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## SCHEDULE 1

### TARGET VALUES AND LONG-TERM OBJECTIVES FOR OZONE CONCENTRATIONS IN AMBIENT AIR

#### PART I

##### DEFINITIONS AND INTERPRETATION

In this Schedule—

- (a) all values shall be expressed in  $\mu\text{g}/\text{m}^3$ ;
- (b) the volume shall be standardised at the following conditions of temperature and pressure: 293K and 101.3kPa;
- (c) the time shall be specified in Central European Time;
- (d) “AOT40” (expressed in  $(\mu\text{g}/\text{m}^3)\cdot\text{hours}$ ) means the sum of the difference between hourly concentrations greater than  $80\mu\text{g}/\text{m}^3$  (which equals 40 parts per billion) and  $80\mu\text{g}/\text{m}^3$  over a given period using only the 1 hour values measured between 8:00 and 20:00 Central European Time each day;

in order to be valid, the annual data on exceedances used to check compliance with the target values and long-term objectives below must meet the criteria set out in Part II of Schedule 8.

#### PART II

##### TARGET VALUES FOR OZONE

	<i>Parameter</i>	<i>Target value for 2010<sup>(a)</sup></i>
1. Target value for the protection of human health	Maximum daily 8-hour mean <sup>(b)</sup>	$120\mu\text{g}/\text{m}^3$ not to be exceeded on more than 25 days per calendar year averaged over three years <sup>(c)</sup>
2. Target value for the protection of vegetation	AOT40, calculated from 1h values from May to July	$18,000\mu\text{g}/\text{m}^3\cdot\text{h}$ averaged over five years

- (a) compliance with target values will be assessed as of this value. That is, 2010 will be the first year the data for which is used in calculating compliance over three or five years, as appropriate.
- (b) the maximum daily 8-hour mean concentration shall be selected by examining 8-hour running averages, calculated from hourly data and updated each hour. Each 8-hour average so calculated shall be assigned to the day on which it ends – that is, the first calculation period for any one day shall be the period from 17:00 on the previous day to 01:00 on that day; the last calculation period for any one day will be the period from 16:00 to 24:00 on that day.
- (c) if the three or 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 shall be as follows:
  - (i) for the target value for the protection of human health, valid data for one year; and
  - (ii) for the target value for the protection of vegetation, valid data for three years.

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## PART III

### LONG-TERM OBJECTIVES FOR OZONE

	<i>Parameter</i>	<i>Long-term objective</i>
1. Long-term objective for the protection of human health	Maximum daily 8-hour mean within a calendar year	120µg/m <sup>3</sup>
2. Long-term objective for the protection of vegetation	AOT40, calculated from 1h values from May to July;	6,000µg/m <sup>3</sup> ·h

## SCHEDULE 2

### CLASSIFICATION AND LOCATION OF SAMPLING POINTS

The following considerations will apply to fixed measurements:

## PART I

### MACROSCALE SITING

<i>Type of station</i>	<i>Objective of measurement</i>	<i>Representativeness <sup>(a)</sup></i>	<i>Macroscale siting criteria</i>
Urban	<b>Protection of human health:</b> to assess the exposure of the urban population to ozone, i.e. where the population density and ozone concentration are relatively high and representative of the exposure of the general population.	A few km <sup>2</sup>	Away from the influence of local emissions such as traffic, petrol stations etc.;  vented locations where well-mixed levels can be measured;  locations such as residential and commercial areas of cities, parks (away from the trees), big streets or squares with very little or no traffic, open areas characteristic of education, sports or recreation facilities.
Suburban	<b>Protection of human health and vegetation:</b> to assess the exposure of	Some tens of km <sup>2</sup>	At a certain distance from the area of maximum emissions downwind following

(a) sampling points should also, where possible, be representative of similar locations not in their immediate vicinity.

