

COMMISSION DECISION

of 29 April 2004

**concerning guidance on a provisional reference method for the sampling and measurement of
PM_{2,5}**

(notified under document number C(2004) 1713)

(Text with EEA relevance)

(2004/470/EC)

THE COMMISSION OF THE EUROPEAN COMMUNITIES,

Having regard to the Treaty establishing the European Community,

Having regard to Council Directive 1999/30/EC of 22 April 1999 relating to limit values for sulphur dioxide, nitrogen dioxide and oxides of nitrogen, particulate matter and lead in ambient air (1), and in particular the third subparagraph of Article 7(5) and Section V of Annex IX thereto,

After consulting the Committee instituted by Article 12 (2) of Council Directive 96/62/EC (2),

Whereas:

(1) Pending the establishment by the European Committee for Standardisation (CEN) of a reference method for the sampling and measurement of PM_{2,5} guidance concerning a provisional reference method for such sampling and measurement should be provided.

(2) Commission Decision 2003/37/EC (3) gives guidance on such a provisional reference method.

(3) Decision 2003/37/EC should be amended due to an omission in its Annex concerning the sampling devices used in field validation campaigns; at the same time other information in that Annex with regard to measurement methods and the state of validation work should be updated for clarification and to take account of technical progress.

(4) Decision 2003/37/EC should be replaced in the interests of clarity,

HAS ADOPTED THIS DECISION:

Article 1

Guidance concerning a provisional reference method for the sampling and measurement of PM_{2,5} is set out in the Annex.

Article 2

Decision 2003/37/EC is hereby repealed.

Article 3

This Decision is addressed to the Member States.

Done at Brussels, 29 April 2004.

For the Commission

Margot Wallström

Member of the Commission

(1) OJ L 163, 29.6.1999, p. 41. Directive as amended by Commission Decision 2001/744/EC (OJ L 278, 23.10.2001, p. 35)

(2) OJ L 296, 21.11.1996, p. 55. Directive as amended by Regulation (EC) No 1882/2003 of the European Parliament and of the Council (OJ L 284, 31.10.2003, p. 1).

(3) OJ L 12, 17.1.2003, p. 31.

ANNEX

GUIDANCE ON PM_{2,5} MEASUREMENT UNDER DIRECTIVE 1999/30/EC

The purpose of this document is to give recommendations to air quality managers and network operators on the selection of PM_{2,5} measurement devices required by Directive 1999/30/EC for fine particles. These recommendations do not apply to other possible applications with different measurement objectives, as for example in the case of research activities, or in the case of indicative measurements.

Background and CEN standardisation work

Directive 1999/30/EC states in Article 5 that «Member States shall ensure that measuring stations to supply data on concentration of PM_{2,5} are installed and operated. Each Member State shall choose the number and the siting of the stations at which PM_{2,5} is to be measured as representative of concentrations of PM_{2,5} within that Member State. Where possible sampling points for PM_{2,5} shall be co-located with sampling points for PM₁₀ ». Article 7 further mentions that «The provisional reference method for the sampling and measurement of PM_{2,5} shall be laid down in Section V of Annex IX.» Annex IX finally asks for the preparation of a guideline to be developed by the European Commission in consultation with the committee referred to in Article 12 of Directive 96/62/EC.

DG Environment has given a mandate to CEN to develop a standard European reference method for the measurement of PM_{2,5}. This method is based on the gravimetric determination of the PM_{2,5} fraction of particles in air, sampled at ambient conditions. CEN TC 264/WG 15 started its work in 2000. Field validation campaigns have been carried out in eight European countries, namely Spain, Germany, The Netherlands, Austria, Italy, Sweden, the United Kingdom and Greece and have been completed in summer 2003. The final CEN standard method will therefore not be available before 2004.

CEN WG 15 is currently testing various candidate devices based on the gravimetric determination method and equipped with different inlet types from European manufacturers as well as the US Federal Reference sampler:

MINI-WRAC, single filter sampler, from Fraunhofer Institute for Toxicology and Aerosol Research (FhG-ITA), Germany,

US-Federal Reference sampler, single filter sampler: RAAS 2,5-1, from Thermo Andersen, USA

Partisol FRM Model 2000, from Rupprecht and Patashnick, United States of America,

Partisol plus Model 2025-SCC, sequential sampler, from Rupprecht and Patashnick, United States of America,

LVS-3D, single filter sampler, from Derenda, Germany,

SEQ 47/50, sequential sampler, from Leckel Company, Germany,

HVS-DHA 80, sequential sampler, from Digital, Switzerland.

