COMMISSION DECISION

of 19 March 2004

concerning guidance for implementation of Directive 2002/3/EC of the European Parliament and of the Council relating to ozone in ambient air

(notified under document number C(2004) 764)

(Text with EEA relevance)

(2004/279/EC)

THE COMMISSION OF THE EUROPEAN COMMUNITIES,

Having regard to the Treaty establishing the European Community,

Having regard to Directive 2002/3/EC of the European Parliament and of the Council of 12 February 2002 relating to ozone in ambient air [1], and in particular Article 12(1) thereof,

Whereas:

(1) Directive 2002/3/EC establishes long-term objectives, target values, an alert threshold and an information threshold for concentrations of ozone in ambient air.

(2) Article 7 of Directive 2002/3/EC requires Member States under particular conditions to draw up short-term action plans, where there is a risk of exceedances of the alert threshold. The guidance developed by the Commission in this respect should in accordance with Article 7(3) provide Member States with examples of measures, the effectiveness of which has been assessed.

(3) In accordance with Article 9(3) of Directive 2002/3/EC, the Commission should provide Member States with guidelines for an appropriate strategy to measure ozone precursor substances in ambient air, as part of the guidance to be developed under Article 12 of that Directive.

(4) In drawing up the guidance and guidelines in question the Commission has called upon expertise in the Member States and in the European Environment Agency.

(5) The measures provided for in this Decision are in accordance with the opinion of the Committee established by Article 12(2) of Council Directive 96/62/EC of 27 September 1996 on ambient air quality assessment and management [2],

HAS ADOPTED THIS DECISION:

Article 1

1. The guidance with regard to the drawing up of short-term action plans in accordance with Article 7 of Directive 2002/3/EC shall be as set out in Annex I to this Decision.

2. When developing and implementing the short-term action plans, Member States shall consider the relevant examples of measures set out in Annex II to this Decision in accordance with Article 7(3) of Directive 2002/3/EC.

3. The guidelines for an appropriate strategy for measuring ozone precursor substances in accordance with Article 9(3) of Directive 2002/3/EC shall be as set out in Annex III to this Decision.

Article 2

This Decision is addressed to the Member States.

Done at Brussels, 19 March 2004.

For the Commission

Margot WALLSTRÖM

Member of the Commission

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[1] OJ L 67, 9.3.2002, p. 14.

[2] OJ L 296, 21.11.1996, p. 55.

ANNEX I

GENERAL ASPECTS FOR CONSIDERATION BY MEMBER STATES WHEN DRAWING UP SHORT-TERM ACTION PLANS IN ACCORDANCE WITH ARTICLE 7 OF DIRECTIVE 2002/3/EC

Article 7 of Directive 2002/3/EC sets out the requirements for short-term action plans. Article 7(1) in particular requires Member States in accordance with Article 7(3) of Directive 96/62/EC to draw up action plans, at appropriate administrative levels, indicating specific measures to be taken in the short term, taking into account particular local circumstances, for the zones where there is a risk of exceedances of the alert threshold, if there is a significant potential for reducing that risk or for reducing the duration or severity of any exceedance of the alert threshold. However, according to Article 7(1) of Directive 2002/3/EC it is up to Member States to identify whether there is significant potential for reducing the risk, duration or severity of any exceedance, taking account the national geographical, meteorological and economic conditions.

With regard to the EU long-term policy, the key question is whether short-term action plans still offer a significant additional potential for reducing the risk of exceedances of the alert value (240 $\mu g/m^3$) or for reducing their duration or severity.

In the following the guidance on appropriate short-term actions is given with regard to geographical differences, regional extension and duration of possible measures.

1. GEOGRAPHICAL ASPECT

Regarding the need for short-term actions to avoid exceedance of the 240 $\mu g/m^3$ threshold, the 15 Member States can be split up into three groups:

1. In the Nordic countries (Finland, Sweden and Denmark) and Ireland no exceedances of the alert threshold happened so far (according to data reported to European Environment Agency AIRBASE) and in view of the implementation of the abovementioned long-term policy, they are even more unlikely to happen in the future.

   Therefore Nordic countries and Ireland would not need to prepare short-term actions plans as there seems to be no risk of any exceedance of the alert threshold.

2. Air mass transport in north-western and central European countries is most frequently dominated by advection and often gives rise to long range transboundary pollution transport.

