	Uncertainty Estimation	http://publications.jrc.ec.europa.eu/repository/handle/111111111/8170
D.6.3.5.3	Documentation of QA/QC	https://uk-air.defra.gov.uk/assets/documents/reports/cat13/1309300904_All-Networks_QAQC_Document_2012__Issue1a.pdf) https://www.lcsqa.org/rapport/2015/ineris-lne-mines-douai/guide-validation-donnees-mesures-automatiques
D.6.3.6.1.1	Sampling duration unit (see code list)	week
D.6.3.6.2	Sampling interval	2 weeks

Notes:

1. Validation method (non – exhaustive list)

- Preparation of the sampler:
  To prepare the samplers, 3 steel meshes were coated using 40 ml freshly prepared 10% v/v aqueous solution of TEA.
- Method of analysis: Nitrite is extracted into aqueous solution and quantified by Saltzman reaction and colorimetric absorption at 540 nm.
- Determination of limit of detection: 1.4 µg/m^3
- Laboratory and field comparison with the reference method: please see the results of NO2 for Lab 1 in: http://publications.jrc.ec.europa.eu/repository/handle/111111111/10710
- Estimation of uncertainty: please see chapter 5.3 Uncertainty calculation in: http://publications.jrc.ec.europa.eu/repository/handle/111111111/8170

2. Documentation of QA/QC may contain (non – exhaustive list):

- The following QA/QC methods were introduced for preparation, cleaning and storage:
  - plastic tubes (Gradko International Ltd. DIF100) and caps (transparent XDIFCAP-001 and coloured XDIFCAP- 003) are cleaned using Millipore water and a shaker, for 3 h. The water was changed every half an hour.
  - all of the tubes and caps were placed in an oven at 45°C until they were completely dry.
  - the stainless steel mesh discs (XDISC) were cleaned in an ultrasonic bath at 60°C changing the water ten times at intervals of 30 min. The meshes were then dried in an oven at 125°C under a stream of nitrogen.

- A link to the internal SOP Standard Operational Procedure for preparation, analysis and reporting the results could be made available.

- The chemical analyses are performed using high quality chemical reagents; the calibration curve is checked by using standard check at the beginning, in the middle and at the end of each series of analysis.

(3) Modelling information and validation procedure

Legal reference : Decision 2011/850/EU, Article 9, paragraph 5 and Annex II D (iv)

***

Information about modelling shall include at least the following:

- the description of the modelling system and its inputs;
- the model validation through measurements;
- the coverage area;
- the documentation of data quality.

The EU Forum for AIR quality MODelling (FAIRMODE) (http://fairmode.ew.eea.europa.eu/) has developed guidelines which can be found in "The application of models under the European Union's Air Quality Directive: A technical reference guide", available at:

http://www.eea.europa.eu/publications/fairmode

Models are important assessment techniques that can help in assessing pollution levels throughout MS. They need to be configured to assess levels in the locations specified in Annex III of the AAQD. When used in conjunction with measurements to assess attainment of limit and target values the assessment shall be:

- based on the highest observed or predicted concentration, i.e., either the maximum measured or maximum modelled in each zone,
- model outputs must be relevant to the assessment requirements in Annex III of the AAQD.

The highest concentration in a zone will typically occur at a traffic location (or alternatively at an industrial location). However, those should neither include locations to which the public does not have access or locations within 25 metres of major junctions. Urban background locations are typically representative of exposure of the general population over several square kilometres.

(4) Objective estimation

Legal reference: Decision 2011/850/EU, Article 9, paragraph 6 and Annex II D (v)

***

Information about objective estimation shall include at least the following:

- the description of the estimation method;
- the documentation of data quality.

“Objective estimation techniques” will be interpreted as mathematical methods to calculate concentrations from values measured at other locations and/or times, based on scientific knowledge of the concentration distribution. One example is linear interpolation based on a justified assumption that the concentration pattern is sufficiently smooth. Another example is a dispersion model that has

been adjusted to reproduce concentrations measured within its domain. More information is available at: http://ec.europa.eu/environment/air/pdf/guidanceunderairquality.pdf)

(5) Reporting of data quality and traceability

Legal reference: Decision 2011/850/EU Annex II D (ii) (10-13), (40-44), (iii) (12-16), (iv) (13-14), (v) (4-6) all include data quality information as information to be reported by MSs.

***

All requirements for data quality and traceability as laid down in Directives 2008/50/EC Annex I and 2004/107/EC Annex IV are directly applicable to the assessment procedures implemented by Member States. Data quality objectives are to be reported for each measurement configuration.

Data quality and traceability as set out by Decision Annex II D (ii)-(v) form part of the data flows set out by Decision Annex II E and F - data quality and traceability being properties of primary and aggregated data. Thus, the data quality objectives, i.e., measurement uncertainty, data capture and data coverage, will be reported with the measurement configurations in Dataset E (Primary data) and F (Aggregated data) whilst information on the limit of detection is reported in Dataset D (Information about assessment methods).

In addition, quality assurance is documented by flagging individual measurements data according to their validation status (see also E (2) Validity flag and verification status flag).

The current reporting scheme only allows reporting one value for uncertainty. Until a solution has been found, the best practice would be to report the highest uncertainty to indicate the upper bound.

Note:

AQUILA has finalised in 2014 a guidance document on the reporting of Measurement Uncertainty– called “The Reporting of Measurement Uncertainties for Regulated Gaseous Air Pollutants and for Particulate Matter and its Constituents in Ambient Air, in Conformance with Directives 2008/50/EC and 2004/107/EC” (AQUILA N 256 – CIRCABC: https://circabc.europa.eu/faces/jsp/extension/wai/navigation/container.jsp?FormPrincipal:_idcl=FormPrincipal:_id1&FormPrincipal_SUBMIT=1&id=304b4052-ca59-4563-ba0b-df9c83a66ea6&javax.faces.ViewState=5S%2BL70BQcuq0UL1enonxX%2BnXI8OiZKW8RV%2Blj6p1hy3ShbV4SM2BrdZfBDPWVW17OeND9oORNWELqq%2BRyiPdNl6b2ahz%2FiMFs7glaJkppORX8kJwKjNVIXnEJMQKhY4nVdrDLdsAQpw3ht6mpgoRsyCTz%2B2PQbJVYIV3gw%3D%3D)

(E) Information on primary validated assessment data and primary up-to-date assessment data (Article 10)

(1) Averaging times

Legal reference:

Decision 2011/850/EU, Article 2 provides the following definitions:
(7) 'primary data' means information on the concentration or deposition level of a specific pollutant at the highest time resolution considered in this Decision;
(8) 'primary up-to-date assessment data' means primary data collected with the frequency appropriate to each pollutant assessment method and made available to the public without delay.

***

All measurement values reported as primary data or primary up-to-date data shall be reported at the highest time resolution considered appropriate in relation to the environmental objectives stated in the Directives (refer also to section Annex II (F) (2) Data aggregation).

For gaseous pollutants the averaging time for measurements is one hour. In some cases, where Member States record raw data obtained by automatic monitors as half hour mean values, these data should be used to calculate the hourly mean values before transmitting.

In the case of PM_{10} or $PM_{2.5}$, 24-hour mean values are obtained by using the gravimetric reference method described in EN12341. These data are transmitted as daily values. However, if automatic monitors (beta-absorption, tapered element oscillating microbalance (TEOM), etc.) are used, raw data with a resolution of 30 minutes or one hour are usually available. These data have to be aggregated to hourly averages for reporting. All PM data reported, both up-to-date as well as validated values, shall be reported as equivalent to the reference method for fixed measurement purposes. In the case of indicative measurements, the data should be supplied with a correction factor where this is required. PM can be reported without applying the correction factor only for Exchange of Information and objective estimations purposes.

Non-automatic sampler based techniques measured components (e.g. benzene, the components from the 4th Daughter Directive (Directive 2004/107/EC of the European Parliament and of the Council of 15 December 2004 relating to arsenic, cadmium, mercury, nickel and polycyclic aromatic hydrocarbons in ambient air) may use a variety of sample averaging times e.g.: 1-week, 2-week, 4-week, 1-month, 3-month, year, variable (varying sampling times). These measurements consist of samples with a start date/time and an end date/time. The averaging time of the sample is the period of the sample (end date/time minus start date/time).

It should be indicated in the reporting which averaging period has been used.

(2) Validity flag and verification status flag

Legal reference: Decision 2011/850/EU Annex II E points 12 and 13; note, also applicable for Annex II F points 14 and 15.

***

Validity and verification flags shall be used for the primary validated assessment data (E1a) and primary up – to –date assessment data (E2a), reported with dataset E.

Validity flags are
1: valid
2: Valid, but below detection limit measurement value given
3: Valid, but below detection limit and number replaced by 0.5*detection limit
-99: not valid due to station maintenance or calibration
-1: Not valid due to other circumstances or data is simply missing.

See also:
http://dd.eionet.europa.eu/vocabulary/aq/observationvalidity/view

Verification flags are

1: verified
2: preliminary verified
3: not verified

See also:
http://dd.eionet.europa.eu/vocabulary/aq/observationverification

When calculating aggregate statistics, verification and validity flags need additional attention. The database might contain unverified data for two reasons:

- Datasets E1a and E2a are merged in a single database within the system. The UTD/E2a data (with verification flags set to "not verified" or "partly verified") is normally overwritten by Dataset E1a which is being officially submitted later (with verification flag set to " verified"). If a country does not submit the data which have been transmitted earlier than UTD/E2a also through Dataset E1a, the UTD/E2a data remains in the system with the associated verification flags.
- If that happens, the country has submitted Dataset E1a but has not verified all data in that dataset. In this case, the UTD/E2a is replaced by E1a data, but the verification flags still indicate unverified data.

As statistics are calculated from the last submitted data (which might include E1a and UTD/E2a data at the same time), it might happen in these cases unverified or partly verified data are used for calculating compliance statistics. As good practice, in case they are calculated with data other than "verified", the statistics are flagged as "verification incomplete". One single “partly” or “unverified value” trigger this flagging.

(3) Handling of values below the detection limit

Legal reference: None.

***

For all measurements, basic values which are greater than or equal to the negative detection limit (–DL, i.e. the negative value of the detection limit) shall be accepted as they are, flagged with validity flag 2, and used for further evaluations and in all aggregations and calculations.

Values smaller than the negative detection limit, shall be discarded. Only in cases where values which are greater than or equal to the negative detection limit, but lower than the detection (or quantification, if available) limit are not available, shall these missing values be replaced by half the detection (or quantification, if available) limit and flagged with validity flag 3.

> The limit of **detection** (LoD or DL) is the lowest analyte concentration likely to be reliably distinguished from the limit of blank (LoB) and at which detection is feasible.
> The limit of **quantification** (LoQ or QL) is the lowest concentration at which the analyte can not only be reliably detected but at which some predefined goals for bias and imprecision are met. The LoQ may be equivalent to the LoD or it could be at a much higher concentration.
> (Source: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2556583/)

The only exceptions are some continuous PM monitoring techniques where negative values below the negative DL have a physical reason and shall therefore not be discarded in the course of data validation. Such values are to be considered as valid measurement values with a validity flag = 2.

The above rules were drawn by AQUILA and could be found at:
https://ec.europa.eu/jrc/sites/jrcsh/files/aquila-meeting-minutes-20090506-07-recommendations.pdf

These provisions generally apply for all kinds of measurements. The rounding should be done according to the commercial rounding rules.

Example

The detection limit is 2 µg/m³. A value of -3.1 µg/m³ is below the negative detection limit and has to be discarded. A value of -2µg/m³ is equal to the negative detection limit and therefore has to be considered as a valid measurement value (validity flag = 2, i.e. value below detection limit but measurement value given).
Discussions about two alternatives could arise in the case of -2.1 µg/m³:
1) -2.1 is smaller than -2, so the value has to be discarded (validity flag = -1);
2) -2.1 is rounded to -2 and therefore equal to the detection limit, so the value has to be considered as a valid measurement value (validity flag = 2);
The correct answer is that the value is rounded with one decimal place ($1 \leq |-2.1| < 10$ (see section Annex I (A) *(2) Number of significant digits and rounding*) and has to be discarded (option 1).