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<i>Type of station</i>	<i>Objective of measurement</i>	<i>Representativeness <sup>(a)</sup></i>	<i>Macroscale siting criteria</i>
	the population and vegetation located in the outskirts of the agglomeration, where the highest ozone levels, to which the population and vegetation is likely to be directly or indirectly exposed, occur.		<p>the main wind directions during conditions favourable to ozone formation;</p> <p>where population, sensitive crops or natural ecosystems located in the outer fringe of an agglomeration are exposed to high ozone levels;</p> <p>where appropriate, some suburban stations also upwind of the area of maximum emissions, in order to determine the regional background levels of ozone.</p>
Rural	<b>Protection of human health and vegetation:</b> to assess the exposure of population, crops and natural ecosystems to sub-regional scale ozone concentrations.	Sub-regional levels (a few km <sup>2</sup> )	<p>Stations can be located in small settlements and/or areas with natural ecosystems, forests or crops;</p> <p>representative for ozone away from the influence of immediate local emissions such as industrial installations and roads;</p> <p>at open area sites, but not on higher mountain-tops.</p>
Rural background	<b>Protection of vegetation and human health:</b> to assess the exposure of crops and natural ecosystems to regional-scale ozone concentrations as well as exposure of the populations.	Regional/national/continental levels (1,000 to 10,000km <sup>2</sup> )	Station located in areas with lower population density, e.g. with natural ecosystems, forests, far removed from urban and industrial areas and away from local emissions;

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<i>Type of station</i>	<i>Objective of measurement</i>	<i>Representativeness <sup>(a)</sup></i>	<i>Macroscale siting criteria</i>
			avoid locations which are subject to locally enhanced formation of near-ground inversion conditions, also summits of higher mountains;
			coastal sites with pronounced diurnal wind cycles of local character are not recommended.
<hr/>			
<b>(a)</b> sampling points should also, where possible, be representative of similar locations not in their immediate vicinity.			

For rural and rural background stations, consideration should be given, where appropriate, to co-ordination with the monitoring requirements of Commission Regulations (EC) No. 1091/94(1) concerning protection of the Community's forests against atmospheric pollution.

## PART II

### MICROSCALE SITING

The following guidelines should be followed, as far as practicable:

1. the flow around the inlet sampling probe should be unrestricted (free in an arc of at least 270°) without any obstructions affecting the air flow in the vicinity of the sampler, i.e. away from buildings, balconies, trees and other obstacles by more than twice the height the obstacle protrudes above the sampler.

2. in general, the inlet sampling point should be between 1.5m (the breathing zone) and 4m above the ground. Higher positions are possible for urban stations in some circumstances and in wooded areas.

3. the inlet probe should be positioned well away from such sources as furnaces and incineration flues and more than 10m from the nearest road, with distance increasing as a function of traffic intensity.

4. the sampler's exhaust outlet should be positioned so as to avoid recirculation of exhaust to the sampler inlet.

The following factors may also be taken into account:

- (a) interfering sources;
- (b) security;
- (c) access;
- (d) availability of electrical power and telephone communications;
- (e) visibility of the site in relation to its surroundings
- (f) safety of public and operators;

(1) O.J.No. L125, 18.5.1994, p. 1

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- (g) the desirability of co-locating sampling points for different pollutants; and
- (h) planning requirements.

## PART III

### DOCUMENTATION AND REVIEW OF SITE SELECTION

Site selection procedures should be fully documented at the classification stage by such means as compass point photographs of the surroundings and a detailed map. Sites should be reviewed at regular intervals with repeated documentation to ensure that selection criteria are still being met.

This requires proper screening and interpretation of the monitoring data in the context of the meteorological and photochemical processes affecting the ozone concentrations measured at the respective site.

### SCHEDULE 3

#### CRITERIA FOR DETERMINING MINIMUM NUMBERS OF SAMPLING POINTS FOR FIXED MEASUREMENTS OF CONCENTRATIONS OF OZONE

### PART I

MINIMUM NUMBER OF SAMPLING POINTS FOR FIXED CONTINUOUS MEASUREMENT TO ASSESS AIR QUALITY IN VIEW OF COMPLIANCE WITH THE TARGET VALUES, LONG-TERM OBJECTIVES AND INFORMATION AND ALERT THRESHOLDS WHERE CONTINUOUS MEASUREMENT IS THE SOLE SOURCE OF INFORMATION

<i>Population (<math>\times 1,000</math>)</i>	<i>Agglomerations (urban and suburban) <sup>(a)</sup></i>	<i>Other zones (suburban and rural) <sup>(a)</sup></i>	<i>Rural background</i>
0 – 250		1	1 station/50,000 km <sup>2</sup> as an average density over all zones per country <sup>(b)</sup>
251 – 500	1	2	
501 – 1,000	2	2	
1,001 – 1,500	3	3	
1,501 – 2,000	3	4	
2,001 – 2,750	4	5	
2,751 – 3,750	5	6	
>3,750	1 additional station per 2 million inhabitants	1 additional station per 2 million inhabitants	

**(a)** at least 1 station in suburban areas, where the highest exposure of the population is likely to occur. In agglomerations, at least 50% of the stations should be located in suburban areas.