   There are clear indications that for most parts of the north-western and central European countries exceedances of the alert threshold are diminishing. Short-term measures already in the mid-90s showed only a restricted reduction potential and implementation of the EU long-term strategy will necessitate the generalised and permanent application of some former short-term measures.

   Therefore countries in which there is no significant potential for reducing the risk of exceedances through short-term action plans would not need to prepare such plans.

3. Major cities and regions in southern Member States experience, on the other hand, more often recirculation of air masses due to topography and the influence of the sea. In some cases the same air masses are recirculating several times ([1]). Due to high natural VOC emissions, emission reductions of VOC are relatively ineffective (so-called 'NO_x-limited' regime).

   No significant trend of ozone peak values can be seen in the ensemble of rather limited and only recent time series. Moreover in those areas there is a lack of knowledge with regard to the efficiency of short-term measures.

   Therefore cities and/or regions in southern Europe characterised by particular orographic conditions can, in principle, locally profit from short-term measures for reducing the risk or severity of exceedances of the alert value, especially for exceptional situations of extreme O_3-episodes such as experienced in 2003.

2. REGIONAL EXTENSION OF MEASURES

Local scale efforts to reduce temporary the emissions of ozone precursors will be locally more paying in recirculation regimes than it might be in mainly by advection dominated regions.

Some countries (e.g. France) have both regimes depending on the region. Those countries may develop separate short-term action plans for southern cities, which might not be efficient at all for agglomerations or regions located in the more northern advection dominated part of the country.

([1]) For example, Millán, M.M., Salvador, R., Mantilla, E., Kallos, G., 1997. Photo-oxidant dynamics in the Western Mediterranean in summer; Results of European research projects. J. Geophhy. Res., 102, D7, 8811-8823.

The solution to ozone air pollution problems requires a proper diagnosis of the processes in each region and for each time of year, as well as of the links between the regions. Remedial short-term actions can be effective in some airsheds during some times of the year and not in others. Similarly, short-term actions may require a regional-wide assessment and approach, where layering and transport account for a significant part of the observed ozone.

3. SHORT-TERM VERSUS LONG-TERM MEASURES

Only long-term permanent large scale and drastic reductions of the ozone precursor emissions will sustainably bring down ozone peak concentrations as well as ozone background levels in urban and rural areas all over the EU. These reductions will follow from the ozone Directive itself and from the closely related Directive 2001/81/EC on national emission ceilings for certain atmospheric pollutants ([1]) (in its turn endorsed by Directive 2001/80/EC on the limitation of emissions of certain pollutants into the air from large combustion plants ([2])). Furthermore EU-wide regulations to reduce VOCs (Directive 94/63/EC on the control of volatile organic compound emissions resulting from the storage of petrol and its distribution from terminals to service stations ([3]); Directive 1999/13/EC on the limitation of emissions of volatile organic compounds due to the use of organic solvents in certain activities and installations ([4]); Directive 96/61/EC concerning integrated pollution prevention and control ([5])) as well as pending strategies to regulate the VOC content in products will reduce ozone peak levels. These European-wide permanent emission reductions are expected to reduce the ozone peak values by 20 to 40 % depending on the scenario and the region.

To be efficient, short-term actions would have to result in emission reductions of the same order of magnitude. Moreover these actions would have to be taken well in advance, e.g. one or two days, of an exceedance event (either on the basis of forecasts or during the whole summer season), and should have the appropriate regional extension (see above).

It should be noted that dissemination of information on ozone concentrations and recommendations to the public and to appropriate health care bodies is obligatory. Combined with adequate ozone forecasting this dissemination of information may reduce the exposure duration or exposure intensity of the population to the high ozone values.

Temporary measures (triggered by exceedance of the hourly threshold of 240 $\mu g/m^3$) which are locally limited reduce the ozone peak concentrations by at most 5 % (primarily because of the relatively small emission reduction effects). This is the case for almost all traffic related measures such as speed limits, driving ban for non-catalysed vehicles when limited to the (sub)regional scale.

The combination of several locally limited measures (including industry and households) may result in a higher ozone peak reduction potential, but it is clear that a regional strategy is substantially more efficient than individual local measures. The total ozone peak reduction potential however is not expected to be larger than 20 %.