(F) Information on generated aggregated data and statistics (Article 11)

This section provides a description of the rules for calculation of aggregations and statistical values that are applied by the e-Reporting system. The calculations are made by the EEA on all primary data that is reported (i.e., for all stations and measurement configurations and can even be applied to modelled data). All statistics are accompanied by an associated time coverage and data capture rate as calculated by the EEA.

All valid data whatever their verification status are used for the calculation. However, if the data set contains one or more unverified or partly verified data, the statistics is flagged as unverified or partly verified.

Since all aggregations and statistical values are calculated by the EEA, the MS do not need to submit on F.

(1) Pollutants and their reporting metrics

Legal reference:
- Directive 2008/50/EC, Annexes VII, XI, XIV
- Directive 2004/107/EC, Annex I

Table 16 indicates for each of the main pollutants, which parameters can be calculated from which base data. The parameters in question include the percentiles corresponding to the relevant limit values.

Table 16 Pollutants and their reporting metrics

Component	Parameter based on			
	Hourly values, if reported	Daily values, if reported (raw daily & aggregated daily)	Daily maximum 8-hour running mean (aggregated from hourly)	Non hourly/daily (sample) data
Sulphur dioxide (SO_2)	- annual mean - hours with c > 350 µg/m^3 - 99.73 percentile* (~ max. 25 h) - hours with c > 500 µg/m^3 - winter mean	- annual mean* - days with c > 125 µg/m^3 - 99.2 percentile* (~ max. 4 days) - winter mean		- annual mean

Nitrogen dioxide (NO_2)	- annual mean - hours with c > 200 μg/m^3 - 99.79 percentile* (~ max. 19 h) - hours with c > 400 μg/m^3	- annual mean*		- annual mean
Nitrogen oxides (NO_x)	- annual mean	- annual mean*		
Ozone (O_3)	- hours with c > 180 μg/m^3 - hours with c > 240 μg/m^3 - AOT40 - AOT40 averaged over 5 years		- days with c >120 μg/m^3 - 93.2 percentile* (~ max. 26 days) - days with c >120 μg/m^3 averaged over 3 years	- annual mean
Carbon monoxide (CO)			- days with c >10 mg/m^3 maximum 8-hour running mean	
Particulate matter (PM_{10})	- annual mean	- annual mean - days with c > 50 μg/m^3, - 90.4 percentile (~ max. 36 days)		- annual mean*
Particulate matter ($PM_{2.5}$)	- annual mean	- annual mean AEI** NERT**		- annual mean*
All other pollutants	- annual mean	- annual mean		- annual mean

(*) Not to be used for compliance checking.

(**) As described in the appropriate chapters of this Guidance.

(2) Data aggregation

Legal reference:

Section A, Annex XI and Section A.2, Annex VII (ozone) of Directive 2008/50/EC provide criteria for checking validity when aggregating data and calculating statistical parameters.

***

The minimum time resolution that data shall be reported in in Dataset E (raw data) is hourly. Any values with a higher time resolution than one hour shall be aggregated to hourly values by the Member States before reporting. This aggregation shall be done according to the criteria provided in section A.2. of Annex VII and section A of Annex XI (i.e. a minimum of 75% (45 minutes) is required for a valid one hour value).

There are a few parameters for which the data needs to be aggregated further to time units larger than one hour (i.e., 8 hours and 24 hours). Only for checking the minimum requirements for time coverage and data capture (see next section) and calculating the **annual mean and the AOT40** (ozone), the data shall **not** be aggregated further than one hour (unless the time resolution of the reference method is higher than one hour).

To check compliance with the **limit and target values which are not expressed as hourly values or such as the annual means and the AOT40 for ozone**, the data needs to be aggregated further following the requirements of Section A, Annex XI and Section A.2, Annex VII (ozone) of Directive 2008/50/EC. That refers to:

- maximum daily 8 hours mean (ozone, CO)
- 24-hour values (PM10, SO2)

For aggregating the data to check compliance with the target value and the long-term objective regarding the **maximum daily 8-hour mean for ozone**, the requirements in Annex VII, Section A.2 of Directive 2008/50/EC regarding one hour values, eight-hour values, and daily maximum values from running eight-hour means need to be applied. Besides these, Annex VII, Section A.2 provides two additional criteria, i.e., the "number of exceedances and maximum values per month" and the "number of exceedances and maximum values per year". In practice, these latter two criteria should only be applied after compliance with the target value (TV) and the long-term objective (LTO) regarding the **maximum daily 8-hour mean for ozone** were checked. See also section Annex II (F) (4) *Compliance checking* for further explanations.

Data aggregation is performed before rounding. Data shall therefore always be reported with the same number of digits as obtained and processed in the monitoring network.

(3) Data quality objectives: Time coverage and data capture

Legal reference:

Section A, Annex I of Directive 2008/50/EC and Section I, Annex IV of Directive 2004/107/EC provide data quality objectives such as time coverage and data capture for ambient air quality assessment referring to the monitoring networks.

***

Definitions:

Time coverage and data capture are defined as follows:

Time coverage

Definition: Proportion of a calendar year (with specific seasonal provisions for ozone) during which measurements/sampling shall be/were in operation. The time coverage is always given as a percentage.

The time coverage shall not be less than the minimum time coverage requirements set out in Section A of Annex I in the Directive 2008/50/EC and Section I, Annex IV of Directive 2004/107/EC.

In order to calculate the time coverage of the dataset, the following formula shall be used:

$$\text{Time coverage} = N_{meas} / N_{year}$$

where

N_{meas} *is the number of days/hours on which measurements take place;*
N_{year} *is the total number of days/hours in the calendar year.*

N_{meas} can include invalid measurements, regardless of what caused the invalid measurement (e.g., maintenance or malfunction).

For many pollutants, the minimum time coverage requirements for fixed measurements are not explicitly provided. This is because fixed measurements of these pollutants are required to be continuous throughout a calendar year. In practice, this implies a minimum time coverage requirement of 100%, meaning that measurements should be planned throughout the year. For all other measurements, minimum time coverage requirements are provided as percentages.

For *indicative* measurements of ozone, time coverage shall be calculated only for the summer season, i.e., N_{meas_summer} shall consider actual measurement time during the summer season, and N_{summer} (which is the total number of days/hours in the summer season) shall replace N_{year} being the total number of days/hours in the summer season.

No minimum requirement for time coverage is given for benzene measurements in rural areas. It is therefore recommended to use the percentage given for urban background and traffic (35%) for rural and suburban background stations as well.

Examples for checking compliance with time coverage

The examples below illustrate two potential options for determining time coverage for indicative measurements of NO_2:

Minimum time coverage requirement = **14%**

Where measurements are carried out once per week (i.e. 52 days a year):

Time coverage = 52/365 = **14.25%**

Where measurements are carried out twice per week (i.e. 104 days a year):

Time coverage = 104/365 = **28.49%**

In practice, time coverage is a measure that is used to plan the measurements beforehand (measurement frequency, coverage of the year). After the year has ended, compliance with the minimum required time coverage is reported as a Boolean (TRUE/FALSE) in Dataset E1a (see also section Annex II (F) *(4) Compliance checking* below).

Data capture

Definition: Proportion of valid measurements in relation to the required number of days/hours on which measurements have to take place (i.e., as required by the time coverage objective). The data capture is always given as a percentage.

The data capture shall not be less than the minimum data capture requirements set out in Section A of Annex I in the Directive 2008/50/EC and section I, Annex IV of Directive 2004/107/EC respectively.

The data capture is defined by the following formula. To avoid rounding problems, the required number of days/hours on which measurements take place ($N_{minTimeCov}$) should not be calculated in advance but expressed as the product of the required percentage (MinTimeCov) multiplied by the number of days/hours in a year (N_{year}).

Data capture = $N_{valid}/N_{minTimeCov} = N_{valid}/(N_{year}*\text{MinTimeCov})$

where

N_{valid} *is the number of* ***valid*** *hourly/daily measurements in the measurement period;*

$N_{minTimeCov}$ *is the* ***required*** *number of days/hours on which measurements have to take place;*

MinTimeCov *is the requirement for time coverage expressed as a percentage given by Annex I of Directive 2008/50/EC and Annex IV of Directive 2004/107/EC*

Example

Arsenic in PM10, Fixed measurements, Leap year

MinTimeCov = 50%

N_{valid} = 164 days

N_{year} = 366 days

$$\text{Data capture} = \frac{164}{366 \times 50\%} = 0.896 \approx 90\%$$

The following tables provide all applicable values of N_{year} (Table 17) and the minimum numbers of days/hours to satisfy the time coverage requirements (Table 18) for all pollutants and all types of

measurement as set out in Section A of Annex I in the Directive 2008/50/EC and section I, Annex IV of Directive 2004/107/EC respectively (see Table 18).

Table 17: All applicable numbers of N_{year}

	N_{year} (Common year)		N_{year} (Leap year)	
	hourly values	**daily values**	**hourly values**	**daily values**
All pollutants except ozone	8760	365	8784	366
Ozone: summer (April – Sept)	4392	183	4392	183
Ozone: winter (Jan-March, Oct-Dec)	4368	182	4392	183

Table 18: Minimum time coverages for all pollutants and all types of measurement

Pollutant	MinTimeCov in %	Reference
minimum time coverage for fixed measurements		
SO_2	100	2008/50/EC, Annex I
NO_2	100	2008/50/EC, Annex I
NO_x	100	2008/50/EC, Annex I
Benzene (industry)	90	2008/50/EC, Annex I
Benzene (background, traffic)	35	2008/50/EC, Annex I
CO	100	2008/50/EC, Annex I
O_3 (summer)	100	2008/50/EC, Annex I
O_3 (winter)	100	2008/50/EC, Annex I
Pb	100	2008/50/EC, Annex I
PM_{10}	100	2008/50/EC, Annex I
$PM_{2.5}$	100	2008/50/EC, Annex I
As	50	2004/107/EC, Annex I
Cd	50	2004/107/EC, Annex I
Ni	50	2004/107/EC, Annex I
BaP	33	2004/107/EC, Annex I
Required minimum time coverage for random measurements (fixed)		
Benzene (industry)	14	2008/50/EC, Annex I
Benzene (background, traffic)	14	2008/50/EC, Annex I
Pb	14	2008/50/EC, Annex I
PM_{10}	14	2008/50/EC, Annex I
$PM_{2.5}$	14	2008/50/EC, Annex I
Required minimum time coverage for indicative measurements		
SO_2	14	2008/50/EC, Annex I
NO_2	14	2008/50/EC, Annex I
NO_x	14	2008/50/EC, Annex I

Benzene (industry)	14	2008/50/EC, Annex I
Benzene (background, traffic)	14	2008/50/EC, Annex I
CO	14	2008/50/EC, Annex I
O_3 (summer)	10	2008/50/EC, Annex I
Pb	14	2008/50/EC, Annex I
PM_{10}	14	2008/50/EC, Annex I
$PM_{2.5}$	14	2008/50/EC, Annex I
As	14	2004/107/EC, Annex I
Cd	14	2004/107/EC, Annex I
Ni	14	2004/107/EC, Annex I
BaP	14	2004/107/EC, Annex I
Total deposition	33	2004/107/EC, Annex I

Adjustment "Data Capture" for maintenance and calibration

Since the AQ Directive states that the requirements for minimum data capture and time coverage do not include losses of data due to the regular calibration or the normal maintenance of the instrumentation (Annex I, Section A, last sentence and Annex XI Section A, footnote 1), the requirement for minimum data capture can be reduced as follows.

According to the "Guidance on the Annexes to Decision 97/101/EC on Exchange of Information as revised by Decision 2001/752/EC", 5% is a good general approximation of the proportion of measurement time in a calendar year dedicated to planned equipment maintenance and calibration. This was also confirmed in several meetings of EIONET in 2008.

It is therefore possible to reduce the data quality objective **for minimum data capture by 5%** in order to cover data losses by regular maintenance etc. This is only to be applied to **fixed** measurements. In the case of indicative measurements, maintenance and calibration should be done outside the measurement periods.

