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99/0068 (COD)

Proposal for a

DIRECTIVE OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL

on national emission ceilings for certain atmospheric pollutants

Proposal for a

DIRECTIVE OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL

relating to ozone in ambient air

(presented by the Commission)

EXPLANATORY MEMORANDUM

1. INTRODUCTION

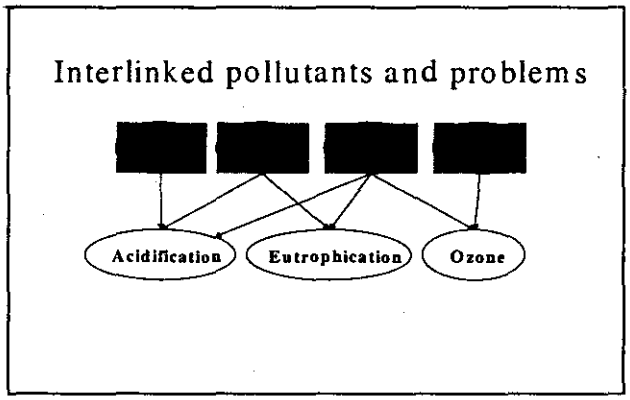
The attached proposals are for:

- a European Parliament and Council Directive on national emission ceilings for certain atmospheric pollutants;

- a European Parliament and Council Directive relating to ozone in ambient air.

Acidification, tropospheric ozone and soil eutrophication are inter-related problems caused by emissions of sulphur dioxide (SO_2), nitrogen oxides (NO_x), volatile organic compounds (VOC) and ammonia (NH_3). Emissions of nitrogen oxides contribute to all three problems. These problems may be addressed individually, but to ensure a coherent and cost-effective Community approach to solving them they need to be considered jointly.

Such a joint analysis was performed in preparing the proposal for a directive on national emission ceilings (NEC), which constitutes the principal instrument for ensuring not only that the emission reductions already anticipated over the next decade are fully realised, but that yet further progress is made towards achievement of the Community's long-term environmental objectives. The proposal sets national ceilings for the four pollutants, to be achieved by 2010. These ceilings are linked to a set of interim objectives identified for acidification and ozone in the Community.



The accompanying proposal relating to ozone in ambient air meets the requirements of Council Directive 96/62/EC on ambient air quality assessment and management[1] (the "Air Quality Framework Directive") and introduces *inter alia* target values for ozone concentrations, to be attained as far as possible within a given period. These are an important supporting element to the nationally based emission ceilings. While the ceilings should ensure that ozone is tackled effectively at the regional and transboundary scale, the target values establish a minimum level of protection at the local scale. They also provide a benchmark against which progress in improving regional ozone levels can be measured. It is implementation both of the national emission ceilings for NO_x and VOCs and of the target values contained in the "ozone daughter directive" which should ensure that the interim objectives for ozone are met.

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

1.1 The need for action

A substantial body of existing and upcoming Community legislation, notably the auto-oil, large combustion plants, integrated pollution prevention and control, solvents, and sulphur content of liquid fuels Directives, and new air quality standards for sulphur dioxide, oxides of nitrogen and particulate matter, as well as other internationally or nationally agreed measures, should already ensure that emissions of all four pollutants will decline over the next decade.

However, despite the improvements in air quality and protection of the environment which can be expected by 2010, the Community will continue to be exposed to the problems of acidification, tropospheric ozone and soil eutrophication. Not even the application of all technical emission control measures currently available would be sufficient to achieve the goal of no exceedance of critical loads and levels set in the Community programme of policy and action in relation to the environment and sustainable development (the Fifth Environmental Action Programme[2]) and endorsed by the Council and Parliament in their Decision of 24 September 1998[3]. The measures being proposed here are fully in line with the Air Quality Framework Directive, which sets out to avoid, prevent and reduce the harmful effects of ambient air pollution on human health and the environment.

As local and regional authorities may be called upon to play an important role in implementing measures to abate the environmental problems considered here, the Committee of the Regions will be requested to give its opinion on the two proposals.

1.2 The acidification problem

Deposition of acidifying pollutants (SO_2, NO_x, NH_3) onto vegetation, surface waters, soils, buildings and monuments has a wide range of effects, such as:

- Reduced alkalinity of lakes and streams, which can have both acute and chronic effects on biological populations. Acidification in Scandinavia has destroyed fish populations in thousands of lakes and streams. Part of the biological effect is due to the increased aluminium levels that accompany lowered pH levels.

- Reduction of forest soil pH and leaching of vital nutrients (base cations), leading respectively to reduced root distribution and nutrient deficiencies, which in turn make forests vulnerable to drought, disease and insect attack.

- Acid groundwater, causing severe corrosion damage to drinking water supply systems, while dissolved metals (aluminium, cadmium, copper) may also pose a health hazard.

- Acid deposition and high concentrations in ambient air, causing damage to buildings and cultural monuments.

While a considerable proportion of NH_3 (ammonia) is deposited close to the emission sources, a significant proportion is immediately transformed into ammonium nitrate and sulphate and dispersed across borders because of its relatively long residence time in the atmosphere. In either case, ammonia contributes to the acidification and eutrophication problem.

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2 OJ C 138, 17.5.1993, p. 1.
3 OJ L 275, 10.10.1998, p. 1.

The principal elements of the Commission's 1997 acidification strategy[4] were:

- a future proposal on national emission ceilings to be presented by the Commission in 1998 on the basis of further refinements to the integrated assessment model and input data, and integration of interim objectives for ozone into the analysis;

- a proposed decision on Community ratification of the 1994 Protocol on further reduction of sulphur emissions under the UNECE Convention on Long-range Transboundary Air Pollution (CLRTAP);

- a proposal for a directive on the sulphur content of certain liquid fuels[5], amending Directive 93/12/EEC and *inter alia* setting a maximum limit for sulphur in heavy fuel oil;

- a future proposal for a revision of Directive 88/609/EEC on large combustion plants;

- designation of the North Sea and the Baltic Sea as sulphur dioxide emission control areas under the Convention for the Prevention of Pollution from Ships (MARPOL).

Of these elements, the Community ratification of the 1994 Sulphur Protocol has been adopted[6], the new directive on sulphur in liquid fuels was adopted on 26 April 1999[7] and the proposal for the revision of the LCP directive was put forward by the Commission in July 1998[8]. The Baltic Sea was designated an SO_2 emission control area at the MARPOL Conference in September 1997[9]. (However, this designation will not become effective until the new air pollution annex to MARPOL enters into force, which will take several years. The continuing effort to ensure effective action to reduce ship emissions is described in Section 7.)

In its conclusions on the acidification strategy[10] the Council supported the method for technical assessment used to calculate national emission ceilings and recognised that such ceilings can constitute an effective as well as flexible approach to emission reduction. The Council considered that the analysis should be refined by improving input data and exploring alternative options. The European Parliament[11] supported both the approach and the interim environmental targets of the strategy, and called on the Commission to develop a new and ambitious objective for 2015, whereby in principle the critical loads must not be exceeded in any area.

1.3 The ozone problem

Tropospheric ozone, in contrast to the ozone layer at higher altitudes, is the ozone produced and trapped in the air near the Earth's surface. It is not emitted directly from man-made sources in any significant quantities, but is a secondary pollutant formed by the reaction of precursors such as nitrogen oxides (NO_x) and volatile organic compounds (VOC) in the presence of sunlight. The highest ozone load therefore occurs in summer, in particular on

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4 Commission Communication on a Community strategy to combat acidification (COM(97) 88 final and COM(97) 88 final/2 (addendum).

5 OJ C 364, 25.11.1998, p. 20.

6 OJ L 326, 3.12.1998, p. 34.

7 OJ L

8 OJ C 300, 29.9.1998, p. 6.

9 Protocol of 1997 to amend the International Convention for the Prevention of Pollution from Ships.

10 2062nd Council meeting, Brussels, 16 December 1997, 13373/97 (Presse 399) C/97/399.

11 Resolution on the Communication to the Council and the European Parliament on a Community strategy to combat acidification.

days with high temperatures. Ozone and its precursors can be transported over hundreds of kilometres. Photochemical pollution is thus a widespread transboundary phenomenon, with some contribution from sources outside the Community and even outside Europe.

There are some natural ozone sources. There is a weak flow of ozone down to the surface from the densely concentrated ozone layer in the higher atmosphere (> 20 km height). Ozone is also formed by lightning. The contribution of these natural ozone sources and fluxes to the present average ozone levels near the ground is estimated to be about 20%. The global background concentration of ozone before air masses move into Europe from the west is 60 to 70 $\mu g/m^3$ at European latitudes during summer.

Ozone is a powerful oxidant. It can react with a wide range of cellular components and biological materials. In particular, it can damage all parts of the respiratory tract. Studies in APHEA[12] and European and US cities suggest that ozone affects mortality. At ambient concentrations found in Europe, ozone produces a range of effects on individual crop and tree species, as well as natural vegetation species mixtures, leading to losses in economic value, quality traits, and biodiversity. It can also degrade materials in a number of ways.

Ozone in the troposphere is also of relevance to climate change, being estimated to add around 8% to the greenhouse warming potential of other greenhouse gases such as CO_2, halocarbons, etc.

The ozone precursor gases and several photochemical by-products are themselves hazardous to human health (NO_2 and some important VOC species like benzene, formaldehyde, 1,3-butadiene, etc.). Some are carcinogenic. Secondary particulate matter (PM) is largely formed by ozone reacting with other pollutants such as NO_2, SO_2, VOC and ammonia. It constitutes a significant part of the total PM concentration, which causes, amongst other things, increases in daily mortality rates and hospital admissions[13].

Directive 92/72/EEC on air pollution by ozone[14] sets a series of thresholds (largely based on the then WHO guidelines) for assessing air quality in terms of ozone load. Thresholds exist for the protection of human health and vegetation and for releasing information to the public on observed ozone concentrations. The protection thresholds are currently substantially exceeded in all Member States. About 300 million people (94% of the Community population) are exposed to at least one threshold exceedance a year. In large areas of central and southern Europe more than 50 days of exceedances have been observed for several years. The vegetation-related threshold (65 $\mu g/m^3$) is exceeded widely and frequently by a factor of up to 3[15].

1.4 An ozone strategy

Whilst measures have already been introduced internationally and within Member States to drive down precursor emissions over the next decade, further reductions will be required if the Community is to move closer towards its overall aims of protecting human health and the environment.

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12 (Touloumi G., Katsouyanni K., Zmirou D. *et al.* Short-term effects of ambient oxidant exposure on mortality: a combined analysis within the APHEA project. Am. J. Epidemiology 1997; 146: 177-85).

13 See proposal for a daughter directive for SO_2, NO_2, particulate matter and lead (COM(97) 500 final).

14 OJ L 297, 13.10.1992, p. 1.

15 For details of the thresholds in Directive 92/72/EEC and exceedances, see "The Ozone Position Paper", drafted by an Ad-Hoc Expert Group. Available from the Commission.

The Commission has therefore developed a strategy to tackle tropospheric ozone, the main focus of which is on the identification of challenging but achievable interim objectives to be reached by the year 2010 and an assessment of the potential of various measures to reduce ozone precursor emissions at both national and local levels.

The strategy, which is described more fully in Section 2, also fulfils the requirement in Article 8[16] of Directive 92/72/EEC for the Commission to present proposals which it deems appropriate for the control of air pollution by ozone and, if necessary, for the reduction of ozone precursors.

1.5 The eutrophication problem

Nitrogen supply is critical for plant nutrition. While all plants require nitrogen, they differ greatly in their needs, their sources of supply and their response to the range of concentrations that occur in nature. The deposition of nitrogen compounds (NO_x and NH_3) from the atmosphere leads to changes in terrestrial (land) ecosystems, such as[17]:

- Changes in plant community composition and biodiversity, as species (such as common grasses) which thrive on high nitrogen soils out-compete species which prefer nitrogen-poor soils. More than 50% of the plant species in central Europe can only compete in areas that are low in nitrogen supply. Furthermore, an estimated 75-80% of threatened plant species in Europe prefer a poor nitrogen supply. The integrity of many of the communities that are protected in nature reserves is dependent on low soil nitrogen availability.

- As indicated in subsection 1.2, nitrogen input into soils leads to changes in nutrient availability and uptake, and this has been linked to forest decline, particularly in Dutch forests.

A fully worked up strategy on soil eutrophication has not been developed at this stage, nor are interim objectives proposed. However, it has been possible to demonstrate and calculate the benefits for soil eutrophication of reducing acidification and tropospheric ozone and to make important progress on the eutrophication issue.

1.6 The need for an integrated response

Since the problems of acidification, ozone and soil eutrophication are inter-related, so too should be the solutions. The integrated approach described in this explanatory memorandum exploits the potential for synergies in tackling multiple objectives simultaneously in a coordinated, balanced and cost-effective manner.

In particular, it is possible to take account of the relationship between emission sources and their receptors and the transboundary nature of the pollutants. The methodology described in Section 2 enables the Commission to propose differentiated national emission ceilings which both reflect the polluter-pays principle and maximise the environmental benefits of emission reductions. The basic approach was first presented in the acidification strategy and has been endorsed by the Council and Parliament. Whilst it has been further refined over the last

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16 The same Article also requires the Commission to submit a report on the information collected under the Directive and on the evaluation of photochemical pollution in Europe. This will soon be published by the Commission (Tropospheric ozone in the European Union. The "Consolidated Report").