**(b)** 1 station per 25,000 km<sup>2</sup> for complex terrain is recommended.

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## PART II

### MINIMUM NUMBER OF SAMPLING POINTS FOR FIXED MEASUREMENTS FOR ZONES ATTAINING THE LONG-TERM OBJECTIVES

The number of sampling points for ozone must, in combination with other means of supplementary assessment such as air quality modelling and co-located nitrogen dioxide measurements, be sufficient to examine the trend of ozone pollution and check compliance with the long-term objectives. The number of stations located in agglomerations and other zones may be reduced to one-third of the number specified in Part I. Where information from fixed measurement stations is the sole source of information, at least one monitoring station should be kept. If, in zones where there is supplementary assessment, the result of this is that a zone has no remaining station, co-ordination with the number of stations in neighbouring zones must ensure adequate assessment of ozone concentrations against long-term objectives. The number of rural background stations should be 1 per 100,000 km<sup>2</sup>.

### SCHEDULE 4

#### MEASUREMENTS OF OZONE PRECURSOR SUBSTANCES

##### Objectives

The main objectives of measurements of ozone precursor substances are to analyse any trend in ozone precursors, to check the efficiency of emission reduction strategies, to check the consistency of emissions inventories and to help attribute emission sources to pollution concentration.

An additional aim is to support the understanding of ozone formation and precursor dispersion processes, as well as the application of photochemical models.

##### Substances

Measurements of ozone precursor substances must include at least nitrogen oxides, and appropriate volatile organic compounds (VOCs). A list of VOCs recommended for measurement is given below.

ethane	1-butene	isoprene	ethyl benzene
ethylene	trans-2-butene	n-hexane	m+p-xylene
acetylene	cis-2-butene	i-hexane	o-xylene
propane	1,3-butadiene	n-heptane	1,2,4-trimeth.benzene
propene	n-pentane	n-octane	1,2,3-trimeth.benzene
n-butane	i-pentane	i-octane	1,3,5-trimeth.benzene
i-butane	1-pentene	benzene	formaldehyde
	2-pentene	toluene	total non-methane hydrocarbons

##### Reference methods

The reference method for the analysis of oxides of nitrogen shall be that specified in Part II of Schedule 6 to the Air Quality Limit Values Regulations (Northern Ireland) 2002, ([S.R.2002/94](#)).

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## Siting

Measurements should be taken in particular in urban and suburban areas at any monitoring site set up in accordance with the requirements of the Air Quality Limit Values Regulations (Northern Ireland) 2002 and considered appropriate with regard to the monitoring objectives in this Schedule.

## SCHEDULE 5

### DATA QUALITY OBJECTIVES AND COMPILATION OF RESULTS OF AIR QUALITY ASSESSMENT

## PART I

### DATA QUALITY OBJECTIVES

The following data quality objectives, for allowed uncertainty of assessment methods, and of minimum time coverage and of data capture of measurement, are provided to guide quality-assurance programmes:

<i>For ozone, NO<sub>x</sub> and NO<sub>2</sub></i>	
<b>Continuous fixed measurement</b>	
Uncertainty of individual measurements	15%
Minimum data capture	90% during summer 75% during winter
<b>Indicative measurement</b>	
Uncertainty of individual measurements	30%
Minimum data capture	90%
Minimum time coverage	>10% during summer
<b>Modelling</b>	
Uncertainty	
1 hour averages (daytime)	50%
8 hours daily maximum	50%
<b>Objective estimation</b>	
Uncertainty	75%

The uncertainty (on a 95% confidence interval) of the measurement methods shall be evaluated in accordance with the principles laid down in the "Guide to the Expression of Uncertainty of Measurements" (ISO 1993)<sup>(2)</sup> of the methodology in ISO 5725-1 "Accuracy (trueness and precision) of measurement methods and results" (ISO 1994) or equivalent. The percentages for uncertainty in the table are given for individual measurements, averaged over the period for calculating target values and long-term objectives, for a 95% confidence interval. The uncertainty for continuous fixed measurements should be interpreted as being applicable in the region of the concentration used for the appropriate threshold.