The data quality objective for minimum data capture to be used for compliance checking (Annex IV Section I of Directive 2004/107/EC; Annex I Section A of Directive 2008/50/EC) should be taken as 85% instead of 90% for fixed measurements.

Note that maintenance is only mentioned in Annex I and Annex XI, but not in Annex VII, so that for **ozone** reducing the data capture is not applicable for any statistical parameter but only for the data quality objectives set out in Annex I. In practice, complying with Annex VII implies that the deduction of 5% for maintenance from the data quality objectives in Annex I is not applicable. For example, the data capture in winter needs to be at least 75% instead of 70% in order to comply with the corresponding requirement in Annex VII, Section A of Directive 2008/50/EC, if the data is to be used to calculate the annual mean concentration of ozone (not a target value or long-term objective).

Footnote (1) to the table in section A, Annex I of Directive 2008/50/EC and the final paragraph of section I, Annex IV of Directive 2004/107/EC allow for lower minimum time coverage requirements for some measurements, provided that given requirements regarding uncertainty are met. Where this provision is applied, the calculations described above shall be adjusted accordingly.

There is no guidance yet on a method to verify that the distribution of measurements is representative of various conditions for climate and traffic, as required by the second footnote of the table in Annex I, Section of Directive 2008/50/EC, and evenly spread over the weekdays and the year as required by Annex IV, Section I of Directive 2004/107/EC. AQUILA is in the process of developing such guidance.

To facilitate verifying whether the data capture and time coverage requirements are met, the following tables can be used. Table 19, Table 20 and Table 21 specify the number of hourly/daily values in the periods corresponding to the minimum requirements for data capture. The values are determined by the smallest proportion of data that commercially rounded equals the required data capture (at least 84.5% or 89.5%).

Table 19: Minimum number of N_{valid} for fixed measurements (considering 5% maintenance and calibration)

Pollutant	Fixed measurements			
	Minimum number of hours		Minimum number of days	
	Common year	Leap year	Common year	Leap year
SO_2	7403	7423	309	310
NO_2	7403	7423	309	310
NO_x	7403	7423	309	310
Benzene (industry)	6662	6681	278	279
Benzene (background, traffic)	2591	2598	108	109
CO	7403	7423	309	310
O_3 (summer) *	3712	3712	155	155
O_3 (winter) *	3036	3053	127	128
Pb	7403	7423	309	310
PM_{10}	7403	7423	309	310
$PM_{2.5}$	7403	7423	309	310
As	3702	3712	155	155
Cd	3702	3712	155	155
Ni	3702	3712	155	155
BaP	2443	2450	102	103
* These numbers apply the 5% deduction for maintenance allowed for in Annex I. Hence, these numbers of hours/days would not be sufficient to comply with the criteria in Section A of Annex VII. This applies to calculating the annual mean ozone concentration, too.				

Table 20: Minimum number of N_{valid} for random measurements (fixed)

Pollutant	Random measurements (fixed)
	Minimum number of days (common year and leap year)
Benzene (industry)	44
Benzene (background, traffic)	44
Pb	44
PM_{10}	44
$PM_{2.5}$	44
Note that measurements must be evenly distributed over the year in order to avoid skewing of results.	

Table 21: Minimum number of N_{valid} for indicative measurements

Pollutant	Indicative measurements	
	Minimum number of days	
	Common year	Leap year
SO_2	46	46
NO_2	46	46
NO_x	46	46
Benzene (industry)	46	46
Benzene (background, traffic)	46	46
CO	46	46
O_3 (summer)	394 hours	394 hours
Pb	46	46
PM_{10}	46	46
$PM_{2.5}$	46	46
As	46	46
Cd	46	46
Ni	46	46
BaP	46	46
Total deposition	108	108
Note that measurements must be evenly distributed over the year in order to avoid skewing of results.		

Examples for checking data capture (Data Quality Objectives)

1) Fixed measurement of NO_2 (hourly values)

Minimum time coverage requirement (MinTimeCov) = 100%
Minimum data capture requirement = 85% (including 5% loss for calibration)

N_{valid} = 8199 hours
N_{year} = 8760 hours

$$\text{Data capture} = \frac{8199}{8760 \times 100\%} = 0.936 \approx 94\%$$

Actual data capture (94%) ≥ Minimum data capture (85%) √

2) Fixed measurement of ozone (hourly values)

Minimum time coverage requirement (MinTimeCov) = 100%
Minimum data capture requirement for summer = 85%
Minimum data capture requirement for winter = 70%

N_{valid_summer} = 3420 hours
N_{valid_winter} = 3950 hours

N_{summer} = 4392 hours
N_{winter} = 4368 hours

summer: $\text{Data capture} = \frac{3420}{(4392 \times 100\%)} = 0.779 \approx 78\%$

winter: $\text{Data capture} = \frac{3950}{(4368 \times 100\%)} = 0.904 \approx 90\%$

Actual data capture in summer (78%) < Minimum data capture in summer (85%) X
Actual data capture in winter (90%) > Minimum data capture in winter (70%) √

3) Fixed measurement of benzene (hourly values), industrial site – leap year

Minimum time coverage requirement (MinTimeCov) = 90%
Minimum data capture requirement = 85% (including 5% loss for calibration)

N_{valid} = 7545 hours
N_{year} = 8784 hours

$$\text{Data capture} = \frac{7545}{(8784 \times 90\%)} = 0.954 \approx 95\%$$

Actual data capture (95%) ≥ Minimum data capture (85%) √

4) Fixed measurements of Benzo(a)pyrene (daily values)

Minimum time coverage requirement (MinTimeCov) = 33%
Minimum data capture requirement = 85% (including 5% loss for calibration)

N_{valid} = 112 days
N_{year} = 365 days

$$\text{Data capture} = \frac{112}{(365 \times 33\%)} = 0.930 \approx 93\%$$

Actual data capture (93%) > Minimum data capture (85%) √

Note that the samples must also be spread evenly over the weekdays and the year.

5) Fixed measurements of Benzo(a)pyrene (daily values)

Minimum time coverage requirement (MinTimeCov) = 33%
Minimum data capture requirement = 85% (including 5% loss for calibration)

N_{valid} = 101 days
N_{year} = 365 days

$$\text{Data capture} = 100 \times \frac{101}{(365 \times 33\%)} = 0.839 \approx 84\%$$

Actual data capture (84%) < Minimum data capture (85%) X

Note that the samples must also be spread evenly over the weekdays and the year.

6) Indicative measurement of PM10 (daily values)

Minimum time coverage requirement (MinTimeCov) = 14%
Minimum data capture requirement = 90% (5% loss for calibration cannot be deducted)

N_{valid} = 40 days
N_{year} = 365 days

$$\text{Data capture} = \frac{40}{(365 \times 14\%)} = 0.783 \approx 78\%$$

Actual data capture (78%) < Minimum data capture (90%) **X**

Note that the samples must also be spread evenly over the weekdays and the year.

7) Indicative measurement of NO_2 (weekly mean data obtained from passive sampling)

Minimum time coverage requirement (MinTimeCov) = 14%
Minimum data capture requirement = 90% (5% loss for calibration cannot be deducted)

N_{valid}: 7 valid samples out of 8
$N_{valid,1}$ ... $N_{valid,7}$ are derived from the start and end of each sampling period.
($N_{valid,1}$ ... $N_{valid,7}$) = (7, 7, 7, 7, 7, 6.5, 7) days

N_{valid} = 48,5 days
N_{year} = 365 days

$$\text{Data capture} = \frac{48{,}5}{(365 \times 14\%)} = 0.949 \approx 95\%$$

Actual data capture (95%) > Minimum data capture (90%) **√**

Note that the samples must also be spread evenly over the weekdays and the year.

8) Fixed measurement of heavy metals. Pooled samples.

Minimum time coverage requirement (MinTimeCov) = 50%
Minimum data capture requirement = 85% (including 5% loss for calibration)

N_{valid}:
Daily measurements averaged over each month:

$N_{valid,1}$ ... $N_{valid,12}$ are derived from the start and end of each sampling period.
($N_{valid,1}$ ... $N_{valid,12}$) = (31, 28, 22, 12, 31, 30, 31, 31, 28, 20, 30, 31) days
Sum of days (N_{valid}) = 325 days

N_{valid} = 325 days
N_{year} = 365 days

$$\text{Data capture} = \frac{325}{(365 \times 50\%)} = 1.781 \approx 178\%$$

Actual data capture (178%) > Minimum data capture (90%) **√**

Note that the samples must also be spread evenly over the weekdays and the year.

(4) Compliance checking

Step 1: Data Quality Objectives

Compliance with the data quality objectives, i.e., time coverage and data capture, as set out in Annex I of Directive 2008/50/EC and Annex IV of Directive 2004/107/EC has to be checked independently. Simply because they are defined in the Directive, the requirements for time coverage and data capture both have to be met. After checking compliance with each of these two metrics, the result has to be reported as a Boolean (TRUE/FALSE) in Dataset E1a of the e-reporting.

In essence, checking the data capture requirement is a combined check of both data capture and time coverage focusing on the amount of valid data per year (see section Annex II (F) (3) *Data quality objectives: Time coverage and data capture*) as it considers both requirements from the Directives 2008/50/EC and 2004/107/EC.

For checking data quality objectives, the monitoring data should not be aggregated unless it has a time resolution higher than one hour.

Step 2: Calculation of statistical parameters

Before computing the parameters, monitoring data should at least be aggregated to a time resolution of one hour. To check compliance with the **limit and target values other than the annual mean, the hourly limit value for NO2 and SO2, and AOT40**, the data needs to be aggregated further following the requirements of Section A, Annex XI and Section A.2, Annex VII (ozone) of Directive 2008/50/EC. That refers to:

- maximum daily 8 hours mean (ozone, CO)
- 24-hour values (PM10, SO2)

Step 3: Checking compliance with environmental objectives

The next step is to check for compliance with the environmental objectives as set out in Annexes VII and XI in Directive 2008/50/EC and Annex I of Directive 2004/107/EC. For compliance checking in general, please refer also to the flowcharts below.

Sulphur dioxide, nitrogen dioxide and oxides of nitrogen, carbon monoxide, benzene, particulate matter (PM2.5, PM10) and lead, nickel, arsenic, cadmium, B(a)P in PM10 – ***Annual mean***

If the monitoring network has not delivered sufficient valid data as intended by Annex I of Directive 2008/50/EC and Annex IV of Directive 2004/107/EC (step 1) and Annex XI of Directive 2008/50/EC, it is still possible based on expert judgment to voluntarily consider a station's measured statistical parameters as exceeding rather than missing. When there is no reason to consider the station as exceeding based on expert judgement, the station should be reported as missing.

*Sulphur dioxide, nitrogen dioxide, carbon monoxide, particulate matter (PM10) – **Limit and target values other than annual mean***

For the parameters related to short-term health effects (all parameters except the annual mean), the compliance check has to be done regardless of the results of step 1. If the monitoring network has not delivered sufficient valid data as intended by Annex I of Directive 2008/50/EC (step 1), the valid data might still indicate a noncompliance with the limit or target values listed below. In their case, measurements of a fraction of a year can already constitute a noncompliance. Therefore, compliance with these environmental objectives has to be checked regardless of whether the data quality objectives are being achieved:

- SO_2: hourly means (350 µg/m³, 24 hours allowed) and daily means (125 µg/m³, 3 days allowed)
- NO_2: hourly mean (200 µg/m³, 18 hours allowed)
- PM_{10}: daily mean (50 µg/m³, 35 days allowed)
- CO: highest daily 8-hour mean (10 mg/m^3)

If a station does not meet the data quality objectives (step 1) but does have an exceedance of those statistical parameters, it has to be considered as non-compliant with the corresponding limit or target value (after correcting for natural sources and winter salting and sanding).

If a station´s dataset does not meet the data quality objectives (step 1) and does not indicate an exceedance, it should be treated as *missing* for compliance checking. That way it shows up as missing in the compliance tables. The complete data of a station reported as missing should be delivered in data flow E1a nonetheless. The flowcharts below illustrate this.