17 Impacts of Nitrogen Deposition in Terrestrial Ecosystems. Report prepared for the UK Department of the Environment, 1994.

two years, most importantly by incorporating objectives for ozone, the underlying principle of differentiated emission ceilings remains at the heart of the Commission's strategy.

1.7 Anticipated effects of the national emission ceilings proposal

It is estimated that compliance with the proposed national emission ceilings will produce the following overall improvements for the Community as of 2010:

- The total load of acidifying deposition in excess of critical loads over the Community area will be reduced from the level of about 24 000 million acid equivalents in 1990 to about 600 million acid equivalents in 2010. The Community ecosystem area exposed to further acidification will be reduced to 4.3 million hectares in 2010. This compares with an unprotected area of 37 million hectares in 1990. The area of unprotected ecosystems is reduced by at least 50% on the 1990 situation in practically all areas[18] of the Community.

- The number of days with ozone concentrations above the World Health Organisation's guideline for health is reduced from more than 60 days in the worst affected areas in 1990 to about 20 days in the same areas in 2010. Other areas with ozone episodes will enjoy improvements on the same scale. An index of health-related ozone exposure (which weighs each ozone episode by its level and the number of people exposed) indicates a 75% overall reduction in exposure in the Community.

- An index of vegetation exposure to damaging levels of ozone in the Community indicates that such exposure will be reduced by more than 50% between 1990 and 2010.

- The Community ecosystem area exposed to further soil eutrophication is reduced to approximately 42 million hectares, around 30% down on the 1990 figure.

The national emission ceilings are set out in Table 1 of Annex I to this explanatory memorandum. Country and grid-cell specific information on the environmental improvements expected from the ceilings is given in Tables 2-5 and Figures 1-5 of the same.

For the Community as a whole, the national emission ceilings will ensure that, compared with 1990 levels, SO_2 emissions are reduced by 78%, NO_x emissions by 55%, VOC emissions by 60% and NH_3 emissions by 21%.

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[18] 'Areas' here refers to the grid cells of the grid system of the Co-operative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe (EMEP). This polar stereographic grid system with a grid size of 150 km x 150 km at 60°N is defined in EMEP/CCC Report 1/1986. All the maps in Annex I are displayed using this grid.

Table A: Community emissions in 1990 and projected emissions in 2010, based on the reference scenario (REF) and the proposal on national emission ceilings

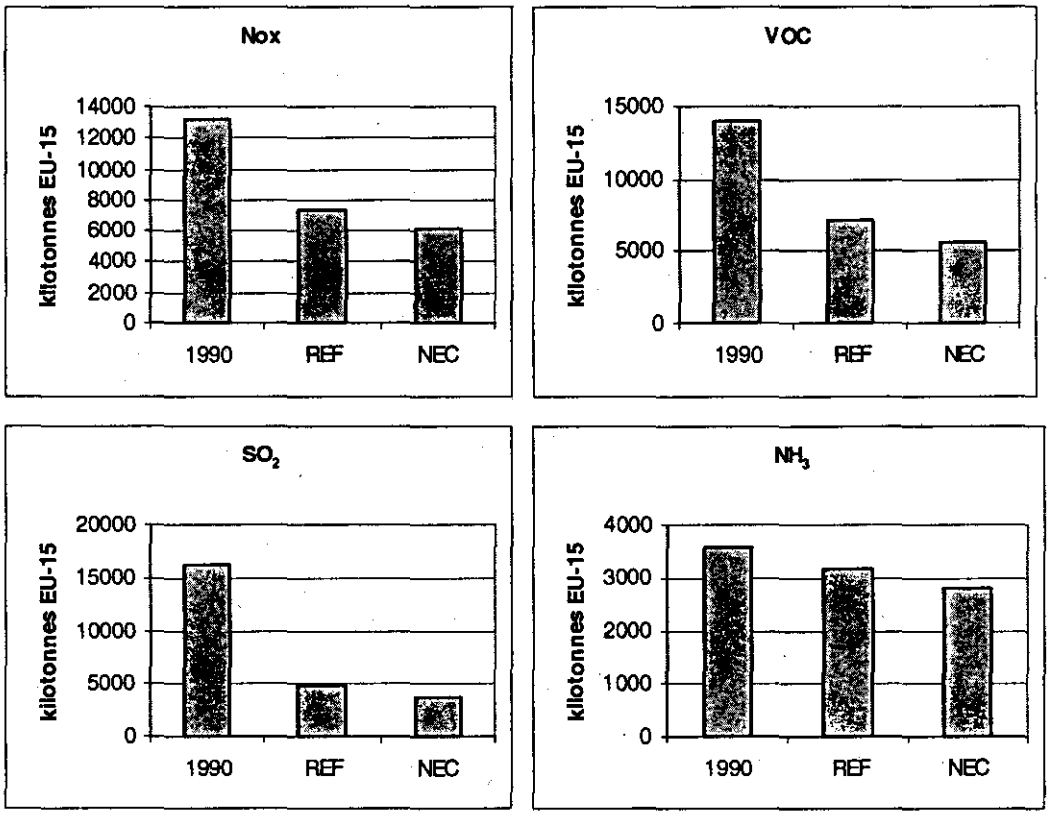
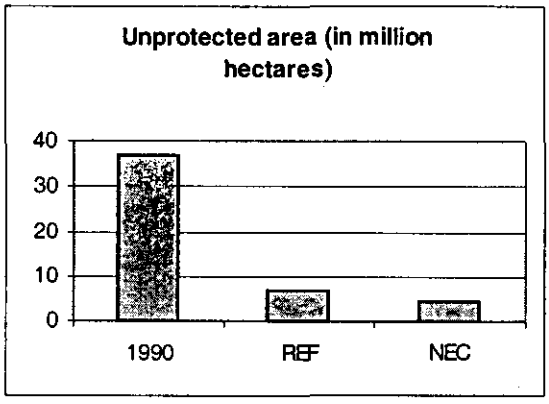
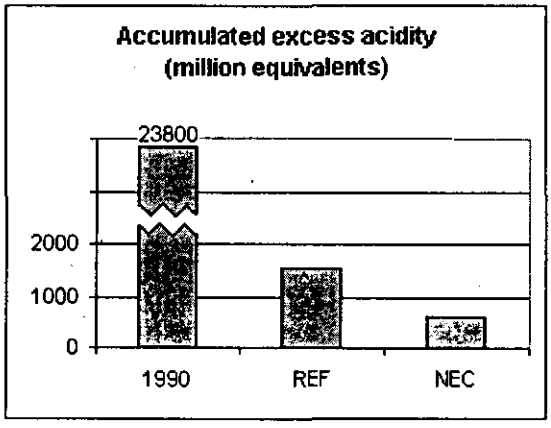


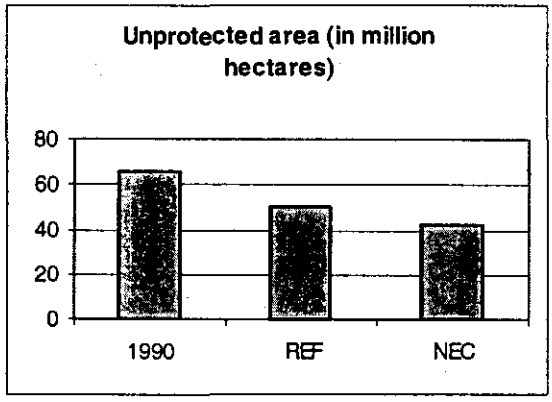
Table B: Health and environmental protection indicators for 1990 and projections of indicators in 2010, based on the reference scenario (REF) and the proposal on national emission ceilings

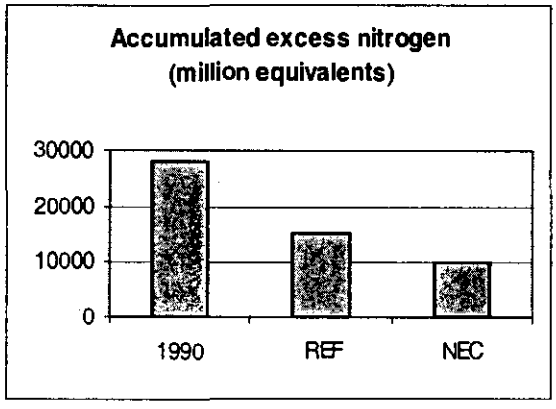
Acidification



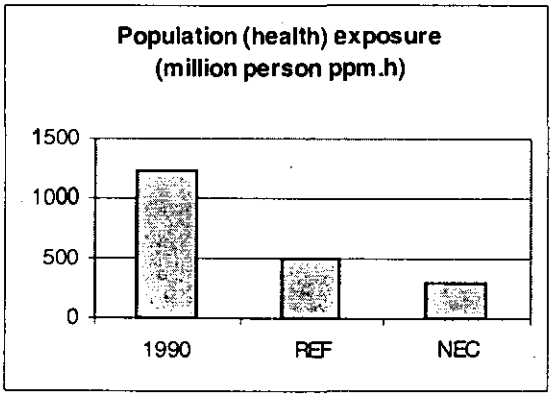


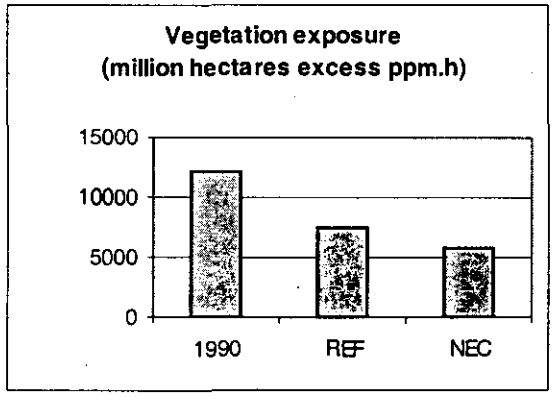
Eutrophication





Ozone





2. DEVELOPMENT OF THE PROPOSALS

Overview

In order to present these legislative proposals, the Commission services undertook three phases of study. The first phase was completed with the production in 1997 of the acidification strategy (COM(97)88), which included both proposed objectives and provisional emission ceilings for an "acidification-only" approach. The second phase was the development in 1997 and 1998 of a strategy to combat tropospheric ozone, which investigated possible interim objectives, provisional emission ceilings for an "ozone-only" approach, cost-effective measures to reduce emissions, and, for the purposes of the ozone daughter directive, the possible quantification of target values for the protection of human health and vegetation. The third and final phase was a combined analysis whereby the objectives for acidification and ozone were compared with alternative ambition levels and subjected to a joint optimisation to enable the identification of an integrated set of possible national emission ceilings. Whilst objectives for soil eutrophication were not introduced into this optimisation, it was possible to demonstrate and calculate the consequential benefits of reducing acidification and tropospheric ozone for soil eutrophication.

Throughout the process, the Commission services aimed to maintain the principles of sound science, transparency and cost-effectiveness. Both data and modelling methodologies were presented for detailed scrutiny by all stakeholders. Working groups were established on ozone and key issues were presented for discussion to the Steering Group on Ambient Air Quality and specially convened expert meetings. The Commission gratefully acknowledges the contributions and commitment of experts from the Member States, industry, non-governmental organisations, the European Environment Agency (EEA), the World Health Organisation (WHO), the UNECE/CLRTAP and others in supporting the development of these proposals and their underlying analysis.

The Commission has also aimed to maintain an approach which is both internally consistent (e.g. in terms of data and models) and which relates closely to on-going work under CLRTAP. The Commission's contractor, the International Institute for Applied Systems Analysis (IIASA), was able to use common data and models for integrated assessment, thus ensuring a high level of consistency between the exercises. A full description of the methodologies and databases used by the consultants is contained in a series of reports, which are available from the Commission[19]. An additional consultancy study[20] was undertaken to estimate the benefits, in monetary terms, of policies to meet the ozone and acidification objectives.

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19 "Cost-effective control of acidification and ground-level ozone". The 5th Interim Report (May 1998) focuses on the methodology for ozone-related target setting; the 6th Interim Report (October 1998) presents scenarios using separate and joint optimisation for ozone and acidification; the 7th Interim Report (January 1999,) presents the final scenarios which underpin the proposals. Reports are available from the Commission, DGXI.

20 'Economic evaluation of the control of acidification and ground-level ozone' by AEA Technology. January 1999; available from the Commission.

2.1 Critical loads and levels

The Fifth Environmental Action Programme sets the general and long-term objectives for acidification, eutrophication and ozone that there must be no exceedance of critical loads and levels[21]. These concepts are fundamental to the methodology used to support the development of the Commission's legislative proposals. The definition and quantification of the long-term and interim objectives which emerged from the strategies for acidification and ozone and which drive the proposed national emission ceilings are given in Section 3.

Critical loads for acidification and eutrophication

Critical loads for acidification are calculated for soils and freshwaters on the basis of chemical criteria reflecting, respectively, the base cation/aluminium ratio in soil water and the alkalinity (ANC - Acid Neutralising Capacity) of freshwaters. The critical loads vary greatly across Europe, reflecting differences in bedrock, soil layer, alkaline depositions and other factors. Granitic bedrock (common in Scandinavia), which does not contain calcium and weathers slowly, will produce soils with a low capacity for neutralising acid inputs. Soils in southern Europe, on the other hand, are generally more calcium rich, due both to the bedrock quality and to the deposition of dust from the Sahara, and therefore have good acid neutralising capacity.