The uncertainty for modelling and objective estimation means the maximum deviation of the measured and calculated concentration levels, over the period for calculating the appropriate threshold, without taking into account the timing of events.

(2) Copies of these International Standards Organisation publications can be purchased from the British Standards Institution "BSI" sales department either by telephone on 020-8996-9001 or by post from the BSI, Standards House, 389 Chiswick High Road, London, W4 4AL

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“Time coverage” means the percentage of time considered for settling the threshold value during which the pollutant is measured.

“Data capture” means the ratio of the time for which the instrument produces valid data, to the time for which the statistical parameter or aggregated value is to be calculated.

The requirements for minimum data capture and time coverage do not include losses of data due to the regular calibration or normal maintenance of the instrumentation.

## PART II

### RESULTS OF AIR QUALITY ASSESSMENT

The following information should be compiled for zones within which sources other than measurements are employed to supplement information from measurement:

- a description of the assessment activities carried out;
- specific methods used, with references to descriptions of the method;
- sources of data and information;
- a description of results, including uncertainties and, in particular, the extent of any area within the zone over which concentrations exceed long-term objectives or target values;
- for long-term objectives or target values whose object is the protection of human health, the population potentially exposed to concentrations in excess of the threshold.

The Department shall ensure that maps are compiled showing concentration distributions within each zone.

## SCHEDULE 6

### REFERENCE METHODS FOR ANALYSIS OF OZONE AND CALIBRATION OF OZONE INSTRUMENTS

The reference method for analysis of ozone shall be the UV photometric method (ISO FDIS 13964).

The reference method for calibration of ozone instruments shall be the Reference UV photometer method (ISO FDIS 13964, VDI 2468, B1.6).

## SCHEDULE 7

### INFORMATION AND ALERT THRESHOLDS

## PART I

### INFORMATION AND ALERT THRESHOLDS FOR OZONE

	<i>Parameter</i>	<i>Threshold</i>
Information threshold	1 hour average	180µg/m <sup>3</sup>
<b>(a)</b> The exceedance of the threshold is to be measured or predicted for three consecutive hours.		



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	<i>Parameter</i>	<i>Threshold</i>
Alert threshold	1 hour average <sup>(a)</sup>	240µg/m <sup>3</sup>
<b>(a)</b> The exceedance of the threshold is to be measured or predicted for three consecutive hours.		

## PART II

### MINIMUM DETAILS TO BE SUPPLIED TO THE PUBLIC WHEN THE INFORMATION OR ALERT THRESHOLD IS EXCEEDED OR EXCEEDANCE IS PREDICTED

Details to be supplied to the public on a sufficiently large scale as soon as possible should include:

1. Information on any observed exceedance:
  - (a) the location or area of the exceedance;
  - (b) the type of threshold exceeded (information threshold or alert threshold);
  - (c) the time at which the exceedance began and its duration; and
  - (d) the highest 1-hour and 8-hour mean concentration.
2. Forecast for the following afternoon, day or days:
  - (a) the geographical area of expected exceedances of an information threshold or alert threshold; and
  - (b) the expected change in pollution (that is, improvement, stabilisation or deterioration)
3. Information on the type of population concerned, possible health effects and recommended conduct:
  - (a) information on population groups at risk;
  - (b) description of likely symptoms;
  - (c) recommended precautions to be taken by the population concerned; and
  - (d) where to find further information.
4. Information provided under this Schedule shall also include:
  - (a) information on preventive action to reduce pollution or exposure to it;
  - (b) an indication of main source sectors; and
  - (c) recommendations for action to reduce emissions.