In some regions, where the ozone formation is VOC-limited, the above temporary and locally limited measures may even result in higher ozone peak concentrations.

([1]) OJ L 309, 27.11.2001, p. 22.
([2]) OJ L 309, 27.11.2001, p. 1.
([3]) OJ L 365, 31.12.1994, p. 24.
([4]) OJ L 85, 29.3.1999, p. 1.
([5]) OJ L 257, 24.9.1996, p. 26.

ANNEX II

Short-term measures: Examples and experience

1. FIELD EXPERIMENT: HEILBRONN/NECKARSULM (GERMANY)

The field experiment in the Heilbronn/Neckarsulm conurbation (approximately 200 000 inhabitants) started with abatement actions on Thursday 23 June, 1994, and lasted until Sunday 26 June, 1994. It was accompanied by measurements at four fixed stations, with 15 mobile units, with an aircraft and balloons and included model calculations on the basis of a detailed emission inventory. The study was designed to answer the following question, taking a typical summer smog episode as an example.

— Can peak ozone concentrations during an episode be significantly reduced by local and temporary abatement actions, and how can reductions of NO_x and VOC be achieved by realistic measures?

— Are local and temporary short term actions, such as traffic bans, feasible on the basis of a given infrastructure, and will they be accepted by the public?

Three zones were defined for the experiment. The total model area consisted of 910 km^2. Within the inventory area (400 km^2), comparably mild abatement actions were applied; a speed limit of 70 km/h or less was imposed on all roads including motorways, and industry and smaller enterprises promised emission reductions on a voluntary basis. In the downtown area of 45 km^2, traffic bans were enforced; however cars equipped with controlled catalytic converters and low emitting diesel vehicles were exempted from this ban, as well as essential traffic, such as fire brigades, suppliers of fresh food, and medicines. Additional measures included a speed limit of 60 km/h or less and voluntary emission reductions by industry and smaller enterprises.

Fair weather, with maximum temperatures climbing from 25 °C to about 30 °C, prevailed during the experiment, with cloud cover on the afternoons of 25 and 27 June. Wind speeds were moderate (i.e. 2 to 4 m/s on 23 and 25 to 27) or elevated (i.e. 4 to 7 m/s on 24), the meteorological conditions thus being favourable, but not exceptionally good for ozone production.

As a result of the abatement actions the precursor emissions in the model area were reduced by 15 to 19 % for NO_x and 18 to 20 % for VOC. In the downtown area the ambient concentrations were thus reduced by up to 30 % for $NO_x$and up to 15 % for VOC.

However no significant changes of the ozone burden beyond measurement uncertainty could be detected. This result is in accordance with model calculations. A closer examination of the results revealed three main reasons for this lack of response in the ozone burden.

— The area with strict abatement actions was too small (45 km^2).

— The voluntary reductions in the industrial sector (especially VOC) were not sufficient.

— Due to meteorological conditions during the experiment ozone concentrations were mainly influenced by regional ozone transport instead of local ozone production.

— Due to moderate wind speed any effects could only have been observed further downwind of the area where the field experiment took place.

References:

Umweltministerium Baden-Württemberg (Hrsg.):

Ozonversuch Neckarsulm/Heilbronn. Dokumentation über die Vorbereitung und Durchführung des Versuchs, Stuttgart, 1995

Umweltministerium Baden-Württemberg (Hrsg.):

Ozonversuch Neckarsulm/Heilbronn, Wissenschaftliche Auswertungen, Stuttgart, 1995

Bruckmann, P. and M. Wichmann-Fiebig: 1997. The efficiency of short-term actions to abate summer smog: Results from field studies and model calculations. EUROTRAC Newsletter, 19, 2 to 9.

2. GERMAN PROGRAMME OF CONTROL CONCEPTS AND MEASURES FOR OZONE — ‘SUMMER SMOG’

2.1. **Objective**

The aim of this research project was the determination and evaluation of the effectiveness of large scale (German-, respectively EU-wide) as well as of local emission control measures on elevated ground level ozone concentrations in midsummer episodes by applying photochemical dispersion models. Thus, the research project was designed to contribute to scientific conclusions as regards the effectiveness of ozone abatement strategies. Furthermore, taking into account the ongoing political discussions to advance legislation for ozone abatement at federal and at state levels, the findings of this project were to contribute to improving the basis for decision-making.