*Ozone - **maximum daily eight-hour mean***

The target value and the long-term objective associated with the maximum daily eight-hour mean for ozone explicitly applies to the whole year (not just the summer), because it is defined as "maximum daily eight-hour mean **within a calendar year**".

Besides the data quality objectives stated in Annex I of Directive 2008/50/EC (step 1), also the criteria for validity when calculating statistical parameters of Annex VII of Directive 2008/50/EC need to be checked. In practice this includes checking whether the requirements "number of exceedances and maximum values per month" and the "number of exceedances and maximum values per year" are complied. Specifically, there need to be 27 available daily values per month and five out of six valid months over the summer season (April to September).

Note, however, that even if either the data quality objectives of Annex I of Directive 2008/50/EC or the parameters “Number of exceedances and maximum values per month” (27 available daily values per month) and “Number of exceedances and maximum values per year” (five out of six months over the summer season) set out in Annex VII are **not** met, the valid data might still indicate a noncompliance situation as regards the target value and / or long-term objective related to the maximum daily eight-hour mean.

If a station's dataset does not meet the data quality objects in Annex I and/or the requirements for calculating statistical parameters of Annex VII of Directive 2008/50/EC and does not indicate an exceedance of the TV or LTO, it should be treated as *missing* for compliance checking. That way it shows up as missing in the compliance tables. The complete data of a station reported as missing should be delivered in data flow E1a nonetheless.

However, if these criteria are not fulfilled and either the TV or LTO was exceeded (based on the three year average with regard to the TV), the sampling point should not be treated as missing, but as exceeding for the purpose of compliance checking.

A station can only be in compliance with the environmental objectives when the detailed criteria of Annex VII are met (which does not necessarily imply that the DQO in Annex I are met). It needs to be treated as missing otherwise.

Section B of Annex VII of Directive 2008/50/EC provides that it is permissible to use one instead of three years of data for checking compliance with the target value, if the three year average cannot be determined on the basis of a full and consecutive set of annual data.

Ozone – ***AOT40***

For AOT40, data quality objectives shall be checked (step 1). If they are met, criteria from Annex VII have to be checked.

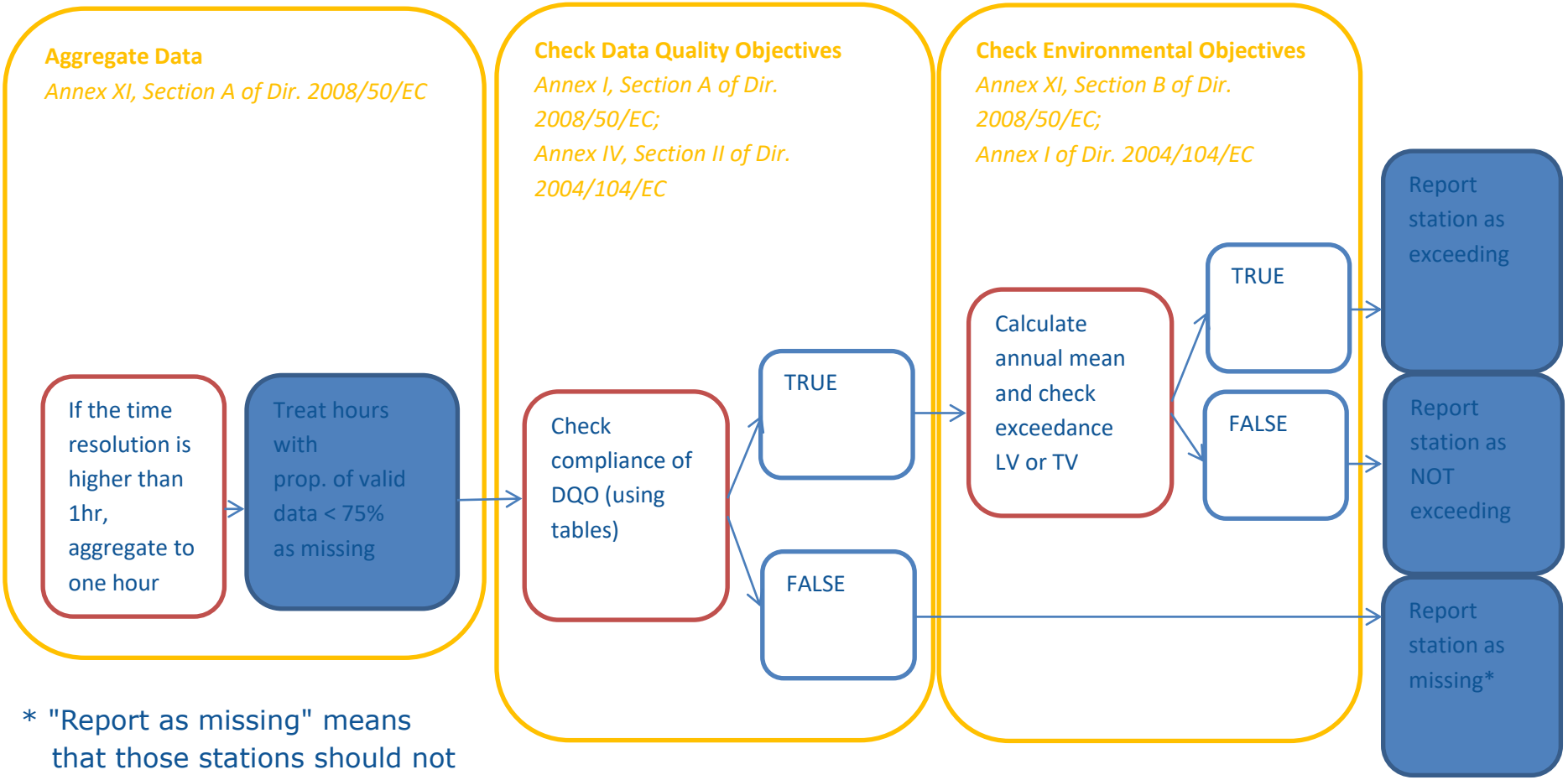
A station shall *not* be treated as missing for compliance checking with the TV and LTO if the data quality objectives from Annex I are *not* met, but at the same time the detailed criteria of Annex VII are complied with. For example, a station with less than 85% valid values in summer (April to September) can still have 100% of the hourly values in the AOT40-period for (May to July for vegetation protection, April to September for forest protection, in both cases from 8h to 20h CET).

And, the other way round, a station with insufficient one-hour values within the time period (Annex VII) might still have sufficient data capture in summer (Annex I). E.g., a station with only 50% of the of the one hour values over the time period defined for calculating the AOT40 value can reach 85% data capture in summer .This station's AOT40 value has to be reported as missing although the data quality objectives are met.

The AOT40 is sensitive to missing values. For this reason, a correction shall be applied as described in section F(6) (iii) *AOT40 (protection vegetation) (only O3)*.

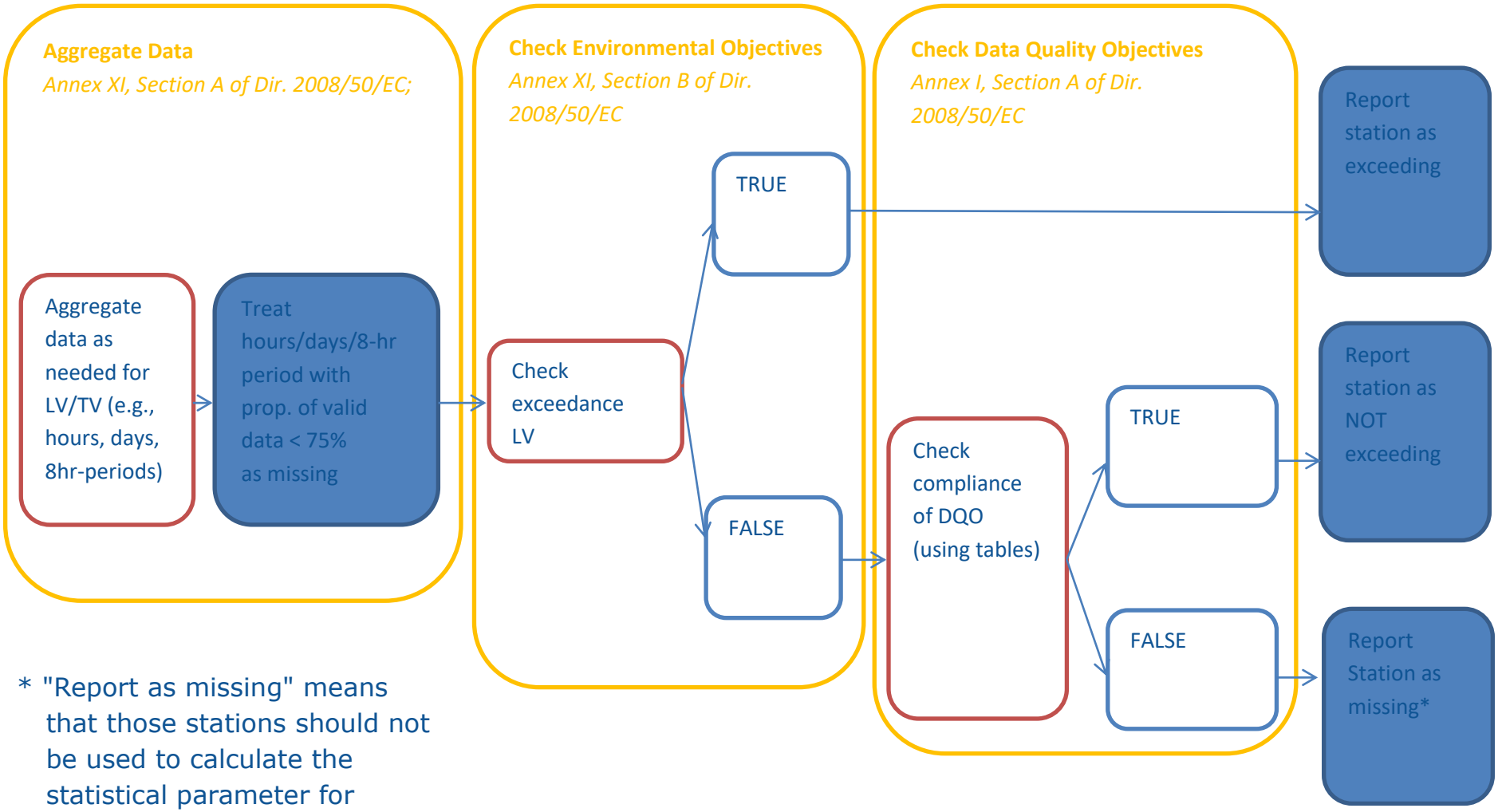
Section B of Annex VII of Directive 2008/50/EC provides that it is permissible to use three instead of five years of data for checking compliance with the target value, if the five year average cannot be determined on the basis of a full and consecutive set of annual data.