The critical loads for eutrophication reflect the level of nitrogen deposition at which vegetation changes will take place or nitrogen will be leached from the soil. In practice, many areas that are sensitive to acidification are also sensitive to eutrophication effects from nitrogen. However, there are ecosystems, such as calcareous grasslands, which may be sensitive to nitrogen deposition and insensitive to acidification. At present, and in projections for 2010, areas exposed to eutrophication effects are found in all parts of Europe. The ecosystems with the highest exceedance are mainly located in Germany and its neighbouring countries.

The methodology for calculating critical loads is established through scientific co-operation under the CLRTAP. The parties to the Convention are responsible for mapping the critical loads in their country in accordance with an agreed methodology[22]. The national data are submitted to the Convention's Co-ordination Center for Effects, which compiles the European maps of critical loads[23] and provides critical load databases for the integrated assessment modellers.

Twelve of the Member States have submitted national data on critical loads, providing details of some 600 000 ecosystems. For the remaining three (Greece, Portugal, Luxembourg) the European background database is employed. This database is constructed by applying the agreed methodology to internationally published information, such as the Food and Agriculture Organisation's 1994 digital soil map. The analysis for the national emission ceilings was based on the most recent database for critical loads available (Annex I, Figures 6 and 7).

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21 "Critical load" means a quantitative estimate of an exposure to one or more pollutants below which significant harmful effects on specified sensitive elements of the environment do not occur, according to present knowledge; "critical level" means the concentration of pollutants in the atmosphere above which direct adverse effects on receptors, such as human beings, plants, ecosystems or materials, may occur, according to present knowledge.

22 UBA 1996 Manual on Methodologies and Criteria for Mapping Critical Levels/Loads and where they are exceeded. UNECE CLRTAP. Texte 71/96, Berlin.

23 Calculation and mapping of critical thresholds in Europe. Status report 1997 (RIVM, 1997).

Critical levels for tropospheric ozone and the World Health Organisation Air Quality Guidelines

In its latest revision (1999) to the Air Quality Guidelines for Europe[24], and based on the most recent evidence, the WHO has adopted a number of guidelines for ozone. The guideline value for human health is 120 $\mu g/m^3$ mean over an 8-hour period. This threshold does not include a margin of safety and is based upon acceptance of a certain amount of risk to the general population. So whilst it is not strictly speaking a "critical level", it is nonetheless considered to be a level at which acute effects on public health are likely to be small.

Based on work under the CLRTAP, the WHO has also adopted a number of critical ozone levels for vegetation expressed as an excess above a certain threshold (Table C). This so-called AOT40 (Accumulation Over Threshold of 40 ppb) is calculated by summing up the excess concentration of every single 1 hour ozone value above 40 ppb[25] (= 80 $\mu g/m^3$) during daylight hours and over a certain period. It should be noted that 40 ppb (or 80 $\mu g/m^3$) as such is not a threshold for effects.

Table C: Critical ozone levels for vegetation recommended by WHO

Vegetation type	AOT40 [$\mu g/m^3.h$][25]	Time period	Constraints
Crops (yield loss of 5%)	6 000	3 months	-
Natural vegetation	6 000	3 months	-
Forests	20 000	6 months	-
Crops (visible injury)	400 1 000	5 days 5 days	Humid air conditions Dry air conditions

2.2 Common features of the data and models, and the need for differentiated emission ceilings

The analyses carried out in support of the strategies for acidification and ozone and the combined national emission ceilings share the following features:

- an estimation of historical (1990) emissions, used as a baseline for emission reductions;
- a database on options and costs for controlling emissions;
- models for atmospheric dispersion processes based on the model of the Co-operative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe (EMEP);

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24 WHO (1999): Air Quality Guidelines for Europe. 2nd edition. World Health Organisation, Regional Office for Europe. Copenhagen, in press; see also Position Paper for ozone, available from the Commission.

25 Ozone levels are expressed either as a "volume mixing ratio" in ppm (parts per million) = 1000 ppb (parts per billion) or as a concentration in $\mu g/m^3$; 1ppb ozone is equivalent to $2 \mu g/m^3$; Table C contains the figures expressed in "$\mu g/m^3$ times hours" though the unit used in the original WHO document was "ppb times hours".

- emission projections for 2010 in a reference or "business as usual" scenario, incorporating all existing and already proposed EC legislation (as of December 1998), as well as national legislation and policy plans;

- a "maximum (technically) feasible reductions" scenario for 2010, where all available/proven technical measures to reduce emissions are assumed to be implemented (this does not, therefore, consider the possibility of structural changes, e.g. to energy supply);

- intermediate scenarios for 2010 which explore cost-effective allocations of emission reductions across the Member States in order to meet various environmental quality objectives.

The Community legislation in the reference scenario includes: the Directive on large combustion plants (88/609/EEC), including the proposal for its revision; the Directive on emissions from passenger cars and light commercial vehicles (70/220/EEC, as last amended by 98/69/EC); the Directive on quality of petrol and diesel fuels (98/70/EC); for heavy duty vehicles, implementation of the Common Position reached in December 1998 on amending Directive 88/77/EEC; the Directive on emissions from non-road mobile machinery (97/68/EC); the Directive on "stage I" controls on gasoline storage and distribution (94/63/EC); the recently adopted solvents Directive 1999/13/EC[26]; and the new Council Directive on the sulphur content of certain liquid fuels. Assumptions about the effect of other Directives, such as Council Directive 91/676/EEC concerning nitrates from agricultural sources, Council Directive 96/61/EC concerning integrated pollution prevention and control (IPPC) and Directive 85/337/EEC on environmental impact assessment, which have only an indirect effect on emission reductions, have not been included in the reference scenario.

These measures, and other measures agreed internationally or introduced within Member States, have and will continue to have an important influence in driving down emissions. Between 1990 and 2010, SO_2 emissions are expected to fall by 71%, NO_x by 48%, VOC by 49% and NH_3 by 12%. However, the Community will continue to be exposed to the problems of acidification, ozone and soil eutrophication; in fact, implementation of all those emission control measures which are currently technically available will still not be enough to meet "no adverse effects" levels over the next decade.

The RAINS model, which has been developed by IIASA to provide a consistent framework for analysing emission reduction strategies for acidification, ozone and eutrophication, was used both to compare the costs and environmental benefits of a range of interim objectives and, in its optimisation mode, to identify cost-optimal allocations of emission reductions by Member State. In developing its strategies for acidification and ozone and in the final combined analysis the Commission has given careful consideration both to the need for proposals which are cost-effective at the Community scale and to the potential distribution of effort between Member States. From the analysis which has been carried out, it has been concluded that if, at the Community scale, the environmental benefits are to be maximised for a given level of costs (or, conversely, if costs are to be minimised for a given environmental objective) there must be a differentiation of Member State emission reductions. This is consistent with the polluter-pays principle, but with an air quality and cost-effectiveness analysis helping to apportion responsibility for taking action. This approach does lead to a significant difference in the relative burdens of the Member States, with a particular effort

[26] Directive on the limitation of emissions of volatile organic compounds due to the use of organic solvents in certain activities and installations (adopted 11 March 1999, OJ L 85, 29.3.1999, p. 1).

being required of Belgium and Greece. However, the economic analysis demonstrates that the benefits outweighs the costs for all Member States when the VOSL approach to the valuation of human health is used. In the review, the Commission will take account of any socio-economic impact on particular Member States or sectors.

Without any differentiation, it would be necessary to oblige all Member States to apply an equally high level of effort but, in many cases (such as for Member States located on the periphery of the Community), with little environmental benefit. The relief to those centrally located Member States which would be required to make the largest reductions under a differentiated approach would be substantially outweighed by the additional costs to other Member States. It has been calculated that the overall costs of achieving the interim objectives with an approach based as far as possible on flat rate percentage reductions would be approximately 50% higher than the approach proposed by the Commission.

Whilst the relationship between emission sources and their receptors is an important factor influencing the identification of national emission ceilings, the fact remains that those Member States which would be obliged to make the greatest efforts are also those with some of the highest levels of economic activity, benefiting at least in part from their proximity to markets and access to good transport infrastructure. The analysis highlights the need to ensure that this historical link between economic activity and pollution is effectively broken.

The models can also be used to highlight those technical measures with good potential for reducing SO_2, NO_x, VOC and NH_3 emissions over the short to medium term; sectors where emission reductions would appear to be particularly cost-effective are power generation, refining and other industry, and commercial and residential heating.

2.3 A strategy to combat tropospheric ozone; development of the daughter directive on ozone

Following the completion of work on the acidification strategy, the Commission services embarked in 1997 on a programme of activities to develop a Community strategy to combat tropospheric ozone and to provide the technical and scientific basis for the ozone daughter directive. An ad hoc working group was set up consisting of experts from all Member States, industry, NGOs, the EEA, the WHO and other international scientific groups and the Commission. Its task was to assess the current state of knowledge and to prepare a technical position paper on ozone[27].

In addition to the support provided by the Commission's contractor, IIASA, studies were commissioned to estimate the benefits, in monetary terms, of policies to meet the strategy's objectives and to explore the effect of the Community-wide control-scenarios on typical local situations (Athens and Stuttgart[28], and the Burriana[29] region) and the scope for additional local-scale measures.

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27 Position paper on ozone; produced by the Ad-Hoc Working Group on ozone [under completion].

28 Moussioupoulos *et al*: "Technical Expertise in the Context of the Commission's Communication on an Ozone Strategy", Final Report to the Commission, DG XI, October 1998.

29 C. Cuvelier, P. Thunis, Joint Research Centre, Ispra: "Influence of NO_x/VOC emission reduction on levels in the Mediterranean area". Report to DG XI, June 1998.

In developing its strategy the Commission has taken into account *inter alia*:

- the impact of ozone pollution on human health and the environment, taking the WHO guidelines as a basis for setting long-term and interim objectives;

- the predicted evolution in emissions of ozone precursor substances, taking into account the impact of existing and forthcoming Community legislation as well as legislative actions and plans of individual Member States (the reference scenario);

- the transboundary nature of the ozone problem, by using internationally agreed data and methods on emissions, transboundary transport and calculation of ozone distribution all over Europe;

- the identification of cost-effective strategies to combat tropospheric ozone taking into account the costs and emission reduction potential of different abatement measures;

- the potential impact of abatement measures from outside the territory of the EC; and

- the impact on related environmental phenomena such as acidification and eutrophication.

The Commission has concluded from this work that an effective and balanced strategy to combat ozone should contain the following elements:

- **Interim objectives** which both move towards the long-term objectives by defining relative improvements in ozone levels everywhere in relation to the situation in the base year (the "gap-closure" target) and improve the situation in areas with the highest pollution load by establishing a uniform ozone concentration level to be complied with everywhere (the "absolute" target);

- **National emission ceilings** for NO_x and VOC which would broadly result in achievement of the interim objectives in a manner which is cost-effective at the Community scale;

- A **daughter directive for ozone** which both supports the implementation of the overall strategy and meets the specific requirements of the Air Quality Framework Directive by, *inter alia*, proposing a combination of both long-term objectives and target values (derived from the interim objectives); and

- The identification and implementation of additional **specific measures**, at European, national and local scales, which would contribute to the implementation of the national emission ceilings and compliance with the target values presented in the daughter directive.

With regard to this last point, the analysis performed for the ozone strategy highlighted the potential cost-effectiveness of further *reducing VOC emissions from some solvent usage* not covered by the solvents Directive, notably *for paints and varnishes*. The Commission services are now considering the possibility of introducing regulatory measures to control the VOC content of decorative paints and varnishes. This initiative is currently being explored at a technical level, and analysed further from a cost-effectiveness perspective, and the Commission services are considering presenting a legislative proposal aimed at controlling VOC emissions from the vehicle refinishing sector through a product-based approach.

In order to identify appropriate interim objectives for ozone, a thorough analysis was performed of several levels and combinations of gap-closures and 'absolute' targets for human health and vegetation, but with the emphasis on ensuring a high level of protection for the former. Expressed in the modelling as AOT60 (accumulation over a threshold of 60 ppb, which is equivalent to the WHO's 120 $\mu g/m^3$ human health guideline value), the reference scenario was already expected to result in a gap closure of at least 35% or an AOT60 of up to 4.5 ppm.hours by 2010, compared with 11.5 ppm.h around 1990. In theory, the introduction of all the measures described in the "maximum feasible reduction" scenario would reduce ozone exceedances to around 1.5 ppm.h, but at this extreme end of the scale the costs, and in all probability the impacts on industry, would be prohibitive. The area of investigation concentrated, therefore, on a minimum gap closure of between 60% and 70% and an absolute ceiling of between 2.8 and 3 ppm.h for the AOT60. For vegetation the range was 30-35% gap closure and 9.5-10.5 ppm.h above the critical level of 3 ppm.h (= 6000 $\mu g/m^3$ h, which is equivalent to the WHO guideline for crops and natural vegetation).

