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 thereof,

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 e provided;

(2) Commission Decision 2003/37/EC of 16 January 2003 gives guidance on a such provisional reference method[3;]

(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

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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

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Decision 2003/37/EC is hereby repealed.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

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 PM_{10}." 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, USA

– Partisol plus Model 2025-SCC, sequential sampler, from Rupprecht and Patashnick, USA

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

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

– HVS-DHA 80, sequential sampler, from Digitel, 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, USA

– TEOM SES, sharp cut cyclone, from Rupprecht and Patashnick, USA

Problems in mass concentration measurements of $PM_{2.5}$

Several problems, partially known from previous experiences with PM_{10} 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 PM_{10} 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 PM_{10} 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 PM_{10} 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 PM_{10} 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