The simulations were among others conducted for an ozone episode in 1994 (from 23 July to 8 August). Ground-level peak ozone concentrations of 250 to 300 µg/m³ (1h-values) were observed in the afternoon. The results of the model calculations are summarised below.

2.2. **Effect of various measures on ozone concentrations in Germany**

Permanent reduction measures: By 2005, the emission control measures already implemented (EC Directives, national environmental legislation, etc.) will reduce the ozone precursor emissions nationwide by 37 % for NO_x and by 42 % for VOC. For this scenario, decreases of the afternoon's ozone peak concentrations ranging from 15 to 25 % are calculated in large parts of the modelling domain. Peak values of 300 µg/m³, for instance, would thus be lowered by 60 µg/m³ on the average. The calculated number of grid hours [1] at ground level, during which in the base case run threshold values of 180, respectively 240 µg/m³, are exceeded, is reduced by 70 to 80 % in the scenario.

In the case of additional permanent reduction measures (–64 % NO_x; –72 % VOC) [2], the calculated afternoon's peak concentrations are 30 to 40 % lower than in the base case run. The calculated frequency of number of grid hours exceeding threshold values of 180, respectively 240 µg/m³, is reduced by approximately 90 %.

Temporary reduction measures: In the case of a ‘severe’ nationwide speed limit (–15 % NO_x; –1 % VOC), the model simulations show a decrease in the calculated frequency of grid hours exceeding the threshold of ground-level ozone concentrations of 180 µg/m³ by approx. 14 %. The domain-related rates of reductions of peak ozone concentrations in the afternoon hours range from 2 to 6 %.

In the case of a nationwide driving ban for passenger cars without a three-way catalyst (–29 % NO_x; –32 % VOC), the simulation shows a 29 % decrease of the calculated number of grid hours with ground-level ozone concentrations above 180 µg/m³. The domain-related rates of reduction of peak ozone concentrations in the afternoon hours range from 5 to 10 %. A hypothetical 48-hour earlier release of the measure results in an additional reduction of ozone peak concentrations of 2 %.

2.3. **Effect of various measures on ozone concentrations in three selected German regions**

The local scale analysis of the effectiveness of control measures was performed for three selected model regions: Rhine-Main-Neckar (Frankfurt), Dresden and Berlin-Brandenburg. In all three regions, ozone peak concentrations significantly exceeded 200 µg/m³ (1h-value) over several days in the episode studied.

Permanent reduction measures: On local scales, for the three model regions, the permanent large-scale control measures (up to -30 % NO_x; up to -31 % VOC; both plus effects in Germany/Europe) result in a decrease of the calculated peak ozone concentrations in the range of 30 to 40 %. Afternoon peak values of 240 to 280 µg/m³ would thus drop below 200 µg/m³. The effectiveness of permanent large-scale control measures is significantly higher than that of temporary measures (see below), although the emission-related reduction effects are ‘only’ in the magnitude of -30 to -40 %. The higher efficiency of permanent control measures is caused by the abovementioned decrease of the precursor emissions at the national (European) level. Thus, the background concentrations of ozone and ozone precursors are reduced.

Temporary reduction measures: Local speed limits (up to –14 % NO_x; –1 % VOC) and local driving bans including non-low emission diesel cars (up to –25 % NO_x; up to –28 % VOC) exert only minor effects on peak ozone concentrations, at maximum –4 % for speed limits and –7 % for traffic bans. As background concentrations of ozone and precursors remain unaffected by local measures, they solely have an impact on the local ozone production. This accounts for the low efficiency of this type of measures.

Local control strategies, temporarily implemented, are able to achieve moderate decreases in the afternoon peak ozone concentrations in the domain exposed to the measures when there are conditions of very little exchange of air masses. Even by exhausting all available local control potentials (and hence by applying the most stringent actions), the effects on peak ozone levels cannot be placed on a par with those of permanent emission control.

(1) The number of grid hours corresponds to the number of hours throughout the entire episode during which a concentration threshold was exceeded in a given grid cell, summed up over all grid cells of the surface layer in the model domain.
(2) The figures in brackets indicate the emission reductions.