Figure 4: ANNUAL MEAN for sulphur dioxide, nitrogen dioxide and oxides of nitrogen, carbon monoxide, benzene, particulate matter ($PM_{2.5}$, PM_{10}) and lead, nickel, arsenic, cadmium, B(a)P in PM_{10}



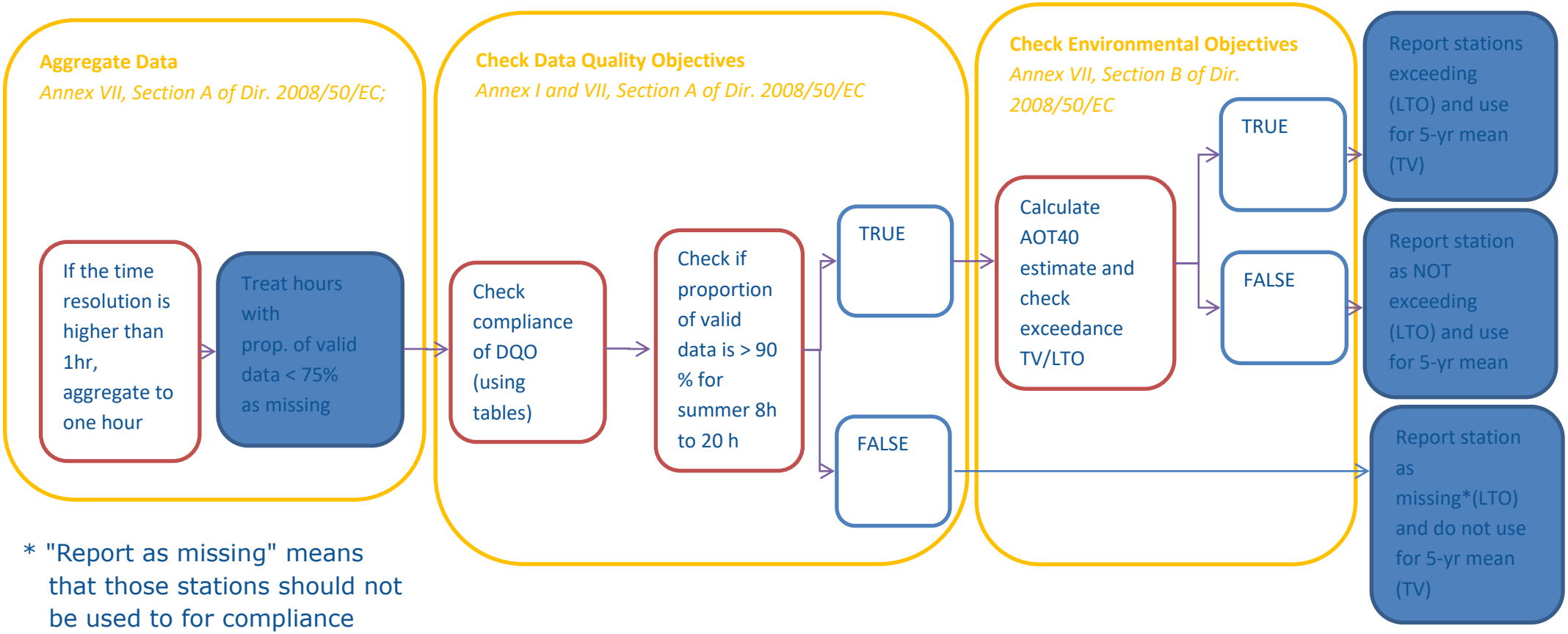
* "Report as missing" means that those stations should not be used to calculate the annual mean for compliance checking.

Figure 5: OTHER THAN annual mean for sulphur dioxide, nitrogen dioxide, carbon monoxide, particulate matter (PM_{10})



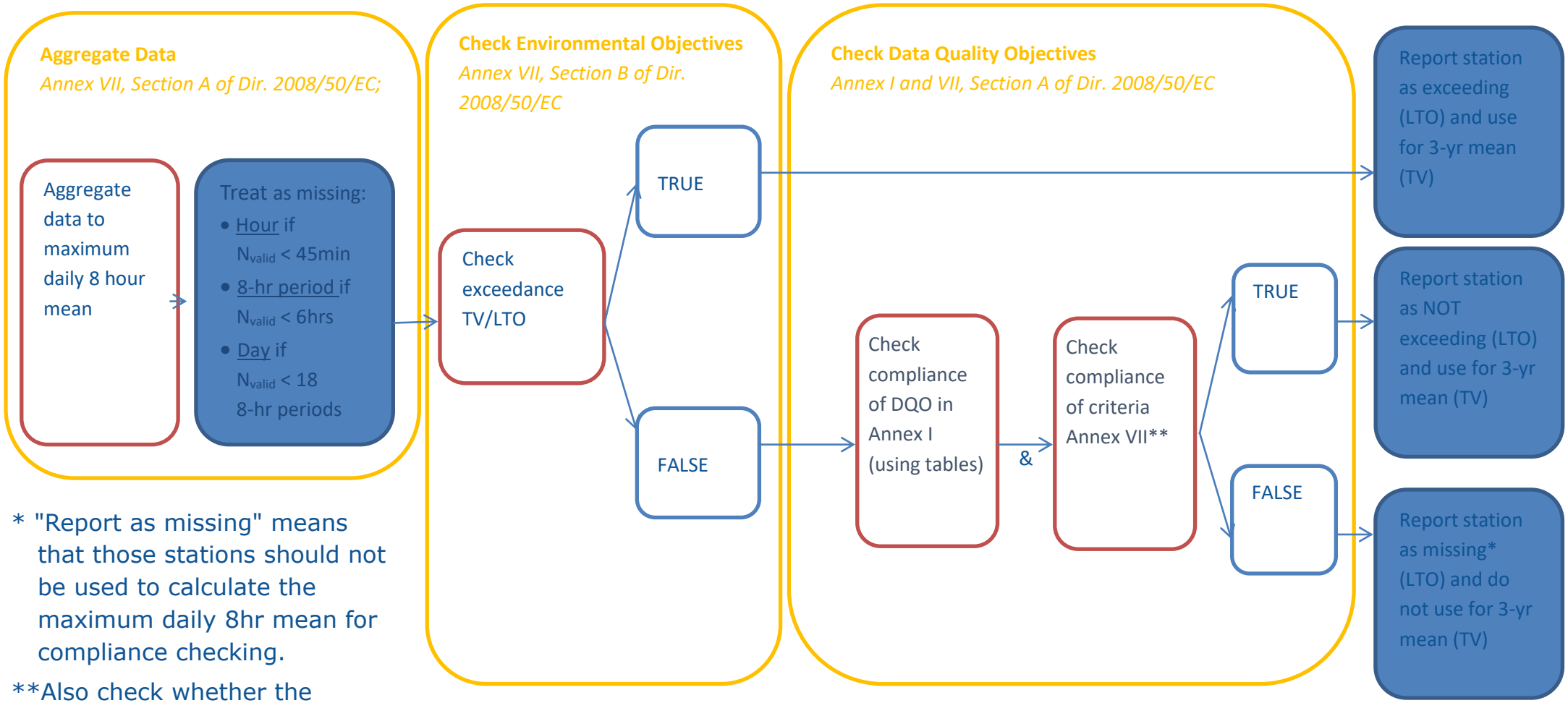
* "Report as missing" means that those stations should not be used to calculate the statistical parameter for compliance checking.

Figure 6: AOT40 for ozone



* "Report as missing" means that those stations should not be used to for compliance checking of AOT40.

Figure 7: Maximum daily 8-hour mean for ozone



* "Report as missing" means that those stations should not be used to calculate the maximum daily 8hr mean for compliance checking.

**Also check whether the criteria in Annex VII (A) are met, incl.

- 27 avail. daily values per month,
- 5 out of 6 months Apr. to Sept.

(5) Calculation of statistical parameters

Annex VII.A and Annex XI.A of Directive 2008/50/EC provide criteria for checking validity when aggregating data and calculating statistical parameters.

***

The methods for calculating the statistical parameters required for all pollutants are described below. Statistical values shall be calculated from the base data aggregations covered in section (ii) of this chapter. Table 16 in section *(1) Pollutants and their reporting metrics* of this chapter (Annex II (F)) presents, for each pollutant, the statistical parameters that need to be calculated from the base data aggregations.

(i) Annual mean

Legal reference:

- annual mean Directive 2008/50/EC at Annex XI A
- ozone: annual mean Directive 2008/50/EC at Annex VII A

***

The annual mean is the average of all valid hourly/daily values for a calendar year. The requirements for the calculation of the annual mean are in line with the requirements for minimum data capture (90% in both cases, not taking maintenance into account).

The annual mean can be calculated using the following formula:

$$\text{Annual mean} = \Sigma_i C_i / N_{valid}$$

where C_i is the valid hourly/daily concentration and the summation is over all valid hourly/daily values measured in the year; N_{valid} is the total number of valid hourly/daily values in the year.

The annual mean is calculated from the data series with the highest time resolution, for example, when both hourly and daily values are available the annual mean is calculated from the hourly data.

The averaging times for some components where non-automatic measurements are applied (e.g., benzene, the components from the 4th Daughter Directive i.e. heavy metals and PAHs) have averaging times other than hourly or daily averages, e.g., 1- week, 2-week, 4-week, month, 3-month, year, var, etc.). Annual means for data which is not hourly or daily must be calculated using a different methodology, described below. The time references of these measurements data has to be provided with start and end data/time.

Note:

1) If a period is partially outside the year, only the hours/day between 1 January and 31 December of the year are taken into account.
2) When the sampling time is across two calendar years, the sampling time refers to the time in the current reporting year only.

Table 22: Calculation of annual mean for a series of arsenic

Start of sampling period	End of sampling period	Measured concentration ng/m3 (C)	Validity flag	Valid data in month (data capture) (%) (Y)	Days in month (Z)	Valid sampling time each month (N)	Concentration x valid sampling time (ng/m3)
2010-12-31 T240000+01	2011-01-31 T240000+01	3.90532	1	100	31	31.0000	121.0649
2011-01-31 T240000+01	2011-02-28 T240000+01	1.40378	1	100	28	28.0000	39.30584
2011-02-28 T240000+01	2011-03-31 T240000+01	0.976502	1	70.97	31	22.0007	21.48373
2011-03-31 T240000+01	2011-04-30 T240000+01	0.129041	1	40	30	12.0000	1.548492
2011-04-30 T240000+01	2011-05-31 T240000+01	0.078314	1	100	31	31.0000	2.427734
2011-05-31 T240000+01	2011-06-30 T240000+01	0.088956	1	100	30	30.0000	2.66868
2011-06-30 T240000+01	2011-07-31 T240000+01	0.077084	1	100	31	31.0000	2.389604
2011-07-31 T240000+01	2011-08-31 T240000+01	0.140637	1	100	31	31.0000	4.359747
2011-08-31 T240000+01	2011-09-30 T240000+01	0.070045	1	93.33	30	27.9990	1.96119
2011-09-30 T240000+01	2011-10-31 T240000+01	0.338542	1	64.52	31	20.0012	6.771246
2011-10-31 T240000+01	2011-11-30 T240000+01	1.41943	1	100	30	30.0000	42.5829
2011-11-30 T240000+01	2011-12-31 T240000+01	1.09143	1	100	31	31.0000	33.83433
	Sum					325.0009	280.3984
	Annual mean						0.862762

(ii) Daily mean

Legal reference:

Directive 2008/50/EC, ANNEX XI defines an averaging period of "one day".

***

The daily mean is the average of all valid hourly values for a day. Annex XI of Directive 2008/50/EC stipulates that a daily mean is valid only if at least 18 valid hourly values are available in the 24-hour period starting 00:00 hours. If the minimum required proportion of valid data is not available, the daily mean is not calculated for that particular day and a not-valid aggregation flag shall be returned.

The daily average shall be calculated for pollutants with environmental objectives based on daily values (SO_2 and PM_{10}) and for which hourly values have been delivered as part of the raw data delivery.

(iii) 8-hour running mean and daily maximum of 8 – hour running mean (daymax)

Legal reference:

Directive 2008/50/EC defines in ANNEX VII and ANNEX XI the following parameters: "*8 hours values and maximum daily 8-hour mean"*.

***

Twenty-four values of 8-hour running means and a daily maximum of 8-hour running mean shall be calculated for O_3 and CO.

The 8-hour running mean value for each hour is calculated as the average of the valid hourly values for that hour and the 7 previous hours. Hence, the averaging period of the first 8–hour running mean value of a calendar year of day_n starts with $hour_{18}$ of day_{n-1} and ends with $hour_1$ of day_n (inclusive). Twenty-four hour values of 8-hour running means shall be calculated for each day.

An 8-hour running mean value is valid if at least 6 valid hourly values (i.e. 75% of the values) are available over the 8-hour averaging period. If the minimum required proportion of valid data is not available, the 8-hour running mean is not calculated for that particular hour and a not valid aggregation flag shall be returned.

The daily maximum 8-hour running mean is the maximum of the valid 8-hour running means for that day. Therefore one daily maximum 8–hour running mean shall be obtained for each day. Calculation of all the 8-hour running means (see above) for a given day is a pre-requisite (see example for the calculation of 8-hour running mean).