## SCHEDULE 8

### INFORMATION TO BE OBTAINED AND COLLATED ON OZONE CONCENTRATIONS, AND CRITERIA FOR AGGREGATING DATA AND CALCULATING STATISTICAL PARAMETERS

## PART I

### INFORMATION ON OZONE CONCENTRATIONS

The following information on ozone concentrations shall be obtained and collated:

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	<i>Type of station</i>	<i>Level</i>	<i>Averaging/accumulation time</i>	<i>Provisional date for each month from April to September</i>	<i>Report for each year</i>
Information threshold	Any	180µg/m <sup>3</sup>	1 hour	— for each day with any exceedance: date, total hours of exceedance maximum 1 hour ozone and related NO <sub>2</sub> values when required. — monthly 1 hour maximum ozone.	—for each day with any exceedance: date, total hours of exceedance, maximum 1 hour ozone and related NO <sub>2</sub> values when required.
Alert threshold	Any	240µg/m <sup>3</sup>	1 hour	– for each day with any exceedance: date, total hours of exceedance, maximum 1 hour ozone and related NO <sub>2</sub> values when required	– for each day with any exceedance: date, total hours of exceedance, maximum 1 hour ozone and related NO <sub>2</sub> values when required.
Health protection	Any	120µg/m <sup>3</sup>	8 hours	– for each day with any exceedance: date, 8 hours maximum <sup>(b)</sup>	– for each day with any exceedance: date, 8 hours maximum <sup>(b)</sup>
Vegetation protection	Suburban, rural, rural=background	AOT40 <sup>(a)</sup> 6,000 µg/m <sup>3</sup> ·h	1 hour, accumulated from May to June		Value

(a) in this Schedule, “AOT40” has the same meaning as in paragraph (d) of Part I to Schedule 1.

(b) maximum daily 8-hour mean.

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	Type of station	Level	Averaging/accumulation time	Provisional date for each month from April to September	Report for each year
Forest protection	Suburban, rural, rural=background	AOT40 <sup>(a)</sup> 20,000 µg/m <sup>3</sup> ·h	1 hour, accumulated from April to September		Value
Materials	Any	40µg/m <sup>3</sup>	1 year		Value

(a) in this Schedule, "AOT40" has the same meaning as in paragraph (d) of Part I to Schedule 1.

(b) maximum daily 8-hour mean.

Where they do not do so already, annual reports must also contain:

- (a) for ozone, nitrogen dioxide, oxides of nitrogen and the sums of ozone and nitrogen dioxide (added as parts per billion and expressed in mg/m<sup>3</sup> ozone) the maximum, 99.9th, 98th and 50th percentiles and annual average and number of valid data from hourly series; and
- (b) the maximum, 98th and 50th percentile and annual average from a series of daily 8-hour ozone maxima.

Data submitted in monthly reports are considered provisional and shall be updated where necessary in subsequent submissions.

## PART II

### CRITERIA FOR AGGREGATING DATA AND CALCULATING STATISTICAL PARAMETERS

In this Part, percentiles are to be calculated using the method specified in Council Directive [97/101/EC](#)(3).

The following criteria are to be used for checking validity when aggregating data and calculating statistical parameters:

Parameter	Required proportion of valid data
1 hour values	75% (45 minutes)
8 hour values	75% of values (6 hours)
Maximum daily 8 hours mean from hourly running 8 hours averages	75% of the hourly running 8 hour averages (8 hours per day)

(b) in cases where all possible measured data are not available, the following factor shall be used to calculate AOT40 values:

$$AOT40 \text{ (estimate)} = AOT40 \text{ (measured)} \times \frac{\text{total possible number of hours}^*}{\text{number of measured hourly values}}$$

\* being the number of hours within the time period of AOT40 definition (that is, 8:00 to 20:00 Central European Time from 1 May to 31 July each year, for vegetation protection and from 1 April to 30 September each year for forest protection).

(3) O.J. No. L35, 5.2.1997, p. 14

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<i>Parameter</i>	<i>Required proportion of valid data</i>
AOT40	90% of the 1 hour values over the time period defined for calculating the AOT40 <sup>(b)</sup>
Annual mean	75% of the 1 hour values over summer (April to September) and winter (January to March, October to December) seasons separately
Number of exceedances and maximum values per month	90% of the daily maximum 8 hours mean value (27 available daily values per month)
	90% of the 1 hour values between 8:00 and 20:00 Central European Time
Number of exceedances and maximum values per year	Five out of six summer months over the summer season (April to September)
<b>(b)</b> in cases where all possible measured data are not available, the following factor shall be used to calculate AOT40 values:	
	total possible number of hours*
	$AOT40 \text{ (estimate)} = AOT40 \text{ (measured)} \times$
	number of measured hourly values
	* being the number of hours within the time period of AOT40 definition (that is, 8:00 to 20:00 Central European Time from 1 May to 31 July each year, for vegetation protection and from 1 April to 30 September each year for forest protection).