References:

Motz, G., Hartmann, A. (1997)

Determination and evaluation of effects of local, regional and larger-scale (national) emission control strategies on ground level peak ozone concentrations in summer episodes by means of emission analyses and photochemical modelling, summary of the study commissioned by the German Federal Environmental Agency — UFO-Plan Nr. 10402812/1).

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3. THE NETHERLANDS

In order to examine the range of effectiveness of short-term abatement actions in the Netherlands between 1995 and 2010 the National Institute of Public Health and the Environment (RIVM) conducted a model study (EUROS model). A base grid resolution of 60 km was used for the whole model domain, whereas within the area Benelux and Germany local grid refinement to 15 km was applied. The simulations were performed using three different smog episodes in 1994, emission base years 1995, 2003 and 2010 and 5 different types of short-term actions. The three basic short-term actions concerned road traffic on a nationwide scale: S1 speed limits, S2 driving bans for cars without catalysts, S3 driving bans for trucks on inner urban roads. Scenario S4 imposes the combined effect of S1, S2 and S3 throughout the Netherlands, S5 does the same for the Benelux and part of Germany (North-Rhine-Westphalia) and S6, a hypothetical scenario, presumes no emissions of precursors in the Netherlands (a bottom-end extreme sensitivity test. The effectiveness of the different scenarios throughout time is given in table 1.

Table 1

An overview of the effects of short-term actions on the national precursor emission total. Values are a percentage of the national emission total

Countries that are affected			NL	NL	NL	NL	Benelux/ Germany	NL
Scenario number			S1	S2	S3	S4	S5	S6
Effect on national emission total	NO_X	1995	– 3	– 14	– 3	– 19	– 19	– 100
		2003	– 2	– 6	– 3	– 11	– 11	– 100
		2010	– 1	0	– 2	– 3	– 3	– 100
	VOC	1995	0	– 13	– 1	– 14	– 14	– 100
		2003	0	– 5	– 1	– 6	– 6	– 100
		2010	0	0	– 1	– 1	– 1	– 100

All short-term actions solely concerned road traffic since other sectors appeared not very effective in reducing ozone precursor emissions and/or with considerable economic consequences.

As a result of the short-term measures the nationwide averaged 95 percentile values increased by a few percent for both 1995 and 2003. Only the bottom end extreme case showed a reduction of a few percent. The effectiveness of short term actions in 2010 becomes negligible (see also table 1). It seems therefore that the effectiveness of short term traffic measures reduces rapidly in time due to a decreasing number of cars without catalytic converters. Grid refined results (15×15 km^2) show that the increase of 95 percentile values is mainly due to increasing values in the highly industrialised/populated areas (the NO-titration effect), while on the other hand ozone concentrations are hardly affected in less industrialised/populated areas. A substantial reduction in the ozone maxima can only be obtained through permanent and large-scale measures as is shown e.g. by the reduction of 95 percentile values between base years 2003 and 2010 of about 9 %.

Reference:

C.J.P.P. Smeets and J.P. Beck, Effects of short-term abatement measures on peak ozone concentrations during summer smog episodes in the Netherlands. Rep. 725501004/2001, RIVM, Bilthoven, 2001.

4. AUSTRIA

In Austria, the Federal Act on Ozone of 1992 contained the necessity to enact short-term action plans in the case of very high ozone levels. The relevant alarm threshold was 300 μg/m² as three-hour mean value. The trigger for taking action was the concentration level exceeding 260 μg/m³ as three-hour mean value, taking into account that the implementation of plans takes some time. Most measures related to traffic (mainly ban of vehicles without catalytic converters). However, measures have never had to be taken, as the abovementioned level triggering action had never been reached. The regulation has been adapted to Directive 2002/3/EC in July 2003.

In general, ozone levels in Austria are mainly influenced by long range transport. In Alpine areas ozone shows a less pronounced diurnal cycle compared to other regions (UBA, 2002). As a consequence, relatively high long-term mean values are observed at those stations. However, levels in excess of the alarm threshold set in Directive 2002/3/EC (240 μg/m³) have not been recorded in the last couple of years in Alpine areas.

Highest ozone peak concentrations (with very few exceedances ([1]) of 240 μg/m³ as one-hour mean value) can be observed in the plume of Vienna, usually in the north-eastern parts of Austria. The ozone levels can exceed the ozone levels outside the plume by up to 50 μg/m³ and more.