A separate document on this strategy has not been prepared by the Commission services, since all the above elements are contained in the two legislative proposals and this explanatory memorandum. The strategy should, however, be seen as evolving over time alongside the other air quality initiatives.

2.4 The combined analysis

The starting point in the combined analysis for the calculation of cost-effective emission reductions is the reference scenario, which projects emissions of the targeted pollutants in 2010 based on current legislation (including Commission proposals as of December 1998) and current reduction plans in the Member States. It is estimated that around 40% of the cost of the reference scenario in 2010 will relate to measures already implemented (i.e. by 1999). Of the remainder, deriving from measures still to be implemented, around 90% relates to measures concerning the road transport sector, such as the vehicle and fuel standards contained in the recently adopted "Auto-Oil I" package.

Given that the starting point for the analysis incorporates ambitious new measures in the transport sector, cost-effective new measures taken to implement the national emission ceilings will largely be concemed with emissions from sources other than road transport, though traffic management may also play a part.

In the model calculations, a central scenario (H1) was established, based on the interim objectives from the strategies for acidification and ozone. This was compared with two altemative ambition levels: the first (scenario H2) relatively less stringent, the second (scenario H3) relatively more stringent, so as to explore a reasonable range of improved protection beyond the 1990 situation and the associated costs and benefits. The scenarios are described in Annex I, Table 6. The conclusion from this exercise was that for the range of environmental objectives explored, the estimated costs increase quite rapidly when more stringent environmental objectives than those in the central scenario are explored. Going from the central scenario to the less stringent objectives used in H2 brings a reduction in costs and increased emissions. (Table D below, and Figures 8-11 in Annex I)

Table D: Emission ceilings and costs (on top of REF) for the Community as a whole resulting from the environmental objectives of the central scenario and more and less stringent interim objectives for acidification and ozone.

EC15	SO_2 Kilotonnes	NO_x Kilotonnes	VOC Kilotonnes	NH_3 Kilotonnes	Costs *per annum* EUR million
More stringent objectives (H3)	2 600	5 185	5 310	2 537	16 202
Central scenario (H1)	3 634	5 923	5 581	2 827	7 514
Less stringent objectives (H2)	4 026	6 152	5 739	3 051	4 227

To avoid an excessive driving force on the emission ceilings from limited areas where the *gap closure* is most difficult to achieve, a limited shortfall was allowed. However, to ensure that overall improvement is not reduced, such shortfalls were compensated where possible by increasing the protection levels in surrounding areas or (for ozone) other years in the same country (Figures 12-14 in Annex I show where this mechanism was used in the central scenario).

In addition, for the calculation of the AOT60 *absolute* target for ozone, the year with the highest AOT60 per grid cell (from a sample of five years) was omitted.

The acidification objectives in a few areas (two grid cells) on the border of a Community and a non-Community country were disregarded in the optimisation runs, since in these particular instances low critical loads in the non-Community countries would otherwise be partially driving the Community reduction requirements. Similarly, two grid cells in northern Finland (at the Russian border) were excluded as depositions there primarily emanate from sources in neighbouring areas in Russia and cannot be reduced significantly through a Community strategy. (Annex I, Figure 15)

For soil eutrophication, the central scenario led to a significant step towards reducing excess nitrogen deposition compared with the 1990 situation. Although soil eutrophication is closely inter-linked with the other two problems, in particular acidification, it was considered appropriate to let acidification and ozone objectives be the principal forces driving the national emission ceilings. Specific objectives related to soil eutrophication were therefore not set in this scenario. However, the impact of the proposed emission reductions for eutrophication was examined in detail (cf. Annex I, Table 5 and Figure 5).

The sum of the implementation costs calculated for scenarios targeting acidification and ozone separately is higher than the implementation cost for the joint scenario. The sum of the costs of two separate scenarios with the same environmental objectives is about 5% higher than the cost of central scenario (Annex I, Table 7). This reflects i) that emission reductions targeted at the problems jointly can be more cost-effectively distributed and ii) that the NO_x reductions required to solve the individual problems partially overlap.

The extent of acidification and ozone pollution varies greatly across the Community. The influence these problems have on the emission reduction requirements for each Member State varies accordingly. In the calculations, there will be a number of grid cells in the Community where one or other of the environmental objectives is most difficult to attain. However, the fact that one objective dominates in a specific region does not mean there are no other problems there.

Analysis shows that the objectives specified for acidification dominate at the German/Dutch border, in eastern Germany, in Ireland and to a limited extent in Spain. Health-related ozone objectives dominate the need for emission reductions in the UK, France, the Benelux countries, in some parts of Germany and in Portugal. Ozone objectives related to vegetation protection pose the most challenging objectives for emission reductions in the Mediterranean countries. (Annex I, Figure 16)

2.5 Options suggested by the modelling

It is recognised that specific measures will have to be progressively identified and implemented across all emission sources so as to ensure attainment of the Community's objectives for 2010 and compliance with the national emission ceilings.

Member States will need to assess what action is appropriate in their particular circumstances and introduce measures accordingly. They will thereby have the possibility of avoiding excessive consequences for particular sectors. Furthermore, the Commission will continue to work with the Member States and other stakeholders to identify promising measures and instruments which could be implemented either at Community or at national and local levels.

Emissions of SO_2, NO_x, VOC and NH_3 generally derive from the following sources:

SO_2 emissions arise predominantly from coal and oil combustion in all sectors, with power plants as the major source category.

NO_x emissions are also related to combustion of fossil fuels in all sectors, with transport as the major source.

VOC emissions derive from fuel combustion in transport, gas evaporation during loading/unloading of petrol, industrial processes, and the use of products containing organic solvents.

NH_3 emissions derive almost exclusively from agricultural activity, and within this sector mainly from animal husbandry.

The cost of the national emission ceilings by sector, as identified in the optimisation modelling, is indicated below:

Sector	Cost of NEC (billion euro/year)
Power plants	0.4
Industry	3.5
Domestic	1.0
Transport	0.5
Agriculture	2.1
Total	7.5

The modelling of course produced a spread of costs over various sectors. The varying level of costs reflects both the extent to which sectors contribute to emissions of pollutants and the extent to which they have already taken measures to curb those emissions.

For SO_2 and NOx, various action might be envisaged in respect of combustion processes and fuels. For VOC, as indicated earlier, measures could include a product-based approach, while the agricultural sector offers the greatest scope for action on ammonia.

3. OBJECTIVES

3.1 Long-term objectives

As stated in Section 2, the Fifth Environmental Action Programme establishes the long-term objectives of no exceedance of critical loads (for acidification) or of critical levels (for ozone). In addition, it provides that all people should be effectively protected against recognised health risks and that WHO values should become mandatory at EC level.

In the case of acidification, the critical loads are taken to be those compiled by the Co-ordination Center for Effects (subsection 2.1).

For tropospheric ozone, the position is complicated by the lack of a clear "no adverse effects" level as far as protection of human health is concerned. Nonetheless, the 1997 guidelines adopted by the WHO provide a robust and internationally recognised basis for the establishment of the Community's long-term objectives. For the purposes of the ozone strategy and the proposal for a daughter directive, the WHO guideline for human health has been treated as the "critical level".

The proposed long-term objectives for ozone are therefore:

	Parameter	Long-term objective (not to be exceeded within the calendar year)
1. Long-term objective for the protection of human health	8-hour mean, calculated from hourly running 8-hour averages	120 $\mu g/m^3$
2. Long-term objective for the protection of vegetation	AOT40*, calculated from 1h values from May to July	6000 $\mu g/m^3.h$

* AOT40 means the accumulation of the difference between hourly concentrations greater than 80 $\mu g/m^3$ (= 40 parts per billion) and 80 $\mu g/m^3$ using only the 1-hour values measured between 8 a.m. and 8 p.m. Central European Time each day from May to July.

WHO has adopted three types of critical level relating to vegetation: for crops and semi-natural vegetation, for forests and for visible damage. In practice, the guideline for crops and semi-natural vegetation is almost always more stringent than the forest guideline, which means forests should be adequately protected without being covered by a separate long-term objective. Since, in addition, there is no practical method of measuring exceedances of the visible injury guideline, only the guideline for crops and semi-natural vegetation is proposed as a long-term objective.

The Commission's analysis has confirmed that there is no prospect of complying with these objectives in the medium term. It does not, as a result, propose to set a deadline at present for their attainment. Nonetheless, the Commission believes it is right to maintain the aspiration to a high level of protection and that this should serve as the benchmark for evaluating progress over the long term.

3.2 Interim objectives

Interim objectives are clearly required if quantified and time limited commitments are to be adopted for acidification and ozone. This principle has been endorsed by both the Council and Parliament in their conclusions on the acidification strategy.

On the basis of the analyses carried out in support of the acidification and ozone strategies and the subsequent combined analysis (scenario H1), the Commission proposes the following interim objectives to be achieved by the year 2010:

Acidification interim objective

- **a reduction of areas with exceedance of critical loads for acidity by at least 50% (in each grid cell) compared with the 1990 situation[30].**

[30] In the model calculations the target was implemented as a 95% gap closure of the accumulated excess acidity (AEA). AEA measures acid deposition in excess of critical loads accumulated for all ecosystems in a grid cell. It was used in the modelling to avoid focusing on a specific ecosystem and to increase the robustness of the modelling results.

Ozone interim objectives

- **for the human health criterion, a reduction by at least two-thirds of the 1990 exceedances of the long-term objective; for the vegetation criterion, a reduction by at least one-third of the 1990 exceedances of the long-term objective; and**

- **a uniform ceiling for the health–related AOT60 of 2.9 ppm.h and for AOT40 of 10 ppm.h expressed as an excess above the critical level of 3 ppm.h for vegetation.**

These objectives will be reviewed by the end of 2004 (see Section 8 below).

The proposed national emission ceilings directive and the proposed ozone daughter directive are designed to be consistent with achievement of these interim objectives. The link between the interim objectives for ozone and the objectives which appear in the ozone daughter directive is explained in more detail in Section 5.

3.3 Scientific Committee

The Commission's Scientific Committee on Toxicity, Ecotoxicity and the Environment (CSTEE) was consulted on the scientific basis on which the objectives were derived for ozone and on the format chosen for interim objectives in the cost-effectiveness analysis. The CSTEE delivered its opinion on 21 May 1999.

In its opinion, CSTEE endorsed the proposed long term objectives for the protection of human health and of vegetation.

CSTEE considered that expressing the interim objective for the protection of vegetation in terms of AOT40 is the best possible approach and endorsed the use of the AOT60 format for expressing the interim objective for health until modeling of the number of exceedances of 120 $\mu g/m^3$ is achievable.

4. PROPOSAL FOR A DIRECTIVE ON NATIONAL EMISSION CEILINGS

4.1 Main elements of the proposal

The central feature is the ceilings set for emissions of sulphur dioxide, nitrogen oxides, volatile organic compounds and ammonia in each Member State. These ceilings will broadly achieve the interim objectives described in Section 3. They are to be complied with by 2010 at the latest.

Member States are required to draw up programmes for the progressive reduction of their annual national emissions and report them to the Commission before the end of 2002. The programmes are to be updated and revised in 2006.

The reporting of national programmes will be important for the Commission's assessment of progress towards the emission ceilings, and assessment of the possible need for complementary action at Community level. To facilitate such assessment it is specified that the programmes must include quantified estimates of the effect of policies and measures on emissions in 2010. Member States are also required to report on the policies and measures that will be taken to attain the national emission ceilings. If significant changes in the geographical distribution of national emissions are expected to occur between 1995[31]

[31] The year when EMEP last updated its grid cell distribution of national emissions in Europe.

and 2010, this must also be indicated, as it may have a bearing on the environmental impact of national emission reductions.

Member States are required to prepare and regularly update national emission inventories and emission projections for 2010 for SO_2, NO_x, VOC and NH_3. These inventories and projections must be reported to the Commission each year. In combination with the national programmes, the inventories will provide essential input on progress towards the ceilings, and will show whether Member States are complying with their ceilings.

The Commission must report at regular intervals (in 2004, 2008 and 2012) to Parliament and the Council on progress in the implementation of the ceilings and towards attaining the interim environmental objectives. These reports must include an economic assessment, including cost-effectiveness, benefits, an assessment of marginal costs and benefits, impact on competitiveness, and the expected socio-economic impact in the different Member States of the implementation of the national emission ceilings. They will also consider the limitations applied to the scope of the Directive. In addition to Member States' reports as described above, the Commission will take account of and explore other aspects relevant to these reports, such as:

- emission reductions and reduction commitments by non-Community countries;
- the enlargement process;
- new Community legislation and any international regulations concerning ship emissions;
- new technical and scientific data;
- assessment of current and projected exceedance of critical loads and of the World Health Organisation's guideline values for tropospheric ozone;
- new livestock projections reflecting developments in the Common Agricultural Policy;
- new energy forecast reflecting the actions taken by the Member states to comply with the Kyoto agreement;
- the identification of an interim objective for reducing soil eutrophication.

The Commission's reports will, if appropriate, be accompanied by proposals for modifications of the national emission ceilings of the proposed directive, for measures to ensure compliance with the ceilings, and for possible further emission reductions.

4.2 Legal basis

The proposed directive aims to protect and improve the quality of the environment and to protect human health. The legal basis is therefore Article 175(1)of the EC Treaty.