Annex VII and Annex XI of Directive 2008/50/EC provides that a daily maximum 8-hour mean shall only be calculated if at least 18 valid 8-hour running means (i.e. 75% of the hourly running eight hour

averages) are available for that particular day. If the minimum required proportion of valid data is not available, the daily maximum 8-hour running mean is not calculated for that particular day and a not valid aggregation flag should be reported.

Example

Calculation of 8-hour running means of ozone for two different days (3rd and 4th August 1989) is presented below.

Table 23: Calculation of 8 hour running means for ozone

Date/time	hourly mean [observation]	Observation Validity Flag	8 hourly mean [aggregation]	Aggregated Validity Flag
1989-08-02T20:00:00+01	*801*	-1		
1989-08-02T21:00:00+01	*789*	-1		
1989-08-02T22:00:00+01	*801*	-1		
1989-08-02T23:00:00+01	*801*	-1		
1989-08-02T24:00:00+01	*801*	-1		
1989-08-03T01:00:00+01	*802*	-1	*799*	-1
1989-08-03T02:00:00+01		-1	*799*	-1
1989-08-03T03:00:00+01	*799*	-1	*799*	-1
1989-08-03T04:00:00+01	*23*	-1	*688*	-1
1989-08-03T05:00:00+01	*28*	-1	*579*	-1
1989-08-03T06:00:00+01	*204*	-99	*494*	-1
1989-08-03T07:00:00+01	106	1	*106*	-1
1989-08-03T08:00:00+01	107	1	*107*	-1
1989-08-03T09:00:00+01	114	1	*109*	-1
1989-08-03T10:00:00+01	118	1	*111*	-1
1989-08-03T11:00:00+01	123	1	*114*	-1
1989-08-03T12:00:00+01	123	1	115	1
1989-08-03T13:00:00+01	127	1	117	1
1989-08-03T14:00:00+01	132	1	119	1
1989-08-03T15:00:00+01	132	1	122	1
1989-08-03T16:00:00+01	136	1	126	1
1989-08-03T17:00:00+01	136	1	128	1
1989-08-03T18:00:00+01	139	1	131	1
1989-08-03T19:00:00+01	142	1	133	1
1989-08-03T20:00:00+01	143	1	136	1
1989-08-03T21:00:00+01	146	1	138	1
1989-08-03T22:00:00+01	148	1	140	1
1989-08-03T23:00:00+01	154	1	143	1
1989-08-03T24:00:00+01	155	1	145	1
1989-08-04T01:00:00+01	154	1	148	1
1989-08-04T02:00:00+01	155	1	150	1

1989-08-04T03:00:00+01	148	1	150	1
1989-08-04T04:00:00+01	146	1	151	1
1989-08-04T05:00:00+01	142	1	150	1
1989-08-04T06:00:00+01	139	1	149	1
1989-08-04T07:00:00+01	132	1	146	1
1989-08-04T08:00:00+01	127	1	143	1
1989-08-04T09:00:00+01	123	1	139	1
1989-08-04T10:00:00+01	118	1	134	1
1989-08-04T11:00:00+01	136	1	133	1
1989-08-04T12:00:00+01	143	1	133	1
1989-08-04T13:00:00+01	136	1	132	1
1989-08-04T14:00:00+01	106	1	128	1
1989-08-04T15:00:00+01	107	1	125	1
1989-08-04T16:00:00+01	114	1	123	1
1989-08-04T17:00:00+01	123	1	123	1
1989-08-04T18:00:00+01	*201*	-99	124	1
1989-08-04T19:00:00+01	*215*	-99	122	1
1989-08-04T20:00:00+01		-1	*117*	-1
1989-08-04T21:00:00+01	*799*	-1	*113*	-1
1989-08-04T22:00:00+01	*802*	-1	*115*	-1
1989-08-04T23:00:00+01	*801*	-1	*119*	-1
1989-08-04T24:00:00+01	*799*	-1	*123*	-1

where the flags are:

1: Valid

-1: Not valid

-99: Not valid due to station maintenance or calibration

The daily maximum 8–hour running means in the example above are 145 µg/m^3 for 3rd August 1989 and 151 µg/m^3 for 4th August 1989 respectively. The daily maximum 8–hour running mean for 3rd August 1989 is, however, "not valid" since there are less than 18 valid 8–hour running mean values for this day. The daily maximum 8–hour running mean for 4th August 1989 is "valid" because there are more than the required 18 valid 8–hour running mean values for this day.

(iv) Number of hours (or days) with concentration > y µg/m3

Legal reference:

Directive 2008/50/EC defines in Annex VII and Annex XI daily and hourly limit and target values as a concentration that, within a given averaging period, shall not be exceeded more than a number of times during a calendar year.

***

The number of hours or days (n) with rounded concentration > y µg/m^3 (with y = limit or target value) shall be calculated from the valid measurement values within a calendar year:

Z_1 , Z_2 , Z_3 , … , Z_k , … , Z_{N-1} , Z_N

N is the number of Z_k-values for which Z_k > y µg/m^3 where Z_k is the concentration rounded according to the rules given in this guidance in section Annex I (A) *(2) Number of significant digits and rounding.* This has to be compared with the permitted number of exceedances in the Directive 2008/50/EC (e.g. 35 days for daily PM10). This is the standard method used for checking compliance with the relevant limit and target values according to the Directive 2008/50/EC.

Example:

The daily mean limit value for the protection of human health for PM10 is a daily mean value of 50 µg/m3 that shall not be exceeded on more than 35 days per calendar year. If the mean concentration is higher than 50 µg/m3 on more than 35 days a year, the limit value for PM10 has been exceeded.

(6) Further aggregation rules

For statistical exercises, it may be desirable to use measurements which do not meet the DQOs. In situations with time series with a low data capture, the corresponding percentile value will normally give a better indication of the air quality than the number of exceedances (de Leeuw, 2012) where percentile values were shown to be less sensitive to missing data. It is recommended that in these circumstances the percentile is used.

These methods for deriving these statistical parameters are described below. Table 24 also provides a summary of the relationships between the relevant number of exceedances and percentiles for the relevant pollutants.

Table 24 Relationship of maximum number of exceedances and percentiles

Pollutant	Averaging period for LV/TV	Max number of exceedances	Percentile
SO_2	day	3	99.2 percentile
	hour	24	99.73 percentile
NO_2	hour	18	99.79 percentile
PM_{10}	day	35	90.4 percentile
O_3	day	25	93.2 percentile

Example

Consider a series of 340 valid daily data for the continuous measurement of PM_{10}. The 306th daily value is 49 µg/m^3 and the 307th daily value corresponding to 90.4 percentile is 51 µg/m^3. The 90.4 percentile is bigger than 50 µg/m^3 but there are only 34 exceedances.

(i) Percentile Calculation

Legal reference:

Directive 2008/50/EC, Annex I.A, Note 1 states that "Member States may apply random measurements [….]. If random measurements are used to assess the requirements of the PM_{10} limit value, the 90.4 percentile (to be lower than or equal to 50 µg/m^3) shall be evaluated instead of the number of exceedances, which is highly influenced by data coverage".

***

Percentiles are primarily used as an additional indicator for the number of exceedances of a given environmental objective and not as relevant parameter used for compliance checking. Percentiles are however used for compliance checking where Note 1 of Annex A of Directive 2008/50/EC is applied (see above).

The y^{th} percentile should be selected from the measurement values (valid hourly/daily/day8hmax concentrations) listed in increasing order:

$X_1 \leq X_2 \leq X_3 \leq \ldots \leq X_k \leq \ldots \leq X_{N-1} \leq X_N$

The y^{th} percentile is the concentration X_k, where the value of k is calculated as follows:

$k = q \bullet N$

with q = y/100 and N = number of values. The value of (q • N) should be rounded off to the nearest rank (values < 0.499999… are rounded to 0, values = 0.5 are rounded to 1.

For example, the SO_2 hourly mean should not be exceeded more than 24 hours per year. Thus the 25th highest hourly value must be less than or equal to 350 µg/m^3. In a series of 8760 hourly samples (for one year) ranked in order of increasing size, the k-number of the 25th highest value is 8736. Note that this percentile corresponds with the 25th highest hourly value only if there is a full (i.e.8760) or nearly full dataset. Thus according to the formula, the relevant percentile is:

$q = (k / N).100$

or in this case, 99.73. The percentile should be specified to the number of decimal places necessary to uniquely identify the relevant k-value. In practice this normally means one decimal place for daily values, and two decimal places for hourly values.

If hourly values have been delivered for SO_2, PM_{10}, O_3 or CO the following aggregations are calculated before the calculation of the general statistics.

(ii) Consecutive hours with concentration > y µg/m^3 (SO_2, NO_2, O_3)

Legal reference: Directive 2008/50/EC sets out in ANNEX XII alert thresholds for sulphur dioxide, nitrogen dioxide and ozone, that triggered action they are exceeded over three "*consecutive hours*".

***

The alert thresholds trigger action when three consecutive measurement values (Z_{k-1} , Z_k , Z_{k+1}) from a time series of valid measurement values exceeds the threshold, i.e., > y µg/m^3 (with y = alert or threshold value).

$$Z_1 , Z_2 , Z_3 , \dots , Z_k , \dots , Z_{N-1} , Z_N$$

For every three consecutive hourly values that are in exceedance, the alert requirements of Directive 2008/50/EC must be implemented.

(iii) AOT40 (protection vegetation) (only O_3)

Legal reference:

Directive 2008/50/EC, Annex VII, provides the following definition: " AOT40 (expressed in (µg/m^3) · hours) means the sum of the difference between hourly concentrations greater than 80 µg/m^3 (= 40 parts per billion) and 80 µg/m^3 over a given period using only the one-hour values measured between 8.00 and 20.00 Central European Time (CET) each day."

***

AOT40 is the cumulative concentration observed above 80 µg/m^3 (= 40 parts per billion) based on hourly measurements. Two statistics shall be calculated as follows;

$$AOT40_{measured} = \Sigma_i \max(0,(C_i - 80))$$

where C_i is the hourly mean ozone concentration in µg/m^3, and the summation is for the period between 08.00 (start time) – 20.00 (end time) Central European Time each day in a certain time period. There is an exception to this rule for territories which are part of a Member State but over 2000 km away from the closest boundaries of the territory where the capital of that Member State is (e.g. Caribbean islands) for which the statistics should be performed using local time.

For the AOT40 vegetation the time period is the 3-month growing season for crops from 1 May to 31 July each year, whilst for forest protection the time period is from 1 April to 30 September each year.

AOT40 has a dimension of (µg/m^3)·hours and is sensitive to missing values. The required proportion of valid data is 90% of the one-hour values over the time period defined for calculating the AOT40 value.

Therefore, $AOT40_{measured}$ shall be routinely corrected to full time coverage to derive $AOT40_{estimate}$ as follows:

$$AOT40_{estimate} = (AOT40_{measured} \cdot N_{period}) / N_{valid}$$

where N_{valid} is the number of valid hourly values and N_{period} is the number of hours in the period (Annex VII, Section A, paragraph 2, footnote 1).

The following rules apply to calculate five-year-averaged target value for protection of vegetation:

- If the five year averages cannot be determined on the basis of a full and consecutive set of annual data, the minimum annual data required for checking compliance with the target values will be valid data for at least three years.
- The annual AOT40 measured is corrected according to the formula written above.
- A year will participate in the five year average if there is at least 90 % of data coverage between 8 and 20 CET (or local time if the exception applies (see above)) in that year.
- The five-year average has to be rounded to the nearest integer.

Note:
Hourly values and the measured AOT40 should not be rounded.

Example

Table 25 Calculation of five – year average for the protection of vegetation

Year	Valid data	% valid data	Valid AOT40 data (max 1104 hours)	% valid AOT40 data	$AOT40_{estimated}$
2008	7841	89,3	1033	93,6	22636
2009	8393	95,8	1068	96,7	6446
2010	8044	91,8	937	84,9	11905
2011	8626	98,5	1094	99,1	15281
2012	8492	96,7	1000	90,6	16768

Note: The 84.9% proportion of valid AOT40 data for 2010 is smaller than the required proportion of valid data i.e. 90%, therefore the $AOT40_{measured}$ or $AOT40_{estimated}$ is not valid.