A photochemical transport model was developed to simulate ozone formation in this region (Baumann et al., 1998). Using this model, the effect of emission reductions within the study area on the ozone levels were investigated (Schneider, 1999).

The results are, in general, in line with results from other, more comprehensive studies and can be summarised as follows: The only significant effects of short-term emission reductions in Austria on ozone levels are predicted for the city of Vienna and in its plume. Within the city area of Vienna, where presumably exposure is most significant, slight reductions of NO_x emissions (10 to 20 %) tend to increase ozone levels, while ozone production decreases as the air mass moves out of Vienna.

References:

UBA (2002). 6. Umweltkontrollbericht. Umweltbundesamt, Wien.

Baumann et al. (1997). Pannonisches Ozonprojekt. Zusammenfassender Endbericht. ÖFZS A-4136. Forschungszentrum Seibersdorf.

Schneider J. (1999). Untersuchungen über die Auswirkungen von Emissionsreduktionsmaßnahmen auf die Ozonbelastung in Nordostösterreich. UBA-BE-160.

5. FRANCE

The French law on air quality and the rational use of energy, adopted on 30 December 1996, requires that in the event of peak pollution incidents, measures must be taken. When alert thresholds are reached or likely to be reached, the prefect shall immediately inform the public and shall take measures to restrict the extent and effects of the pollution peak on the population.

A decree taken by the prefect defines the emergency measures that shall be implemented in case of a peak pollution event and the area where it shall be. The alert procedure includes two levels:

— a level of information and recommendation when the information threshold is reached (180 μg/m³ for ozone),

— an alert level when the alert threshold is reached or likely to be reached (360 μg/m³ for ozone).

The information threshold is often exceeded. In that case, recommendations are advised to the public.

When the alert threshold is reached or likely to be reached, the prefect must immediately inform the public. Moreover the following recommendations are given in that case:

— try to avoid refuelling,

— recommendation not to use gasoline-powered lawn equipment,

— recommendation to use water-based paint products and to avoid using solvents,

— recommendation to use non-polluting means of transport,

([1]) On average one day per year; however, in about half of the years since 1990 no exceedances were measured at all.

— reduction of speed limits (by 20 km/h) on a large scale,

— reduction of industrial activities if NO_x and/or VOCs emissions,

— no solvent fill in industries,

— no burn out of flares in refineries.

Mandatory local short-term actions as prepared by the Prefect services are based on transport measures. Speed limits on roads and motorways are to be reduced by 20 %. Such measures are implemented, when a pollution event is forecast for the following day. In the event of any measures restricting or suspending motor vehicle traffic taken by the regional prefect under alert procedure, access to public passenger transport shall be made free of charge.

So far the alert threshold has been exceeded only once in the south of France in March 2001, in the Berre industrial area, near Marseille. In this industrial area, the petrochemical activity is responsible for about 70 % of the emissions of NO_x and VOC, whereas NO_x and VOC are mainly due to transport around Marseille (VOC 98 %; NO_x 87 %). The night before 21 March, the weather conditions were anticyclonic, no wind, little convection and a warm air mass about 600 meters above, stopping the vertical dispersion of the pollutants. No industrial incident, that might have increased the emissions of pollutants was declared on 21 March. As no pollution peak had been forecasted for 22 March, no short-term measures were planned. On the evening of 21 March, the meteorological conditions changed and the concentrations of ozone decreased rapidly.

As the local short-term action plan was restricted to transport measures, the concerned industrial installations were asked to propose measures to reduce the NO_x and VOC emissions of their plants. They proposed:

— to avoid burning out the flares,

— to defer some maintenance actions,

— to defer the degasification of a production unit,

— to use low nitrogen fuels (pitch),

— to avoid transferring liquids if no VOC recuperation equipment were available.

The prefect services are now working to extend short-term measures to industrial plants.

6. GREECE

6.1. Short-term actions in the Athens area

Elevated ozone concentrations are frequently observed at the northern and eastern suburbs of the Athens basin. In that case the public must be informed and in addition specific suggestions are given in order to reduce transport and supply of fuel-carrying tanker trucks.

Mainly due to the none-obligatory character of these suggestions and the complex meteorology and emissions pattern at the huge Athens territory there is no clear view on the effectiveness of these measures.

