

Implementing EU Air Quality Legislation - the Need for Harmonised Models

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1 Introduction

In the regulatory context atmospheric dispersion modelling has been mainly applied for forecasts and granting permits until nowadays, i.e. in situations where measurements were not available. During the last years however growing confidence in models could be observed which among other reasons can be supposed to be due to increased harmonisation and validation efforts.

With regard to EU legislation in the meanwhile modelling is considered a valuable tool when area covering information is requested. Still modelling is given less credibility than monitoring.

2 Legislative Background and Perspective

New European legislation on air quality has recently been adopted under directive 96/62/EC on ambient air quality assessment and management¹, the so called Framework Directive FWD. The FWD requires to set ambient air standards for 13 pollutants. As for now directive 1999/30/EC² - the first of several so called Daughter Directives DD - has to be implemented by Member States. It addresses SO₂, NO_x, lead and particulate matter. A second DD on CO and benzene was adopted last year³ while a third one on ozone is currently under negotiation at Council and the European Parliament. A proposal for a fourth DD is under preparation. It is going to regulate the remaining pollutants, namely As, Cd, Ni, Hg and PAH.

This legislation requires Member States to assess air quality with regard to the ambient air standards laid down in the DDs. Concerning the application of modelling it has to be mentioned that limit values have been set with reference to different averaging times such as 1 hour, 24 hour or annual mean values. In general a limited number of exceedences per year are allowed for the standards referring to hourly or daily means.

The assessment strategy as set out in the FWD is mainly based on monitoring. Yet it also foresees modelling as a supplementary assessment method. In particular as air quality has to be assessed for the whole territory modelling is considered a useful tool to support monitoring. The directives set out QA/QC requirements for models similar to those for monitoring, i.e. they refer to reference model techniques and uncertainty requirements.

Beyond assessment of air quality the latest air quality legislation requires Member States to set up plans and programmes to attain the limit values where they are exceeded. Clearly this requires identification of reasons for exceedence which is a typical task for air quality modelling. Concerning this second field for the application of dispersion modelling no detailed requirements are set out in the directives. Recommendation might be given at a later stage of implementation in a guidance document on plans and programmes.

3 Application of Atmospheric Dispersion Models for Implementation

3.1 Modelling for the purpose of air quality assessment

Requirements for models for assessment of air quality will in general differ from those for other regular purposes such as granting permits. In particular contributions from all sources, i.e. total emissions, as well as those from long range transport have to be taken into account.

The air quality directives state that no reference modelling techniques can be specified at present. So in general any model might be used for assessment purposes if it meets the uncertainty requirements. It might be questioned whether the definition of a reference model technique would be recommendable. Most probably no clear criteria could be defined for a decision on a particular model. Moreover this might retard further model development and hinder a change to an improved model. With regard to this a harmonisation of models to be applied in this area might be more appropriate. As a first step common minimum requirements could be defined, which were to be fulfilled by models used for this purpose.

Among such minimum requirements model uncertainty would be one important issue. The directives define uncertainty as "the maximum deviation of the measured and calculated concentration levels, over the period considered, by the limit value, without taking into account the timing of the events" thereby giving monitored data a higher credibility than model results. Dependent on the pollutant and the averaging time to which the limit value refers an uncertainty of 30 to 60% is not to be exceeded. It should be mentioned however that the directives allow for an uncertainty of measurements of up to 25%. This uncertainty would not be taken into account when monitored and modelled data were compared. If model results and measurements are used in parallel to assess air quality there may occur the situation that exceedences of limit values are found by modelling without being confirmed by monitoring. Figure 1 illustrates this where (a) is the ideal case, where a monitoring station is sited exactly where the modelled maximum is calculated and moreover both values are equal,

(b) is less ideal, where the model results are equal to the monitored data but the station is not sited at the modelled maximum,

(c) is the realistic case, where model results differ from measured data and where the station not sited at the modelled maximum.

In the latter case it might be questioned whether the modelled exceedence is to be considered as a non-compliance situation. As mentioned above models are considered less reliable than measurements. On the other hand, it is important to realise that one can not measure everywhere and that limit values apply not only where stations are situated. While monitored data are applied for compliance checking without taking into account their uncertainty this is often put into question for modelled data. So a modelled exceedence might only be considered valid if the limit value is outside the range of uncertainty.

Recommendations on how to handle this situation from the legal point of compliance checking are given in the Guidance report on assessment⁴.

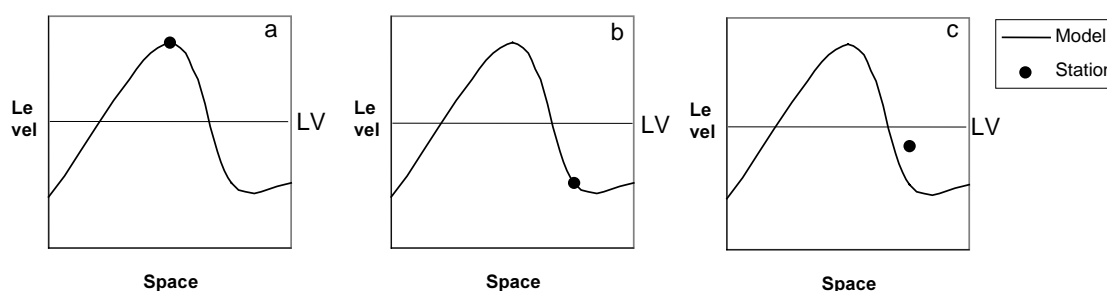


Figure 1 Measured versus modelled exceedence of a limit value (LV).

3.2 Modelling for the purpose of air quality planning

If the limit values are exceeded Member States have to set up plans and programmes to attain compliance. In this context dispersion models are the most appropriate tools to identify the reasons for exceedence as well as cost-effective measures to improve air quality.

If exceedences are caused by single industrial installations the same models might be used as for granting permits. If however multiple sources and source types such as road traffic and residential heating are involved the identification of the most cost-effective measures would most probably require the use of integrated assessment modelling.

3.3 Current model applications in Member States

Article 5 of the FWD requires Member States to perform a preliminary assessment of air quality. Recommendations on how to use modelling on this context were given in a guidance report⁵. From the information on preliminary assessment currently available to the Commission the following conclusions may be drawn:

- Modelling is mostly used to assess contributions from point sources. Most models applied in this context are of Gaussian type and have participated in the evaluation procedures set up during past Harmonisation Conferences.
- Furthermore models were used to assess air pollution from road traffic using different model approaches developed by Member States.
- To determine the contribution from long-range transport to background concentrations some Member States used a nesting approach to combine background and local contributions.

4 Conclusions and Recommendations

Several recently adopted directives on air quality foresee dispersion modelling as a valuable tool to implement legislation. However to make the best use of dispersion models their credibility would have to be increased.

To this purpose further effort has to be given to evaluation. While certification or standardisation as performed for monitoring methods might be difficult and not recommendable for models, some lessons might be learned from the application of uncertainty and validation procedures applied to monitoring methods. Besides that minimum requirements on model features could be defined dependent on application purposes. Harmonisation of models would be important to ensure comparable results in all Member States. Common methods should be used for the validation of models and the validation itself should relate to the averaging time for the limit value in question. To this end additional data sets would be necessary.

With regard to the limit values laid down in the DDs the most critical pollutants are going to be particulate matter and ozone. NO₂ concentrations in street canyons or near motorways are also going to be an issue.

To assess contributions from all sources as well as from long-range transport nesting of models will turn out be necessary to address all scales. Assessment methods which take into account modelled and monitored data at the same time will be of growing importance.

References

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