The proportion of valid AOT40 data in the other years being larger than the minimum requirement, measurements are valid. Therefore, there are 4 years of data available to calculate the average (2008, 2009, 2011 and 2012) which is more than the minimum 3 years.

AOT40 = (22636+6446+15281+16768)/4=15282.75 = 15283

(G) Information on the attainment of environmental objectives (Article 12)

Legal reference:

- Article 27 of Directive 2008/50/EC
- Article 5 of Directive 2004/107/EC
- Article 12 of Decision 2011/850/EU

***

For each zone, pollutant and, environmental objective combination, a declaration of the exceedance or attainment of the relevant environmental objective is to be provided.

Where the environmental objective is exceeded, the numerical value of exceedance (as a concentration, percentile or AOT40) or the number of daily or hourly exceedances shall be given for the worst case (highest) exceedance situation observed in the zone.

Where environmental objectives for the protection of human health have been exceeded, estimates of the total area, population and where applicable road length exposed to levels above the environmental objective shall be reported for each zone as a whole if available.

Where environmental objectives for the protection of ecosystems and vegetation have been exceeded, estimates of the area of ecosystems/vegetation exposed to levels above the environmental objective shall be reported for each zone as a whole.

Associated geometry information (GIS data) shall also be provided. References to the assessment methods observing the exceedances shall also be given e.g. the fixed or indicative measurements, modelling or objective estimation used. Assessment methods are reported within Data flow D.

Where Article 20 or 21 of 2008/50/EC is applicable the following components shall be reported for the worst case exceedance situation in a zone:

i. the numerical value of the exceedance or number of exceedances observed considering all contributions;
ii. the numerical value of the exceedance or number of exceedances observed considering WSS contributions, i.e., after correcting for WSS contributions;
iii. the numerical value of the exceedance or number of exceedances observed considering NAT contributions, i.e., after correcting for NAT contributions;
iv. the final numerical value of the exceedance or number of exceedances observed considering both WSS and NAT contributions, i.e., after correcting for both WSS and NAT contributions.

The code list can be found at: http://dd.eionet.europa.eu/vocabulary/aq/adjustmenttype/

In each case for i-iv above estimates of the total area, population and road link exposed to levels above the environmental objective shall be reported for each zone as a whole. Associated geometry information (GIS data) shall also be provided.

The element related to the assessment method used (Part II, A.2.5.6 for fixed measurement and A.2.5.7 for modelled assessment) should link to the assessment metadata in Dataset D (Fixed measurements: D.5.1; Indicative measurements: D6; Modelling: D.7; Objective estimation: D.8). The field A.2.5.6 refers to the monitoring stations making up the monitoring network in the exceedance area.

Field A.2.1 in Part II ("Exceedance") requires a statement of whether the environmental objectives are exceeded or not, i.e., the status of compliance with Article 13. "TRUE" should be entered if the pollutant concentration measured at one or more measuring stations in the zone exceeds the respective environmental objective (limit and target values, long-term objectives, etc.) after the deduction of contributions from natural sources. "FALSE" should be entered if that is not the case. This field does not refer to the compliance with the data quality objectives (Annex I), the required proportion of valid data (Annex VII, Annex XI), the required number of measuring stations (Annex V), or Article 6 (Assessment criteria) and 7 (Sampling points), etc.

(H) Information on air quality plans and (I) Information on source apportionment (Article 13)

Legal reference: Article 13 of 2011/850/EC

***

If there have been exceedances of limit and target values (reported in Dataset G), Directive 2008/50/EC requires that AQ plans is put into place in those zones. According to the Implementing Decision AQ plans have to be reported with detailed regulatory information on air quality management. Member States have 2 years to compile this information from the end of the calendar year in which the exceedance was first observed. For the exceedances of the pollutants covered by 2004/107/EC, the areas of exceedance, the source contributing as well as the measures implemented have to be reported.

A document on "provisional answers on e-reporting (datasets H-K)" collated from different sources has been prepared by the European Commission (DG ENV and DG JRC). It is accessible via the air quality portal:

http://www.eionet.europa.eu/aqportal/doc/E-Reporting%20%28H-K%29%20-%20Provisional%20Answers%20to%20Questions%20-%20v2.0.pdf

An exceedance situation shall be understood as an amalgamation of individual exceedances which by virtue of their similar source apportionment can be managed together.

Where several individual exceedance situations (e.g., different exceedances observed by traffic stations and/or predicted at the roadside by model within the same city) have been grouped into one macro exceedance situation, the source apportionment presented must be relevant for each of the individual exceedance situations and be applicable to the monitoring station or modelled location with the maximum concentration/number of hours exceeding the limit value. If there is a significant difference in source apportionments across the individual exceedance situations, Member States should consider whether it is legitimate to group them into a macro exceedance situation or whether it would be better to split them into smaller groups.

The source apportionment must, in particular, reflect regional, urban and local contributions within the Member State, but also transboundary contributions. As regards the urban and local contributions, a further split must be given in order to identify any significant sources such as transport (road traffic and shipping, where relevant), industry (including heat and power production), agriculture, commercial and residential sources. For PM10, it is also important to indicate significant natural sources.

In the case of NO_2, Member States may choose whether to use nitrogen dioxide or oxides of nitrogen as a basis for source apportionment, as considered appropriate in relation to the exceedance. The choice should be followed consistently and reflected in the quantification of the impact of individual or groups of measures and allow adequate assessment of the conditions by the Commission.

The ‘reference year’ refers to the year for which the exceedance has been assessed.

As indicated above, the source apportionment should apply at the monitoring site/modelled location with the highest annual mean concentration/number of exceedances of the hourly/daily limit value. In essence, it is asking how much of the exceedance at that single location of maximum exceedance can be accounted for by each of the sources listed. Hence the following equations apply:

- Regional background is the split of total regional background in µg/m³
  The regional background level is the concentration of pollutants on a spatial scale of more than about 50 km. It comprises contributions from outside the exceedance area, but also from sources within the exceedance area. The regional background shall be split, if appropriate data are available, into from within the MS affected and transboundary contributions.

- Urban background increment represents the concentrations arising from emissions within towns or agglomerations, which are not direct local emissions (in µg/m³). It is the sum of the following components: traffic, industry including heat and power production, agriculture, commercial and residential, shipping, non-road mobile machinery, natural, transboundary urban background, and other.

- The local increment identifies contributions from sources in the immediate vicinity of the exceedance situation. The local increment can be estimated as the difference between the concentrations measured or modelled at the location of exceedance and the urban background level. It is the sum of the following components: traffic, industry including heat and power production, agriculture, commercial and residential, shipping, non-road mobile machinery, natural, transboundary urban background and other.

- More detailed description of the factors that could contribute to the estimation of the above is given hereafter:
  - Traffic: road traffic emissions only (excludes emissions from non-road mobile machinery);
  - Industry: emissions arising directly from industrial processes and combustion (e.g., sinter plants, BOS furnaces). This excludes emissions from non-road mobile machinery used in industry. Because industry is such a broad category, a page reference to where the relevant information about the relative contribution of different processes can be found in the full air quality plan should be given as a comment (element I.6);
  - Agriculture: emissions arising directly from agricultural activities (e.g., chicken farming). This excludes emissions from non-road mobile machinery used in agriculture;
  - Commercial and residential: emissions from commercial or residential heating (e.g., domestic boilers). This excludes emissions from non-road mobile machinery used in commercial and residential sectors;
  - Shipping: emissions from shipping (excludes emissions from non-road mobile machinery used at ports).
  - Non-road mobile machinery: this includes non-road mobile machinery used in industry, agriculture, commercial and residential sectors and shipping.

- Natural: sources which are not influenced by human activity, (e.g., dust re-suspended from roads), even if having Saharan origin, must be listed under "traffic"; wind-blown dust from crop fields must be listed under "agriculture").
- Transboundary: transboundary (related to national boundaries) contributions to the urban or regional background level

Note:

To calculate an hourly NO_2 source apportionment the following procedure is recommended:

1. Identify which hours were in exceedance of 200 µg m^{-3} (NB this may highlight that the problem is associated with particular time of day, e.g., morning rush hour);
2. Use hourly data from the main local source to calculate an hourly contribution from this source. For traffic driven exceedances this is likely to require detailed hourly traffic count data, NO_X emissions estimates and primary NO_2 emissions estimates for different vehicle classes, local meteorological data and a dispersion model. For industrially driven exceedances hourly emissions data from the plant(s) causing the exceedance will be required to estimate hourly emissions, and then meteorological data and a dispersion model to estimate concentrations for the relevant hours resulting from the local source.
3. Add on hourly contributions from non-local sources: These are likely to be similar in magnitude to the annual mean contribution from these sources. An alternative method for estimating the contribution from the main local source is to compare the concentrations for the hours with exceedances at the site where the exceedances have been measured with a second site which has similar contributions from urban and regional sources, but little or no contribution from the local source driving the exceedance. For example, the local hourly contribution at a roadside site can be estimated by comparing with a nearby background site. The local contribution at the roadside site can be estimated by subtracting the concentration at the background site.

For pollutants covered by Directive 2004/107/EC, there is no such requirement to report source apportionment upon observing exceedances. As such, the Member States found it useful to add the reason codes as from the Decision 461/2004 as voluntary information. The reason codes should be reported for the worst case exceedance situation.

The code list can be found at: http://dd.eionet.europa.eu/vocabulary/aq/exceedancereason

Table 26 Reasons for individual exceedances: standard codes

Reason code	Description
S1	Heavily trafficked urban centre
S2	Proximity to a major road
S3	Local industry including power production
S4	Quarrying or mining activities
S5	Domestic heating
S6	Accidental emission from industrial source
S7	Accidental emission from non-industrial source

S8	Natural source(s) or natural event(s)
S9	Winter sanding of roads
S10	Transport of air pollution originating from sources outside the Member State
S11	Local petrol station
S12	Parking facility
S13	Benzene storage
S16	Favourable meteorological conditions for ozone formation
S17	Emissions due to public works and construction in the vicinity
S18	Use of studded tyres
Other	Please specify

(J) Information on the scenario for the attainment year (Article 13)

Legal reference: Article 13 of 2011/850/EC

***

In dataset J Information on the scenario for the attainment year (Article 13), a report on the baseline scenario and projection scenario for the attainment year is provided.

The baseline prognosis or scenario should represent the 'business as usual' scenario, which includes the effect of existing measures and of measures that have already been decided to reduce pollution, e.g., efforts to reduce emissions per vehicle, and also the development in pollution activities, e.g., traffic growth levels.

Typically, a prognosis of the baseline concentration at the location of the exceedance requires model calculations in which the future development of the regional background level, the total background level and the local source contributions are taken into account (see also Figure 8). For the future trend in the regional background, results of model calculations by EMEP (http://www.emep.int) may be used, although expert judgement in their use should be exercised to accurately characterise the local situation. It is not possible to make general recommendations about how best to estimate the developments in the contribution of nearby sources. Model calculations could be done to calculate the contribution of these sources. In these calculations, a high level of detail is needed for the contribution from sources that strongly influence the exceedance, e.g., a street model should be used for calculating the concentration at the kerb along a busy road. In this example, the changes in traffic intensities and emission factors need to be taken into account, as their projections for the exceedance area may be quite different to the EU or national averages. It is also important to consider planned or potential new sources in the area.