4.3 Subsidiarity and proportionality

Acidification, tropospheric ozone and soil eutrophication are transboundary problems, and must therefore be tackled through coordinated Community action. Accordingly, the proposed directive establishes emission ceilings for the Member States based on comprehensive analysis of a cost-effective distribution of emission reductions between Member States in order to achieve the improvements in environmental quality and human health described in Section 1.

At the same time, the establishment of national emission ceilings will allow the Member States flexibility in determining the most appropriate means of complying with the ceilings. It also allows Member States which so wish, to reduce emissions further than prescribed by the proposed directive.

4.4 Consistency with other Community policies

The proposed national emission ceilings will bring about environmental improvement on a European scale. This large-scale impact on air quality and acidifying and eutrophying depositions will provide the background for measures at the regional and urban scale. In this way the proposed directive is an important complement to the Air Quality Framework Directive and its daughter directives. Due to the markedly transboundary nature of tropospheric ozone formation, there is a particularly close link between this proposal and the proposed daughter directive on ozone.

The proposed directive allows Member States flexibility in deciding how to achieve the emission ceilings. However, measures in certain sectors can most effectively be implemented by action at Community level. The recently adopted "Auto-Oil I" Directives concerning emissions from road transport, the Directive relating to the limitation of VOC emissions due to the use of organic solvents in certain activities, new directive relating to the sulphur content of certain liquid fuels, the proposed directive on heavy duty vehicles and the proposal for revision of the Directive on large combustion plants are examples of such sectoral measures. In addition, the Integrated Pollution Prevention and Control Directive and the recently adopted directive relating to limit values for sulphur dioxide, nitrogen dioxide and oxides of nitrogen, particulate matter and lead will favour compliance with the ceilings.

The provisions of the proposed directive apply without prejudice to the Member States' obligations set out in the IPPC Directive and to provisions of Community legislation regulating emissions of SO_2, NO_x, VOC and NH_3 from specific sources.

4.5 Opinions of affected parties

During the course of 1997 and 1998 the Commission held several meetings with Member States, industry and NGOs to consider the follow-up of the acidification strategy, the development of the ozone strategy and the national emission ceilings proposal. The last meeting, at which the scenario calculations and the Commission's choice of central scenario for the national emission ceilings were discussed, took place on 19 October 1998.

All Member States support the approach used in developing the proposed directive and have contributed to the modelling exercise by reviewing and commenting on input data and giving their views on the setting of interim environmental objectives. Most Member States support the ambition level of the interim environmental objectives proposed by the Commission.

Some Member States consider that the scenario underpinning the ceilings should include emission reductions from other UNECE countries. Other Member States do not find this a realistic or enforceable approach. Some Member States consider that the emission ceilings should be derived from a scenario which incorporates the effect of climate policies on energy forecasts (a "post-Kyoto" scenario).

Several Member States question the level of and basis for the emission ceilings assigned to them in the draft Commission proposal. Some Member States advocate a two-step approach where the more ambitious step towards improvement would be decided in a few years, e.g. 2004.

Industry *(Unice, Eurelectric, Europia/Concawe, Cecso, ES-VOC-CG)* has questioned whether the environmental improvements which can be expected from the proposal are justified in terms of cost. In this context, uncertainties linked to the model framework and input data used to derive the emission ceilings have been pointed out, as have uncertainties in the estimation of the benefits of the proposal. Furthermore, industry sees the stringency and costs of the reference scenario as already involving a very considerable effort which raises national and sectoral economic and competitiveness concerns.

Environmental NGOs *(European Environmental Bureau)* have supported the Commission's approach to the national emission ceilings, but find the environmental objectives insufficiently ambitious given the likely overestimation of emission reduction costs in RAINS. In particular, the NGOs believe that climate policy and energy saving/energy efficiency efforts would also reduce emissions of SO_2 and NO_x at a lower cost.

5. PROPOSAL FOR A DAUGHTER DIRECTIVE RELATING TO OZONE IN AMBIENT AIR

5.1 Requirements of the Framework Directive

The Air Quality Framework Directive requires daughter legislation to include the following provisions:

- limit values and/or target values, including dates for their attainment;
- alert thresholds if appropriate and minimum details to be supplied in the event of exceedances;
- criteria and techniques for measurement and other methods for assessing ambient air quality.

5.2 Air quality objectives for ozone

As indicated, the Air Quality Framework Directive provides for the setting of either a limit value for ozone or a target value or both. A target value is defined as an air quality objective to be attained *as far as possible* within a given period.

Ozone pollution has a significant transboundary component. In north-western Europe in particular, ozone episodes often occur simultaneously in a number of Member States. High ozone levels in a given Member State will be attributable to emissions originating both within and outside its territory. Accordingly, since air quality objectives are an essential part of joint action to solve the ozone problem, the proposed directive sets *target* values.

Recognising that compliance with the long-term objective cannot be achieved in one step, the Commission has adopted a staged approach in this proposal.

1. The proposal explicitly includes WHO Guidelines for ozone as long-term objectives. The ultimate aim is to avoid exceedances of these long-term objectives, but no date is set by which this should be achieved.

2. As an interim first stage, the proposal sets target values for 2010. These are based on WHO Guidelines with a view to reducing harmful effects on human health and the environment as quickly as possible over the medium term, but also taking account of feasibility and cost. The fact that the Commission used the results of the scenario analysis

performed by its consultant, IIASA, to derive the proposed target values[32] provides consistency between the latter and the interim objectives underpinning the NEC proposal (and thus the expected effect of the emission ceilings proposed in the ozone strategy).

3. The Commission will review the implementation of this directive in due course and consider whether further progress could be made towards meeting the long-term objectives.

Obligations with respect to long-term objectives

It is proposed that Member States report exceedances of the long-term objectives to the Commission. In areas which already comply with the target values, they should aim to achieve the long-term objectives. Though it sets no date for the latter's attainment, the proposal requires Member States to inform the Commission of the steps they have taken towards meeting the long-term objectives.

Obligations with respect to target values

Article 4(1) of the Air Quality Framework Directive provides the following outline:

(i) Member States will need to identify the regions or zones where the target value is not met;

(ii) Member States will need to draw up plans demonstrating how they intend to achieve the target value as far as possible within the required time period, and inform the Commission thereof.

(iii) On the basis of this information the Commission will consider whether additional measures are necessary at EC level beyond the ozone strategy, and if necessary submit further proposals to the Parliament and the Council.

The Air Quality Framework Directive leaves the details of how these obligations are to be fulfilled to daughter legislation. For reasons of consistency, this proposal models its arrangements on requirements for other pollutants dealt with under the framework. They are, however, adapted to reflect the difference between a target value and a limit value.

It should be noted here that the target values were derived from the analysis underpinning the ozone strategy. Accordingly, the establishment of national emission ceilings and implementation of further Community-level measures should ensure compliance with the target values at the regional scale. The requirement for Member States to prepare and implement plans or programmes for attaining the target values as far as possible will provide an additional degree of protection at the local scale, as well as a more transparent and comprehensible benchmark against which to measure progress in implementing ozone reduction strategies at all scales.

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[32] Measured ozone series were used in this evaluation in order to minimise the effect of model inaccuracies. A detailed description of the approach (Working Paper: 'Results of the adaptation of RAINS scenario results for 2010 to measured levels around 1990') is available from the Commission.

5.3 The Commission's proposal for long-term objectives and target values

Table E indicates the levels proposed in the draft daughter directive for long-term objectives and target values for the protection of human health and for vegetation.

Format of Target Value for Human Health

The way the target value for human health is expressed is important. Two options were considered:

- a target value based clearly on the WHO guideline for the protection of human health, i.e. expressing it as 120 $\mu g/m^3$, not to be exceeded on more than 20 days;
- a target value expressed as a higher concentration, with a smaller number of allowed exceedances.

Table E: Long-term objectives and target values for ozone in the daughter directive

For protection of	Long-term Objective	Target Value		
Human health	120 $\mu g/m^3$ as an 8-hour mean	120 $\mu g/m^3$ as an 8-hour mean not to be exceeded on more than 20 days per calendar year[33]	Average over three years	Year by which the target value must be attained as far as possible is 2010
Vegetation	AOT40* = 6 000 $\mu g/m^3$.hours	AOT40* of 17 000 $\mu g/m^3$.h	Average over five years	

*AOT40 means the accumulation of the difference between hourly concentrations greater than 80 $\mu g/m^3$ (= 40 parts per billion) and 80 $\mu g/m^3$ using only the 1-hour values measured between 8 a.m. and 8 p.m. Central European Time each day from May to July. (N.B. WHO sets a flexible daylight window for calculating the AOT40, which is in practice difficult to implement. Data evaluation shows, however, that using the fixed time window between 8 a.m. and 8 p.m. has only a minimal effect on AOT40 values.)

The Commission concluded that the first of these was preferable on grounds of transparency, public confidence and risk management. The great majority of experts who assisted the Commission in preparing this proposal agree.

The advantage of expressing the target value as 120 $\mu g/m^3$ not to be exceeded on more than 20 days is its clear relation to the WHO guideline: it is designed to reduce exceedances of the guideline from today's high level[34] to a much lower level as soon as possible. A potential disadvantage is that attention is focused on continuing exceedances of the guideline and that a relatively high number of these are allowed. This could lead to public concern. In fact, there are precedents for this at EC level (the Directive setting limit values for SO_2, NO_x, PM_{10} and lead) and at Member State level (the United Kingdom's national standards for ozone).

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33 As explained in Section 2, the interim objectives for ozone used in IIASA's model analysis were expressed for practical purposes in units of an AOT60, i.e. the accumulated excess over the above level of 120 $\mu g/m^3$. So, an AOT60 greater than zero is equivalent to at least one exceedance of 120 $\mu g/m^3$. The results of the scenario run with the objective presented in Section 3 were taken to deduce a target value as a pure number of days with exceedances.

34 Today's ozone concentrations exceed the WHO guideline of 120 $\mu g/m^3$ on more than 50 days per year; the AOT40 often reaches more than 20 000 $\mu g/m^3$ times hours (see Ozone Position Paper).

To take the other option and express the target value as a higher concentration with a smaller number of allowed exceedances would be closer to the format of many ambient air quality limit values and might appear likely to command more public confidence, but the difficulty would then be to set the concentration value. While it could be chosen to represent the same level of ambition as the first formulation, the risk is that it would appear arbitrary or even as an attempt to obscure progress vis-à-vis the WHO guideline. This would command less public confidence.

With regard to risk management, the Commission has considered carefully whether one formulation might better reduce risk to public health than the other. For instance, it might be argued that a target value of, for example, 160 $\mu g/m^3$ with few exceedances would reduce peak ozone concentrations more effectively than a target value of 120 $\mu g/m^3$ with a higher number of exceedances. The higher value could indeed provide better protection if high peak concentrations were the main concern, but the Commission has concluded that this is not the case, on both health effect and air quality grounds.

WHO has concluded, in the light of the most recent evidence, that there is a linear relationship between exposure and health effects. It notes that it is therefore impossible to base a guideline on a "lowest observed adverse effects level" with a safety factor. In selecting a guideline it accepted the premise that some detectable responses were of little health concern, that at low concentrations the number of responders to effects might represent a group too small to warrant protection and that medication would be available to relieve asthma symptoms and prevent more serious consequences. Taking all this into account, it adopted a guideline of 120 $\mu g/m^3$ as a level at which acute effects on public health are likely to be small.

Since the relationship between effects and concentration is linear down to at least 120 $\mu g/m^3$, reducing peak concentrations on a few days per year should not be the main goal of an ozone reduction strategy. An increase in concentration from 120 to 140 $\mu g/m^3$ would produce the same increment in acute effects on health as an increase from, say, 160 to 180 $\mu g/m^3$. As explained above, chronic exposure to low concentrations is also of concern. It is therefore at least as important to reduce frequent variation at lower concentrations by reducing average concentrations, as it is to reduce relatively infrequent high peaks. In fact, it is probably more important.

It has been suggested that a target value could be based on the recently adopted US standard of 160 $\mu g/m^3$. However, the US-EPA does not regard this concentration as a value below which effects on health would not be expected to occur. In developing its proposal for the recently introduced US Ambient Air Quality Standard of 160 $\mu g/m^3$ as an 8-hour average, the EPA observed that this standard "does not necessarily reflect a threshold below which effects do not occur, but rather may reflect levels at which studies finding statistically significant effects of concern have been conducted". It noted that a lower concentration "would provide increased protection from long-term exposures that may be associated with potentially more serious but more uncertain chronic effects"[35]. More recent evidence supports this assessment, both with regard to acute effects at concentrations lower than 160 $\mu g/m^3$ and with regard to chronic effects. Information from WHO on hospital admissions due to ozone exposure above 110 $\mu g/m^3$ shows that the bulk of such hospitalisations (i.e. about 70%) can be attributed to ozone concentration levels below 160 $\mu g/m^3$ (see Annex I, Figure 17). A very similar relationship exists between ozone levels and cases of premature death. This clearly confirms the need to frame the target value on the basis of 120 $\mu g/m^3$ both to protect public health and

35 OAQPS Staff Paper, US-EPA, June 1996.

in order to ensure that the scope for improvement in air quality is assessed, and appropriate action taken, in areas with a substantial number of exceedances of 120 μg/m³.