6.2. Permanent measures in Athens

In the centre of Athens municipality area, there is the ‘ring’ where private car-circulation is regulated in relation to the last digit of the number plate (odd/even number). Since the beginning of the 80s the measure remains in force all year, except during the month of August, on working days from 5.00 to 20.00 (15.00 on Fridays). The ring has an area of approximately 10 km^2.

The number plate measure is not related to ozone ambient concentration levels, but mainly aims to reduce primary pollutants in the centre of Athens. Preliminary studies have not clearly shown a relationship between this measure and the ozone concentrations.

ANNEX III

GUIDELINES ON A STRATEGY TO MEASURE OZONE PRECURSORS ACCORDING TO ARTICLE 9(3) OF DIRECTIVE 2002/3/EC

Member States are required by Article 9(3) of Directive 2002/3/EC to monitor ozone precursors at least in one measuring station. According to the paragraph on guidance, an appropriate strategy for this monitoring shall be given. Annex VI of Directive 2002/3/EC further states that the objectives of such monitoring should be:

— to analyse trends,

— to check efficiency of emission reduction strategies,

— to check consistency of emission inventories,

— to help attribute the contribution of emission sources to pollution concentration,

— to support the understanding of ozone formation and precursor dispersion,

— to support the understanding of photochemical models.

1. RECOMMENDATIONS FOR A MONITORING STRATEGY

The foremost objective of monitoring ozone precursors should be to analyse trends and thereby check the efficiency of emission reductions. Additional source related trend analyses are recommended.

To check the consistency of inventories and to attribute the contribution of particular sources is considered a rather difficult task on a regular basis in the monitoring networks. With one mandatory station alone, these objectives cannot be reached. Consequently, additional voluntary measurements nationally or in international cooperation are recommended. While for trend analysis long-term continuous monitoring is indispensable, measurement campaigns are more appropriate for source attribution studies. During such measurement campaigns it is recommended to analyse the full spectrum of the VOC listed in Annex VI to Directive 2002/3/EC. To support the understanding of ozone formation, of precursor dispersion, and of photochemical models, in addition to the VOC listed in Annex VI to Directive 2002/3/EC, measurements of photo-reactive species (e.g. HO_2- and RO_2-radicals, PAN) are advisable. For this more research oriented monitoring, again, measurement campaigns are recommended.

It may be supposed that the NO_x monitoring is covered by following the requirements of Directive 1999/30/EC. Parallel monitoring of VOC with NO_x is recommended.

1.1. **Recommendations for the location of the mandatory measuring station**

Each Member State shall set up at least one station to analyse the general trend of the precursors. It is recommended to place the corresponding station monitoring the full spectrum of VOC listed in Annex VI to Directive 2002/3/EC at a site representative for precursor emissions and ozone formation. Preferably this site should be located in the urban background and should not be directly influenced by local strong sources such as traffic or large industrial installations.

1.2. **Further Recommendations**

1.2.1. *Monitoring rural background concentrations*

Measurements of VOC at rural background stations are part of the EMEP monitoring programme. It is particularly recommended to set up monitoring sites in those areas where no EMEP monitoring sites exist. In the south it should be considered to include some of the most abundant biogenic hydrocarbons, e. g. the monoterpenes α-pinene and limonene, in the monitoring programme.

1.2.2. *Source oriented monitoring*

Major sources of VOC are road traffic, particular industrial plants and the use of solvents. The compounds to be monitored for analysing trends depend on the source type whereby the following strategy is recommended.

— Road traffic

BTX-monitoring is useful to analyse trends in emissions from road traffic but monitoring of more components, e.g. acetylene, may be necessary. With regard to the expected reduction of benzene in fuels it should be ensured that in any case toluene and xylenes are analysed. The full VOC spectrum should be monitored at least at one traffic site. In general strong similarities in spectrum may be expected at different sites with similar characteristics of the vehicle fleet.

— Industrial plants

Petrochemical plants emit a broad spectrum of VOC. The decision on compounds to be monitored depends strongly on this spectrum and must be based on a case-by-case study. At least one monitoring station should be located upwind and downwind of the major sources with respect to the prevailing wind direction.

— Solvent use (commercial areas)

The decision on the selection of VOC to be monitored is most difficult in this case, as there may be several minor sources. It should be based on any knowledge on the spectrum emitted giving also regard to cover those with the highest ozone production potential.