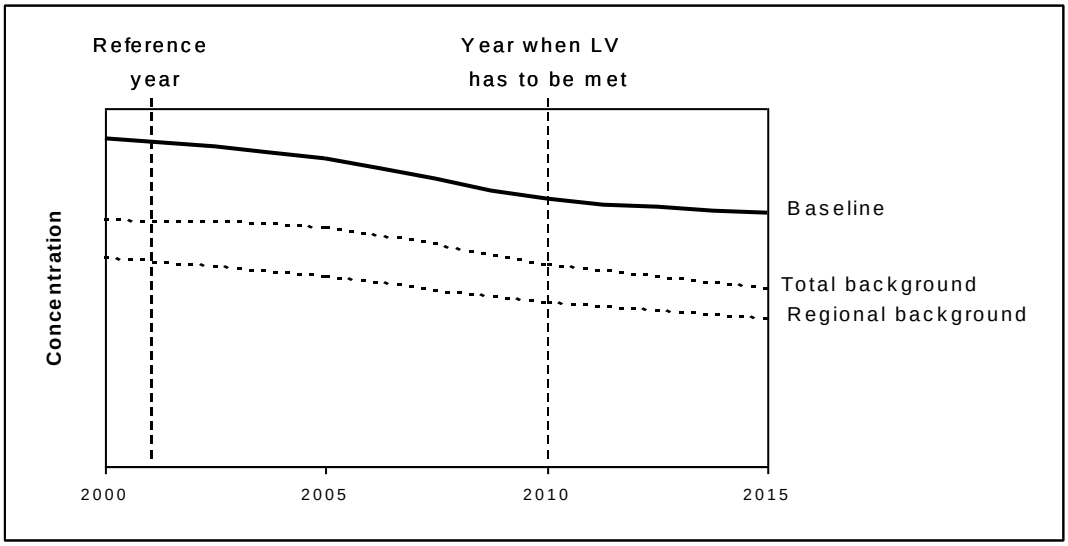


Figure 8: Development of the baseline concentration over time depends on how the regional background level, the total background level and the local contribution develop.

The measures explicitly identified in the AQ plan and introduced in the reported information that are included in this baseline projection should be reported.

In the AQ Plan, the assumptions of the baseline scenario need to be documented, preferably in the form of the changes in emissions of the relevant sources and, as far as appropriate, the effect of existing measures that have not yet come fully into effect. It is always preferable to describe the baseline scenario in terms of emission scenario and to ensure they accurately depict the local situation. If existing calculations, e.g. those by EMEP, are used, it is sufficient to give a reference to the emission prognoses that have been used there. For the development of the local sources, however, no prognosis may be available, and hence the analysis, including the prognosis of emissions, has to be described in the AQ Plan.

The description of the emission scenario is given in free text. In this text, the assumptions regarding the baseline emissions scenario are described. Preferably a reference to background material is given. The total emissions in the relevant area (in kt/yr) mean emissions in the area addressed by the AQ Plan, Short-term Action Plan or single measure. Projected emissions should not take into account reduction due to measures that are not in the baseline.

The expected concentration levels in the projection year under baseline scenario shall be expressed as either as annual mean value expressed in µg/m³ (if environmental objective is an average or percentile) or as a number of exceedances (related to the environmental objective specified in the exceedance situation description) per calendar year.

The projection scenario for the attainment year (for each exceedance situation including only fully committed measures) should include measures identified in the AQ plan that are included in this projection.

A description of the emission scenario used for the projection is given in free text. In this text, the assumptions regarding the emission scenarios are described. Preferably a reference to background material is given. Projected emissions should take into account reductions due to measures that are not in the baseline. They shall be reported as the total emissions in the relevant exceedance situation expressed in kt/yr (number). Also, the expected levels in the projection year under projection scenario shall be given as annual mean value in µg/m³ or the number of exceedances (related to the environmental objective specified in the exceedance situation description) per calendar year.

Annex XV of the Air Quality Directive requires a description of the trend of the concentrations prior to the reference year. This information, together with an analysis of the reasons of the observed changes, can be useful for judging the credibility of the calculated future trends. If possible, the trends should be expressed in terms of the parameter of the limit value.

(K) Information on measures (Article 13 and 14)

Legal reference:
- Article 13 of 2011/850/EC
- Article 14 of 2011/850/EC

***

In dataset K Information on measures, a dataset report on the measures of the Air Quality Plan or a report on measures required following exceedance of a 2004/107/EC target value is given. The form and depth of the description of measures in the AQ Plan may depend on the relationship with other existing policy documents on plans and programmes, e.g., a local environmental action plan.

A short description of the measure in terms of action taken and the associated targets has to be given as a free text. Many of the elements described in this section, i.e., measure classification, the type of measure, the administrative level responsible for the implementation of the measure, the time scale for its implementation, the sources affected by the measure, the spatial scale of the source affected by the measure as well as the status of the implementation of the measure, are part of the respective code lists that are published by EEA at: http://dd.eionet.europa.eu/vocabulary/.

The estimated costs for the implementation of the measure over the whole implementation period should be given, if available. This should take account of the implementation costs including the costs borne by the sector(s) affected as well as the final implementation cost.

In drawing up measures, the responsible authority should consider the secondary effect of their plans on the environment, for example on CO_2 production, and the social effects of the measure. But a report is not required on these secondary effects.

For monitoring the effectiveness of a measure, it is usually not sufficient to just follow how the concentration level changes, as the change may be due to other causes. Hence, it is important to follow the progress of the measures with suitable indicators that relate more directly to the measure. Examples of indicators are:

- have the planned parking fees been implemented [yes/no] and to what extent [number of parking places affected];
- has the planned permit revision been implemented [yes/no];
- how much has the traffic volume on a road gone down [Reduction in numbers of vehicles/vehicle type].

The expected impact upon concentrations in the projection year, i.e., a reduction in concentration level, is to be given as a positive number. For annual mean metrics, this reduction should be presented in µg/m³ at the monitoring site where the highest levels are recorded. Where there is an exceedance situation without a monitoring site, the point of highest modelled concentrations should be used. Deviation from this rule has to be indicated and explained.

The corresponding code lists can be found at:

http://dd.eionet.europa.eu/vocabulary/aq/measureclassification/
http://dd.eionet.europa.eu/vocabulary/aq/measuretype/
http://dd.eionet.europa.eu/vocabulary/aq/administrativelevel/
http://dd.eionet.europa.eu/vocabulary/aq/spatialscale/
http://dd.eionet.europa.eu/vocabulary/aq/measureimplementationstatus/
http://dd.eionet.europa.eu/vocabulary/aq/statusaqplan/

References:

AQUILA – Procedures for determining a national Average Exposure Indicator for assessment of National Exposure Reduction Target, requirements for Quality Assurance /Quality Control, and requirements for the estimation of their uncertainty, 2012.

Buzica D., Gerboles M., Plaisance H., The equivalence of diffusive samplers to reference methods for monitoring O3, benzene and NO2 in ambient air, Journal of Environmental Monitoring, 2008, 10, 1052-1059.

Directive 2008/50/EC of the European Parliament and of the Council of 21 May 208 on ambient air quality and cleaner air for Europe
http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:152:0001:0044:EN:PDF
Directive 2004/107/EC of the European Parliament and of the Council of 15 December 2004 relating to arsenic, cadmium, mercury, nickel and polycyclic aromatic hydrocarbons in ambient air
http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2005:023:0003:0016:EN:PDF

EN 14212:2012 Ambient air quality. Standard method for the measurement of the concentration of sulphur dioxide by ultraviolet fluorescence.

EN 14211:2012 Ambient air quality. Standard method for the measurement of the concentration of nitrogen dioxide and nitrogen monoxide by chemiluminescence.

EN 14662:2005, parts 1, 2 and 3. Ambient air quality. Standard method for measurement of benzene concentrations.

EN 14626:2012 Ambient air quality. Standard method for the measurement of the concentration of carbon monoxide by non-dispersive infrared spectroscopy.

EN 14625:2012 Ambient air quality. Standard method for the measurement of the concentration of ozone by ultraviolet photometry.

Gerboles M., Buzica D., Amantini L., Modification of the Palmes diffusion tube and semi-empirical modelling of the uptake rate for monitoring nitrogen dioxide, Atmospheric Environment, 2005, 39, 2579 - 2592.

Guidance on the Annexes to Decision 97/101/EC on Exchange of Information as revised by Decision 2001/752/EC
http://ec.europa.eu/environment/air/pdf/guidancetoannexes97101ec.pdf

Guidance Report on Preliminary Assessment under EC Air Quality Directives (Van Aalst et al., 1998)
http://reports.eea.europa.eu/TEC11a/en/tech11.pdf

Guidance on Assessment under the EU Air Quality Directives
http://ec.europa.eu/environment/air/pdf/guidanceunderairquality.pdf

Guide to the demonstration of equivalence of ambient air monitoring methods
http://ec.europa.eu/environment/air/quality/legislation/pdf/equivalence.pdf

Hafkenscheid T., Fromage-Mariette A., Goelen E., Hangartner M.,, Pfeffer U., Plaisance H., De Santis F.,Saunders K., Swaans W.,Tang Y.S., Targa J.,Van Hoek C., Gerboles M., Review of the application of diffusive samplers in the European Union for the monitoring of nitrogen dioxide in ambient air, EUR 23793 EN, Joint Research Centre , Institute for Environment and Sustainability, http://publications.jrc.ec.europa.eu/repository/bitstream/111111111/797/1/reqno_jrc51106_eur_23793.pdf%5b1%5d.pdf

International Standard Organisation (ISO) 1992, Quantities and units – Part 0: General principles. ISO 31-0:1992 (E), ISO, Geneva.

Joly M., Peuch H-V., Objective classification of air quality monitoring sites over Europe, Atmospheric Environment, 2011, 47, 111 – 123.

Plaisance H., Leonardis T., Gerboles M., Assessment of uncertainty of benzene measurements by Radiello diffusive sampler, Atmospheric Environment 2008, 42, 2555 – 2568.

SEC 2011 (300) Commission Staff Working Paper concerning guidance on preparing a notification of a postponement of the deadline for attaining the limit values for NO_2 under Directive 2008/50/EC on ambient air quality and cleaner air for Europe.

SCREAM, Assessment on siting criteria, classification and representativeness of air quality monitoring stations, JRC – AQUILA Position Paper.

Recommendations on plans or programmes to be drafted under the Air Quality Framework Directive - http://ec.europa.eu/environment/air/quality/legislation/pdf/recommendation_plans.pdf

Part II

The second part of the guidance describes the details as regards the completion of the “schemata” for the electronic submission of the data flows listed in Annex II of the IPR decision.

The "schemata" contains all the datasets as listed in the IPR Decision i.e.

- (A) Common datatypes
- (B) Dataset "Zones and agglomerations"
- (C) Dataset "Assessment regime"
- (D) Dataset "Information about assessment methods"
- (E) Dataset "Primary data"
- (F) Generated dataset "Aggregated data"
- (G) Dataset "Information on the attainment of environmental objective"
- (H) Dataset "Information on the air quality plan(s)"
- (I) Quantitative source apportionment
- (J) Dataset "Evaluation – Baseline and projection"
- (K) Dataset "Documentation of measures".

Each dataset contains a number of records. Each record contains the following items:

- a reference code,
- an element name and its short description with specification regarding type of data; the specification can be divided in: 1) text where a free text is given, 2) an URL link where the link to the specific document or website is given, 3) a number or 4) a menu, i.e., a code list that is a predefined list of items and their definitions etc.
- a requirement (with a comment); the list of the requirements can be divided in: mandatory (M), conditional (C), generated by the tool (G), generated by external services (X) and voluntary (V).
- Cardinality indicates the number of records which are to be reported: singular (represented as 1), multiple mandatory (represented as 1..*), multiple optional (represented as 0..*), singular optional (represented as 0..1).

Example

Reference	Element	Specification	Description	Requirement	Cardinality	Comments 4 requirement
(A) Common	datatypes					
A.1	Datatype "Contact Detail"					
A.1.1	Name of the responsible authority, institution or body	Text	The official and complete name of the body (institution, company ...) in charge for a specific reporting obligation	M	1	*In Art.3 of DIR 2008/50/EC are called "competent authorities"*
A.1.2	Web address	URL		C	1	M when available
A.1.3	Name of responsible person	Text		M	1	
A.1.4	Address	Text	Postal address: Unambiguous and complete address including ZIP code	M	1	
A.1.5	Telephone number	Text	Complete numbers including country and area codes.	M	1	
A.1.6	E-mail	Text		M	1	

The next part of the document contains the XML schemata translated into an excel file.

[See separate excel document]