Where air quality is concerned, as explained above, the proposed directive on national emission ceilings will be the main tool for ensuring that the target value is met as far as possible at regional level. The target value is derived from consideration of the measures available to comply with the NEC proposal. The NEC directive, and therefore regional ozone levels, will not change however the target value is expressed. However, further local action may be needed to reduce locally generated exceedances. In principle, therefore, the formulation of the target value could be important at local level. There are several regions, e.g. in Eastern Spain, where many values above 120 μg/m³ have been measured, but virtually no exceedance of 160 μg/m³. Setting the target value at a level of 120 μg/m³ would ensure identification of all such areas where significant health effects could be expected, for further evaluation of possible enhanced local and regional measures.

It has been shown that measures available to reduce ozone levels towards 120 μg/m³ will reduce peak ozone concentrations more rapidly than lower concentrations. More specifically, if a target value of 120 μg/m³ with 20 allowed exceedances is met, peaks over 180 μg/m³ should be eliminated.

Practical considerations also suggest a formulation allowing a high rather than a low number of exceedances. Since ozone concentrations vary substantially from year to year on account of weather conditions, zones may flip in and out of compliance more often if compliance is assessed on the basis of a higher level of 160 μg/m³ with fewer exceedances rather than 120 μg/m³ with more exceedances.

To reduce this problem even further, it is proposed that exceedances be averaged over three years (in the case of human health) and five years (in the case of vegetation). The latter period follows a WHO recommendation and will enable proper assessment of trends due to emissions and the effects of reduction programmes. Since the first year to enter into the compliance calculation will be 2010, the first compliance period will be 2010-12 for the target value to protect human health and 2010-14 for the target value to protect vegetation.

5.3a Scientific Committee

The Commission's Scientific Committee on Toxicity, Ecotoxicity and the Environment (CSTEE) was consulted in order to confirm the scientific basis on which the objectives and target values were derived for ozone and the format chosen for the interim target values in the proposed ozone directive. The CSTEE delivered its opinion on 21 May 1999.

As already mentioned in section 3.3, CSTEE endorsed the proposed long term objectives for the protection of human health and of vegetation.

In particular, CSTEE considered that it is not possible to define ozone concentrations where no effects of ozone on human health can be observed. It confirmed that the proposed long-term of objective of 120 μg/m³ is scientifically justified. It also endorsed expressing the target value in terms of 120 μg/m³ and considered that the frequency and extent of exceedances of this value should be limited as much as possible.

It voiced concern that the available data are inadequate to determine whether additional long-term standards are needed to ensure protection of human health against possible chronic effects from long-term exposure and recommended that more research should be carried to resolve this question (see also section 8).

CSTEE furthermore considered an AOT based target for the protection of vegetation to be scientifically sound. It noted that local factors (vegetation type, air, water or soil quality, weather conditions) could affect the toxicity of ozone but concluded that worst-case conditions should be used in the absence of specific information allowing estimation of precise local effects. As far as the target value is concerned the committee supported the use AOT40 as an appropriate format and stated that the proposed provisional range (16-18000 $\mu g/m^3$) was acceptable.

5.4 Alert thresholds and public information

Article 2 of the Air Quality Framework Directive defines an alert threshold as a level of pollution above which brief exposure poses a risk to human health and at which immediate steps must be taken by Member States. Directive 92/72/EEC set a similarly defined warning threshold aimed at informing the general population plus a lower information threshold for sections of the population which are particularly sensitive to ozone. Member States are required to inform the population concerned as soon as possible of any exceedances of these levels so as to enable individuals to reduce their personal exposure to ozone. On the advice of the Ad Hoc Working Group, the Commission concluded that this two-tier scheme should be maintained in the present proposal.

To carry this scheme forward while maintaining consistency with other legislation under the Air Quality Framework Directive, the present proposal sets an 'alert threshold' for the *general* population and a lower alert threshold, defined as an 'information threshold', for *sensitive sections* of the population. (The term 'information threshold' takes up the term used in the current Directive 92/72/EEC.) The alert threshold is set at 240 $\mu g/m^3$ and the information threshold at 180 $\mu g/m^3$. Both are 1-hour averages[36].

The Commission also sought advice by the CSTEE on the question of information and/or alert thresholds for ozone. The committee confirmed the scientific basis for the proposed alert threshold of 240 $\mu g/m^3$. It considered that there were no particular scientific grounds for supporting the proposed level of 180 $\mu g/m^3$ for the information threshold. However, CSTEE acknowledged that from a risk management point of view, 180 $\mu g/m^3$ as an 1h average may be useful as an information level.

The ozone Ad-hoc working group also considered information threshold levels appropriate for risk management purposes. Taking into account the relation between the frequency of an information release and the value of the information for the public the working group recommended 180 $\mu g/m^3$. This is also the widely known information threshold used in the current Directive 92/72/EEC.

Article 1 of the Air Quality Framework Directive envisages alert thresholds as only one element of public information strategies. The present proposal specifies that the public should be supplied with regular information on ozone. Such information should indicate when concentrations exceed the long-term objectives, target values and information and alert thresholds. The WHO guidelines for ozone which were not considered an appropriate basis for long-term objectives or target values are included here as additional reference levels to assist interpretation.

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[36] See ozone Position Paper on the frequency of current exceedances; exceedances of the level proposed for the alert threshold are expected almost to vanish as a result of the emission reduction assumed in the ozone strategy.

Directive 92/72/EEC provides for the Commission to receive monitoring data and prepare reports on the ozone situation in the Community during the summer of the current year and during the previous year. To allow the Commission to continue to prepare these reports, the proposal retains a modified procedure of monthly (during the summer) and yearly data-reporting by Member States. In particular, the monthly submissions may enable the Commission to issue monthly ozone bulletins via new electronic media.

5.5 Short-term measures

Article 7(3) of the Air Quality Framework Directive deals with short-term actions to reduce peak values during pollution episodes. In the case of ozone, the effectiveness of such measures varies markedly according to meteorological conditions. Clearly, while short-term measures should be implemented if they are proportional and effective, there can be no obligation to undertake measures which would produce no improvements. This proposal fills in the details in respect of short-term measures on ozone. Member States will be subject to the following requirements in zones where exceedances of the alert threshold occur:

- they must investigate the effectiveness of short-term measures to reduce ozone peaks in the regions concerned;

- they must determine whether short-term plans would be effective and, if so, devise and implement such plans.

The Commission will develop guidance and organise an exchange of information concerning the development of such plans.

5.6 Air quality assessment

Air quality assessment is the term used in the Air Quality Framework Directive to cover all methods of obtaining information on air quality, including measurement, the compilation of emission inventories and air quality modelling. These are all essential to successful air quality management. Article 6 of the Air Quality Framework Directive therefore provides for the use of all appropriate tools for assessing air quality.

The framework Directive identifies two levels of pollution, which are used to relate the degree of assessment required for an agglomeration or other zone to the risk that a limit value might be exceeded. As no limit value is proposed for ozone, assessment requirements are instead related to the long-term objectives. Attainment of the long-term objective for five consecutive years is the precondition for relaxing assessment requirements.

In principle, it would be possible to relate assessment requirements to target values instead, but this would provide little information on the extent to which the long-term objectives are still unmet. The Commission considers this an inadequate basis on which to assess effects on human health and the environment and to consider the need for any further measures at Community level.

Number of measurement stations and use of additional means of assessment

The Commission's proposals provide criteria for calculating minimum numbers of measurement stations in agglomerations and other zones where measurement is mandatory, if measurement is the only source of reported data. Annex IV provides siting criteria and a classifying scheme for stations, slightly amending the concept set out in Council Decision 97/101/EC on Exchange of Information[37].

Member States will often undertake a more comprehensive analysis of air quality within an area, involving other tools and generating further information (additional measurements, objective estimation techniques, air quality modelling). A key means of improving the representativeness, evaluation and quality of ozone measurements is collocated monitoring of ozone and nitrogen dioxide concentrations. As a minimum, parallel recording of nitrogen dioxide is required at 50% of stations.

For such situations, where a comprehensive picture is generated, the proposal allows the minimum number of sampling points to be reduced by 33%, provided that the whole ozone network is equipped with nitrogen dioxide instruments. In all cases, the number and location of permanent measurement stations should be sufficient, with the additional information, to give confidence in the quality of the overall monitoring arrangements. Depending on the local situation, more or fewer stations may be required than in the default case. Member States will be required to compile information to assist decisions on network design. This strategy should have the potential to provide a much better picture of pollution levels throughout the Community than would emerge from measurement alone.

It should be noted here that areas of high altitude above the timber-line and on high mountain tops are not the focus of assessment for the purpose of this Proposal. Such areas have a relatively high ozone load due to low deposition of ozone and a higher contribution from natural sources. However, since they are largely uninhabited and vegetation is very sparse, the Commission does not consider them appropriate locations for monitoring sites to check compliance with the ozone objectives in this Proposal. Nonetheless, it is important that some ozone monitoring stations be operated in such areas for scientific purposes (to improve our understanding of ozone-forming processes and record the trend in background ozone concentrations).

Uncertainty of air quality assessment

All methods of air quality assessment, including measurement, are subject to uncertainty. Good quality assurance programmes, as required by the Air Quality Framework Directive, can reduce some of the uncertainties associated with measurement. The present proposal includes rigorous data quality objectives - requirements for precision and accuracy - for measurement and for other assessment methods.

5.7 Legal basis

The legal basis of the proposal is Article 175(1) of the EC Treaty. This is also the legal basis of Directive 96/62/EC. The objectives of the Air Quality Framework Directive and daughter legislation relate to the conservation, protection and improvement of the quality of the environment, and the protection of health.

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[37] OJ L 35, 5.2.1997, p. 14.

5.8 Subsidiarity

The present proposal amends existing EC legislation on ozone in line with the requirements of Directive 96/62/EC. The explanatory memorandum accompanying that Directive (COM(94) 109 final) sets out reasons for and the scope of the new framework for action on ambient air quality. The present proposal adheres to the principles of the framework by setting broad Community-wide ambient air quality objectives but making the Member States responsible for determining and implementing the specific action most appropriate to local circumstances.

The specific nature of ozone as a secondary pollutant and its large-scale transboundary distribution point clearly to the formulation of a strategy at Community level. The Commission recognises that, for ozone, the potential for further action on a local scale is limited.

5.9 Opinions of affected parties

All Member States and NGOs were in favour of basing the ozone objectives on the WHO guidelines.

Most Member States support the principle of a two-stage objective: a long-term objective representing WHO levels, and target values as an achievable interim objective. Two Member States would prefer to set only one objective - the target value - at WHO guideline level. They are concerned that target values might trigger additional uncoordinated control efforts by individual Member States, whereas control measures at EC level would be more cost-effective, given the transboundary nature of ozone. Some Member States expressed similar concern with regard to short-term measures.

Industry's general concern is the role of the long-term objective, since it is not achievable throughout Europe in a foreseeable time frame. UNICE also questions the scientific basis on which WHO derived its guideline values. They would rather see a target value set at a higher concentration level (160 $\mu g/m^3$) with fewer allowed exceedances than use the lower concentration of the WHO guideline as a reference. The approach used to determine ozone target values on the basis of IIASA's cost-effectiveness analysis was questioned. UNICE also queried the inclusion of mortality in the estimation of the monetary benefits of meeting the proposed ozone standards.

NGOs (European Environment Bureau) generally supported the Commission's proposal, in particular the staged approach of setting long-term objectives and (interim) target values. Given that even WHO's guideline level of 120 $\mu g/m^3$ for human health does not define a no-effect level, EEB wants to see the target value set relative to 120 $\mu g/m^3$ rather than at higher concentration levels, such as 160 $\mu g/m^3$. They are not in favour of a multi-year average for checking compliance with the target value for human health. They expressed concern as to whether the proposed level of 180 $\mu g/m^3$ for the information threshold might be better set at 150 $\mu g/m^3$.

6. Implementation Costs and Monetised Benefits

The NEC directive is broader in scope than the ozone directive, as it regulates pollutants causing acidification, eutrophication and ozone. Moreover, the interim objectives for ozone underpinning the NEC directive combine an absolute ozone concentration level with a percentage improvement everywhere ("gap-closure"), while the ozone directive only prescribes the attainment of a target value derived from the absolute concentration level of

the interim objectives. The costs and benefits of the NEC directive are therefore higher than those calculated for the ozone directive alone.

The costs estimated for compliance with the ozone directive are not additional to the costs of the national emission ceilings. They are essentially subsumed under the NEC costs. However, to allow separate assessment of the costs and benefits of the two proposals, the figures for the ozone directive alone are presented in subsections 6.2 and 6.5.

6.1 Estimated implementation costs of the national emission ceilings

As explained in Section 2, the proposals have been underpinned by integrated assessment modelling. As a starting point, reference scenarios were determined for each pollutant, taking into account existing national, EC and international legislation, together with Community legislation already proposed by December 1998. The analysis then identified how the additional emission reductions required to meet the proposed environmental targets could be apportioned among Member States in a cost-effective manner.

The additional costs (i.e. above the reference scenario) of the proposed national ceilings are indicated by pollutant and Member State in Annex I, Table 8.