In addition, CEN is also testing a number of automated measurement devices, based on the beta ray attenuation method and the tapered element oscillating microbalance (TEOM), to develop test procedures for equivalency with the reference gravimetric method:

ADAM, beta ray attenuation, sequential, from OPSIS, Sweden,

FH 62 I-R, beta ray attenuation, filter tape, from ESM Andersen Company, Germany,

BAM 1020, beta ray attenuation, filter tape, from Met One, United States of America,

TEOM SES, sharp cut cyclone, from Rupprecht and Patashnick, United States of America.

Problems in mass concentration measurements of PM_{2,5}

Several problems, partially known from previous experiences with PM₁₀ measurements, have to be taken into consideration when determining PM_{2,5} mass concentrations. Preliminary inter-comparison studies carried out in a number of EU countries have shown significant differences between the results of manual PM_{2,5} samplers, ranging up to ± 30 %. Reasons for the observed differences between the samplers are complex and can be divided into:

artefacts on the filter, e.g. evaporative losses during sampling or conditioning of the filter,

artefacts in the size fractionating inlet, e.g. poor design, changes of the cut-off due to poor volume flow control and particle deposition on the impaction plate,

artefacts due to the sampling system set-up; e.g. particle deposition in the sampling tube (especially for long or curved tubes).

It has to be noted that the chemical composition of PM_{2,5} is significantly different from that of PM₁₀ especially the semi-volatile particulate matter (e.g. ammonium nitrate, organic compounds) is enriched in the fine PM_{2,5} size fraction. The particulate matter in the size range between PM₁₀ and PM_{2,5} mainly consists of inert components such as silica, metal oxides, etc. Hence the problems with losses of semi-volatile matter already observed when sampling PM₁₀ may be even more pronounced for PM_{2,5} measurements.

Losses will essentially depend on the composition of the aerosols and the presence of volatile particulate matter, as well as on the difference between ambient and sampling temperatures. The losses may therefore present important seasonal and geographical variations. As an example of this, losses close to 0 % were reported in Scandinavia during a spring episode (aerosols from road

sanding), whereas losses up to 70 % were observed in Central Europe during a winter episode (aerosols with high ammonium nitrate content).

With this background it can be anticipated that any heating of the sampling system will show significantly lower PM_{2,5} mass concentrations than a system kept under ambient conditions.

Recommendations for monitoring PM_{2,5}

In the absence of conclusions from the CEN standardisation activities, the following recommendations for PM_{2,5} can be given:

Regarding the measurement method

The mandate given by the Commission to CEN specified that the measurement method to be standardised is based on the gravimetric determination of the PM_{2,5} mass fraction of particulate matter collected on a filter under ambient conditions. Other methods, such as the beta ray attenuation method and the tapered element oscillating microbalance (TEOM), are currently tested for equivalence with the gravimetric method by CEN WG15.

Regarding the PM_{2,5} specific inlet

Currently there are two main inlet designs available and in use for monitoring and research purposes: the impactor type inlet and the sharpcut-cyclone type. Various inlets of both types are currently under testing e.g. within the framework of CEN WG 15. The size fractionation efficiency of the inlet needs to ensure that 50 % of the particles with an aerodynamic diameter of 2,5 µm are collected on the filter.

Regarding the instruments

Theory and former experience gained in the PM₁₀ validation work suggests that the use of devices whereby the sampling probe and/or filter is heated during collection should be avoided for the measurement of PM_{2,5}. In order to limit as far as possible the losses of volatile particles, instruments sampling as close as possible to ambient temperature should be preferred for PM_{2,5}.

Considering the incomplete manner and the lack of coherence of the results obtained thus far from the various studies, it is impossible for the present to select candidate instruments for the monitoring of PM_{2,5}. When it comes to the selection of a particular measurement device, a careful approach is

recommended. Preference should be given to an approach that does not entail important resource investment and that allows for the adaptation of the measurement requirements to future developments (e.g. the forthcoming European standard method on PM_{2,5} measurements, technical developments by instrument manufacturers, the upcoming regulation on heavy metals).

When reporting PM_{2,5} data, it is essential to document fully the measurement methodology that was used to generate the data.