For the purpose of the cost-effectiveness calculations, a cost curve was constructed for each pollutant for each Member State. It was based on a limited list of characteristic emission control options. For each option, the model extrapolated the current operating experience to future years, taking into account the most important country- and situation specific circumstances. The Member States and industry provided data input, and reviewed and commented on the cost curves.

It is important to be aware that the measures considered in the model calculations are "end of pipe" – i.e. technological solutions. The model does not consider changes in energy supply, or other structural measures. In reality, structural changes may result from other developments, and policies other than environment policy. They may also figure largely in policies to comply with the emission ceilings addressed here, as well as climate policy, and involve costs which may in some cases be significantly lower than those of the technical emission control options.

Furthermore, the use of economic instruments to initiate emission reductions may lead to cheaper solutions than "command-and-control" instruments. Options that may be introduced at the local level, such as road pricing schemes or the introduction of LPG/CNG buses, are also excluded from the current format.

For these reasons it very likely that the RAINS model has provided an upper estimate of the cost of implementing the national emission ceilings. Real costs are expected to be less than the EUR 7.5 billion per year projected by RAINS.

This conclusion is supported by the calculations that have been made to explore the impact that structural changes in the energy and agricultural sectors may have on the emission ceilings and costs. These scenarios are, however, highly "stylised" and can only serve as an illustration of changes in model assumptions regarding these sectors.

The central scenario and those exploring more and less stringent objectives (H3 and H2) are based on energy forecasts for 2010 which do not reflect the action that Member States will take to comply with the Kyoto agreement on climate change. It is at present uncertain how Member States' action will affect the energy projections as, in addition to CO_2, there are a

further five climate gases to be considered, as well as the possibility of emissions trading. However, a very rough "Post-Kyoto/low-CO_2 scenario" has been developed in which total Community CO_2 emissions come close to the Kyoto target.

This "post-Kyoto/low-CO_2" scenario shows that the additional costs of reaching the interim environmental objectives of the central scenario (H1) are substantially reduced when the climate policy targets are taken into account in the analysis. In the low-CO_2 scenario, additional costs were reduced by around 40%. The cost of the reference scenario was reduced by roughly 10%.

Although costs are reduced considerably with "post-Kyoto/low-CO_2" energy forecasts, the pattern of cost-effective emission ceilings remains fairly stable. Overall, the VOC and NH_3 emission ceilings were slightly higher in the post-Kyoto scenario (by 1-3% overall) than in H1, reflecting that lower SO_2 and NO_x emission reductions would follow from the "low-CO_2" policy.

Another important activity forecast used in the model calculations is the livestock projections for 2010. The common agricultural policy is currently under reform. Livestock projections reflecting the Commission's Agenda 2000 proposals are not available, and no decisions have yet been made on them. A very rough scenario was therefore constructed in which livestock projections for 2010 were reduced by 10% across all livestock categories in all Member States. This "low-NH_3" forecast is used to illustrate the impact that structural change in the agricultural sector could have on the distribution of emission ceilings and costs.

Compared with the central scenario, the "low-NH_3" scenario lowers the cost of the interim environmental objectives by about 18% to approximately EUR 6 billion per year. The scenario would allow the SO_2 emission ceiling to be higher (3-4% overall), while the ammonia ceiling would be lower.

6.2 Estimated implementation costs of the ozone directive

The estimated cost of reaching only the interim ozone objectives underpinning the proposed national emission ceilings is around EUR 4.3 billion per year for the Community as a whole. The additional cost per Member State for the required reductions of the ozone precursors (NO_x and VOC) is given in Annex I, Table 9. This cost estimate is arrived at using the same methodology as described above and is for the same reasons likely to be an upper estimate.

The interim ozone objectives comprise a relative improvement everywhere towards the long-term objective of no exceedance (% gap closure), and attainment of an absolute ozone concentration level.

However, the ozone daughter directive proposal does not set gap-closure targets. It only sets absolute target values for ozone concentrations, to be achieved by a given date. On the basis of earlier work, the cost of meeting only the absolute target value of the proposed directive is estimated to be around 10% less[38].

Accordingly, and so as to avoid discussing too many different sets of figures at the same time, the costs and benefits figures given for ozone relate to the emission reduction measures necessary to meet both the "gap-closure" and "absolute" targets of the NEC directive and not just the "target value" of the ozone daughter directive.

[38] This estimate is based on the analysis carried out in the 5th Interim Report by IIASA.

Additional local measures

The national emission ceilings proposal is designed to ensure *inter alia* that the target value for ozone is met cost-effectively over as much of the Community as possible. However, specific local conditions may in some cases require additional local measures to be implemented if the target values are to be met.

Since the need for local measures will depend largely on very local circumstances it is not possible to determine precisely which conurbations might be affected nor to give precise cost estimates. However, the case study for Athens and Stuttgart revealed large differences in local emission reduction potential between the two cities. These results are likely to be transferable to similar conditions elsewhere in the Community.

In Stuttgart, where air masses change frequently, the additional abatement potential beyond the measures proposed in the EC-wide ozone strategy is quite limited. In Athens, which is surrounded by mountains and where the climate favours local ozone production, the potential is greater. In both cases, costs for additional local action to meet the target values would mostly relate to structural and economic measures, such as changes in transport infrastructure, shifts in modal split and reduced traffic congestion. These changes would also produce substantial benefits in other respects.

The Commission considers that the cost of additional local measures is probably very small compared with the estimated cost of the national emission ceilings, and at any rate below 10% of the total cost of the interim ozone objective.

6.3 Economic evaluation of benefits

Reduced emissions of SO_2, NO_x, VOC and NH_3 and the consequent reductions in concentrations and depositions of these pollutants as well as ozone concentrations will produce benefits (avoided adverse effects) for human health, materials and buildings, cultural heritage, crops, forests, and terrestrial and aquatic ecosystems. As far as possible, the benefits resulting from the proposed national emission ceilings and the proposed ozone directive have been quantified in monetary terms[39]. A number of effects could not be quantified and monetised, including direct effects of NO_2 and VOC on health, effects on the historic and cultural heritage and the exceedance of critical loads and levels for ecosystems. It is important to be aware that the economic analysis of the proposals will not be able to reflect a substantial part of the benefits obtained through their implementation and that the economic estimates will tend to systematically underestimate the benefits. This applies notably to the benefits relating to reduced acidification of ecosystems, eutrophication and the effect of tropospheric ozone on ecosystems. Although the economic analysis is important to inform the decision on the choice of ambition level, this choice remains essentially a political one.

The most important effects in the monetary benefit analysis were therefore those relating to health and crops. In addition to morbidity effects (such as restricted activity days and bronchitis), the analysis considered the effects on mortality of short-term exposure (often called acute mortality) to ozone pollution and particulates formed from the primary pollutants. It also included the effects on mortality of long-term exposure to such particulates (often called chronic mortality). There is however some debate about the robustness of the functions used to assess the chronic effects of particulate matter. For this reason we give

[39] AEA Technology under sub-contract to IIASA "Economic evaluation of proposals for Emission Ceilings for Atmospheric Pollutants". The methodology largely follows that of the DG XII ExternE project.

two sets of figures below: one set which includes these chronic effects and one which excludes them.

A potentially significant element which has not been quantified is the effects on human health of chronic exposure to ozone. The research community generally agrees that these are of importance. However, given the shortage of adequate data on which to base quantitative estimates of these effects, they have not been included in the analysis.

The monetary values that should be attached to chronic and acute mortality impacts are difficult to assess and the subject of much debate. To indicate the range of results that can be derived from different assumptions, this study employs two different approaches: it considers the value of a statistical life (VOSL) and the value of a lost life year (VOLY).

The VOSL technique assesses the willingness-to-pay of individuals to reduce the risk of mortality. The result is an indicator of the importance that people attach to risk, and not an assessment of how valuable life is *per se*. Choosing a VOSL value for a particular study is difficult. The approach taken here used relatively conservative estimates of EUR 2.2 million as the VOSL for acute mortality effects and EUR 1.1 million for the VOSL for chronic mortality effects.

There has been some debate about the appropriateness of using the VOSL for cases where the reduction in life expectancy attributable to exposure is small. This will often be the case, for example, where pre-existing chronic respiratory or cardiac disease is a factor in death. An alternative approach is to attach a value to each life year lost (VOLY) as a result of premature mortality, thereby adjusting for the short life expectancy of those affected. The Commission's study uses a value of EUR 110 000 per life year lost for acute mortality and EUR 67 000 for chronic mortality[40].

However, it can be argued that the VOLY approach is inconsistent with the empirical evidence on the relation between age and willingness to pay to avoid risk. Rather than address the debate between VOSL and VOLY directly, the benefit assessment uses both approaches to indicate the sensitivity of the benefits analysis to this issue. Therefore, for both chronic and acute health effects there are two measures of the benefits, of which the lower estimates reflect the use of the VOLY approach and the higher estimates the VOSL[41] approach.

There are uncertainties in the benefits analysis, at most levels of the modelling. However the most significant sensitivities are the approach to valuation of mortality and the inclusion of values for chronic effects. Other factors are unlikely to have as significant an effect on the overall balance between costs and benefits. For example, though the inclusion of a threshold effect for acute mortality from ozone considerably reduces the direct benefits of reducing ozone concentrations, this has relatively little effect on the overall cost/benefit balance, as many of the health effects are related to the precursor gases and associated particulates.

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40 The figure for chronic effects is lower because chronic effects only arise many years in the future, and so are given a lower weight.

41 For a thorough discussion see: AEA Technology: Economic Evaluation of the Control of Acidification and Ground-Level Ozone. Interim Report for EC DG XI, August 1998, based on IIASA's 5th Report.

6.4 Monetised benefits of the proposed national emission ceilings

When all the effects which can be quantified are included, including chronic health effects, the total benefits are estimated to range from EUR 17 billion to EUR 32 billion per year. The valuation of mortality is the factor determining the wide range. The lower end of the benefit range is obtained if a low valuation of mortality (VOLY) is used for acute and chronic effects on mortality, and the high end if a high valuation of mortality (VOSL) is used.

Valuation of the other effects (morbidity, materials, agriculture etc) is unaffected by the way mortality is valued. Morbidity benefits account for EUR 2.3 billion, agriculture productivity improvements for EUR 1.8 billion, materials benefits for EUR 110 million and forest productivity benefits for EUR 140 million (the forest effect relates only to ozone pollution; the effects of acidification and eutrophication on forests are not considered).

For the Community as a whole, therefore, monetised benefits outweigh the estimated costs of the proposed national emission ceilings both when a low valuation of mortality (VOLY) and a high valuation of mortality (VOSL) is used.

If mortality related to chronic exposure to particulates is not assigned a value, the estimated monetary benefits of the proposed ceilings range from EUR 5.5 billion to EUR 16 billion per year. The large range here is again mainly due to the uncertainty in valuation of acute mortality. The benefits of reductions in acute mortality alone range from EUR 270 million to EUR 11 billion. The higher value is obtained if the VOSL approach is used and the lower if the VOLY approach is used. The majority of these benefits derive from reduced damage from fine particulate matter related to ozone precursors.

In conclusion, benefits substantially outweigh costs, except where the VOLY approach is used to value mortality and valuation of chronic effects of exposure to particulate matter is excluded. When these chronic effects are included, then benefits clearly outweigh costs irrespective of the way mortality is valued. Once again it must be emphasised that the economic analysis does not reflect some of the main goals of the proposal, e.g. the benefits of reduced damage to ecosystems.

The largest benefits were found to be in Germany, France, Italy, the UK, the Netherlands, Spain and Belgium. For all Member States except Belgium and Greece, the monetised benefits outweigh implementation costs even under the VOLY approach to valuing mortality – provided that chronic health effects are included. For Belgium and Greece, benefits outweigh costs when the VOSL approach is used to value mortality. A detailed breakdown of benefits by Member State and by impact (health, agriculture, etc.) is given in Annex I, Tables 10-12.

6.5 Monetised benefits of the proposed daughter Directive on ozone

The proposed ozone daughter directive only requires attainment of an absolute concentration level (ozone target value). According to earlier analysis, this limitation does not change the cost/benefit balance significantly.

The benefits associated with reducing ozone concentrations and precursor emissions (NO_x and VOC) only to reach the interim ozone objectives underpinning the proposed national emission ceilings are in the order of EUR 10 to 18 billion per year. As explained in subsection 6.3, the lower or upper range of the estimate is obtained depending on the approach used to evaluate acute and chronic effects on mortality (VOLY or VOSL). Morbidity benefits account for EUR 1.2 billion, agriculture productivity improvements for

EUR 1.9 billion, materials benefits for EUR 17 million and forest benefits for EUR 140 million. These benefits are not affected by the way mortality is valued.

As with the NEC proposal, if mortality related to chronic exposure to particulates is not assigned a value, the estimated monetary benefits of the proposed targets range from EUR 3 to 10 billion per year. The large range here is again mainly due to the uncertainty in valuation of acute mortality. The benefits of reductions in acute mortality range from EUR 180 million to EUR 7.3 billion. The higher value is obtained if the VOSL approach is used and the lower if the VOLY approach is used. The majority of these benefits derive from reduced damage from fine particulate matter related to ozone precursors.

In conclusion, and as with the NEC, benefits substantially outweigh costs, except where the VOLY approach is used to value mortality and valuation of chronic effects of exposure to particulate matter is excluded. When these chronic effects are included, then benefits clearly outweigh costs irrespective of the way mortality is valued.

6.6 Positive side-effects

The emission reductions envisaged under the proposed NEC directive would also deliver secondary benefits, by reducing other environmental problems caused by the same pollutants, such as poor air quality and climate change, or by prompting beneficial structural changes, e.g. in transport. For example:

- reductions in emissions of the primary pollutants would also help drive down concentrations of secondary particulates, CO, benzene and other harmful organic compounds. This is necessary to achieve the limit values set for most of these pollutants in other proposed daughter directives. Some but not all of these benefits are encompassed in the present analysis of monetary benefits;

- reducing the levels of tropospheric ozone also diminishes its contribution to the problem of global warming[42];

- just as emission reductions in non-member countries would benefit the Community, the reverse is also true; it is estimated that the population ozone exposure index averaged over all non-member countries in the UN-ECE region would fall by about 17% compared with the reference scenario; the gain in terms of reducing the ozone exposure of vegetation in non-member countries would be about 7%; in particular, neighbouring eastern countries (Poland, the Czech Republic and Hungary) could expect implementation of the proposed directive to lead to fewer exceedances of the ozone thresholds. There would also be some increase in the overall area protected against acidification and eutrophication.

7. INTERNATIONAL DIMENSION

SO_2, NO_x, NH_3 and VOC emissions in Community countries have environmental and human health impacts in non-Community countries, and vice versa. Action at Community level is therefore related to broader international activities, notably within the 1979 UNECE Convention on Long-range Transboundary Air Pollution (CLRTAP).

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[42] It is estimated that tropospheric ozone adds around 8% to the greenhouse warming potential of the other greenhouse gases such as CO_2 and halocarbons.

7.1 Accession countries

The UNECE/CLRTAP is the main forum through which the European Community and the Member States can influence and promote emission reductions in non-member countries. Further action in some of those countries has proven generally to be highly cost-effective. For example, a sensitivity analysis applying the interim objectives to the wider UNECE area and with measures optimised over the whole UNECE area produces an annual cost reduction for the Community from around EUR 7.5 billion to around EUR 5.5 billion, and an increase in control costs in non-Community UNECE States of around EUR 1.9 billion. It is in the Community interest also to seek an ambitious agreement in which the accession countries subscribe to substantial control of their acidifying, ozone precursor and eutrophying emissions beyond the business-as-usual case.

Once adopted, both the ozone air quality daughter directive and the national emission ceilings directive (and for that matter all the Community legislation in the reference scenario) will become part of the *acquis communautaire* at the time of accession. In due course, therefore, the accession countries will comply with these standards. (National emission ceilings and other arrangements for the applicant countries will have to be added to the NEC directive in the accession treaty for each country.)

At this stage, however, it would be premature to make assumptions about the further emission reductions which can be expected to derive from enlargement. Bearing in mind that further improvements towards the long-term objectives will in any case have to be made in due course, a suggested way forward is that these issues should be picked up in the review of the proposed directive on national emission ceilings planned for 2004.

7.2 UNECE negotiations on a new NO_x Protocol

The Commission and the Member States need to play an active and promoting role in the current CLRTAP negotiations for a new protocol on NO_x and related substances, which will set national emission ceilings for most UNECE countries. The multi-pollutant/multi-effect approach is the same as that used by the Commission in preparing the national emission ceilings proposal. It is important that the Community support the development of the protocol so as to ensure that the UNECE negotiations produce an outcome which contributes to the largest extent possible to Community environmental objectives. This would also constitute a first step towards harmonising the accession countries' environmental objectives with those of the Community.

However, it is not yet clear what ambition level the CLRTAP protocol will aim at, by what year its commitments will be implemented nor how many parties will eventually sign and ratify it. The Commission has therefore proposed a set of national emission ceilings which will achieve the interim environmental objectives for the Community assuming emission projections for non-member countries on a business-as-usual basis.

Eventually, in the context of the accession negotiations, the emission ceilings for the accession countries will have to be calculated on the same basis as for the present Member States. The impact of enlargement, as well as the adoption and eventual ratification/entry into force of the CLRTAP protocol, should be assessed in the planned review of the proposed directive in 2004.

7.3 CLRTAP 1994 SO_2 Protocol

The 1994 SO_2 Protocol was developed using the so-called critical loads approach, i.e. using integrated assessment models to develop an effects-based and cost-effective European strategy for emission reduction. It sets differentiated sulphur emission ceilings for the contracting parties. Eleven Member States and the European Community have ratified the Protocol, which entered into force in 1998.

7.4 CLRTAP 1991 VOC Protocol

The Protocol on the Control of Emissions of Volatile Organic Compounds or their Transboundary Fluxes was adopted in November 1991 and entered into force in September 1997. At its signature the European Community made the following statement:

"The European Economic Community, taking account in particular of the alternatives available to its Member States in application of Article 2(2) of the Protocol, hereby declares that its obligations under the Protocol with regard to the objectives for reducing VOC emissions may not be greater than the sum of the obligations entered into by its Member States which have ratified the Protocol."

As of December 1998, 11 Member States had ratified the Protocol. The Community obligation to reduce VOC emissions in accordance with the above statement would imply that total emissions from these eleven countries should be reduced from 13 million tonnes (base year emissions) to 9.1 million tonnes by 1999. However, in 1996 these countries' emissions still totalled 11.4 million tonnes, a reduction of about 14% and considerably short of the 30% reduction to be achieved by 1999. With existing and adopted Community legislation, total Community emissions are set to fall to around 7.1 million tonnes in 2010 (down 47% on 1990 levels). However, the full impact of these instruments will not have fed through by the end of 1999.

Since compliance with the Protocol's commitments by 1999 appears uncertain, the Commission has not at this stage proposed its ratification, which would otherwise have been a natural step. In the present situation the Commission considers that the focus for Community efforts will have to be the longer time frame of 2010 considered in the on-going negotiations under the CLRTAP, which will establish more stringent VOC reductions than the 1991 Protocol.

7.5 International maritime transport

Technical analysis clearly shows reduction of ship emissions to be cost-effective compared with further measures on land-based sources[43]. To examine the potential impact the control of ship emissions might have on the emission ceilings, a very rough scenario was constructed which considered the potential for control of SO_2 and NO_x from ships. The results show that the use in ships of heavy fuel oil with 1.5% sulphur and the use of selective catalytic reduction technologies to control NO_x emissions cut the overall costs by 11%, i.e. around EUR 800 million per year. The cost of emission control for ships would amount to nearly EUR 200 million per year.

[43] 7th Interim Report from IIASA.

Further action to limit the sulphur content of bunker fuel may be considered in the International Maritime Organisation (IMO) in the near future. At present, though, such action is only foreseen for ship traffic in the Baltic Sea. Even if it is decided under IMO to take further action relating to ship traffic in the North Sea, and possibly other European sea areas, the lead time for IMO measures to enter into force is at least 5-10 years.

The Council conclusions on the acidification strategy, as well as a declaration in relation to the adoption of a common position on the directive relating to sulphur in liquid fuels, firmly supported action by the Member States and the Commission to have the North Sea and, if justified, other sea areas designated SO_2 control areas under MARPOL. The Commission intends to pursue this issue in co-operation with the Member States, although new control areas cannot be formally adopted until the air pollution annex has entered into force.

In parallel with efforts to secure appropriate international action under IMO, the Commission will explore the scope for effective action by the Community. Any concrete action to control ship emissions should be taken into account when the NEC directive is first reviewed in 2004. However, as assumptions about the extent of such measures and their time frames can only be speculation at present, the proposed national emission ceilings are set so as to achieve the interim environmental objectives for the Community assuming no new measures to reduce ship emissions of air pollutants.

8. REVIEW

The Commission will be reporting to the Council and Parliament on both the national emission ceilings directive and the daughter directive on ozone in 2004. Both reports will allow for review of provisions in the directives. Further reports will follow in later years.

The national emission ceilings directive report will be based on reports from the Member States, along with other relevant information and assessments. The Commission may propose modifications of the emission ceilings and measures to ensure compliance with the ceilings and it may suggest further emission reductions. The report must also include an economic assessment, including cost-effectiveness, benefits, an assessment of marginal costs and benefits, impact on competitiveness and the expected socio-economic impact in the different Member States of the implementation of the national emission ceilings.

The report on the ozone daughter directive will take into account new scientific information on the effects of ozone on human health and the environment, as well as technological developments, including what is expected to be delivered under the Fifth Programme for Research and Technological Development. Further research into the effects of ozone on both human health and vegetation was also recommend by the CSTEE. In particular, the committee recommended more research into the possible chronic effects of long-term ozone exposure on human health and into the possible additive/synergistic effects of ozone with other pollutants which are frequently present at the same time. They noted especially PM10 particulates but also expressed concern about sulphur dioxide, nitrogen oxides and other co-pollutants. The committee suggested investigating the relative merits of using AOT values, threshold exceedance values or another parameter, not simply as modelling parameters but as potential legislative targets to protect human health from ambient air pollutants. Where vegetation is concerned CSTEE noted that additional information on the sensitivity of different species and on local environmental factors might in future enable targets to be varied from place to place whilst achieving equivalent levels of protection. They considered that more research is needed on reactions of ozone with or passage through

plasma membranes and that the development of endpoints more sensitive and accurately measurable than reduction in biomass should be encouraged.

As part of the report on ozone the Commission will consider whether further progress should be made towards full compliance with the WHO air quality guidelines for ozone and, if so, by what means.

A number of other reports or reviews relating to air quality are also envisaged over the next few years. For example, a report on the application of the proposed daughter directive on SO_2, NO_2, PM and lead[44] is required before the end of 2003, while a report on progress towards meeting the objectives of the Community acidification strategy is to be made by the end of 2004. Further proposals on additional pollutants and proposals to reduce polluting emissions from the various sources continue to be developed.

There are many important links between these activities, whether in terms of data collection, modelling, or the identification of control measures. There may also be opportunities to develop optimised strategies by investigating pollutants simultaneously and by looking at both the regional and local dimensions. A wider programme and strategy for improving air quality, including acidification and eutrophication, is therefore proposed. Such an approach would bring together the many elements of the Community's actions on air quality and present a consistent assessment of objectives and implementation strategies. The Commission services have invited Member State experts and other stakeholders to contribute actively to an open discussion on how to move forward in the longer term. These ideas are incorporated in Article 11 of the proposal for the ozone daughter directive as an explicit commitment for the Commission.

[44] COM(97) 500.

Table 1. National emission ceilings (to be achieved by 2010) resulting from the central scenario (H1) and estimated implementation costs (million euro per year)

Country	SO_2 Kilotonnes	NO_x Kilotonnes	VOC Kilotonnes	NH_3 Kilotonnes	Total Costs
Austria	40	91	129	67	119
Belgium	76	127	102	57	1 053
Denmark	77	127	85	71	5
Finland	116	152	110	31	0
France	218	679	932	718	916
Germany	463	1 051	924	413	2 146
Greece	546	264	173	74	338
Ireland	28	59	55	123	44
Italy	566	869	962	430	403
Luxembourg	3	8	6	7	5
Netherlands	50	238	156	104	971
Portugal	141	144	102	67	57
Spain	746	781	662	353	22
Sweden	67	152	219	48	87
UK	497	1 181	964	264	1348
EC15	3 634	5 923	5 581	2 827	7 514

Table 2. Ecosystems where critical loads for acidification are exceeded. The situation in 1990, in 2010 according to the reference scenario (REF), and after implementation of the national emission ceilings (NEC)

Country	**Unprotected ecosystem area % 1990**	**Unprotected ecosystem area % 2010 (REF)**	**Unprotected ecosystem area % 2010 (NEC)**
Austria	47.6	3.3	2.0
Belgium	58.4	22.1	7.4
Denmark	13.8	2.3	1.5
Finland	17.2	4.3	4.2
France	25.8	0.7	0.3
Germany	79.5	15.8	7.1
Greece	0.0	0.0	0.0
Ireland	10.7	1.3	1.0
Italy	19.6	0.7	0.6
Luxembourg	66.7	5.9	0.9
Netherlands	89.3	60.4	23.7
Portugal	0.0	0.0	0.0
Spain	0.9	0.2	0.2
Sweden	16.4	4.1	3.7
UK	43.0	12.3	6.8
EC15	24.7	4.3	2.9

Table 3. Health-related ozone load estimated by AOT60 exposure index[45]. The situation in 1990, in 2010 according to the reference scenario (REF), and after implementation of the national emission ceilings (NEC)

	Cumulative population exposure (million person.ppm.hours)			
	1990	2010 (REF)	2010 (NEC)	% reduction REF → NEC
Austria	16	3	2	- 33%
Belgium	71	34	23	- 32%
Denmark	9	3	1	- 67%
Finland	0	0	0	0%
France	310	89	53	- 40%
Germany	405	140	99	- 29%
Greece	7	4	2	- 50%
Ireland	3	1	0	- 100%
Italy	183	63	38	- 40%
Luxembourg	3	1	1	- 0%
Netherlands	73	38	27	- 29%
Portugal	16	8	6	- 25%
Spain	35	7	4	- 43%
Sweden	4	0	0	- 0%
UK	125	77	45	- 42%
EC15	1 260	468	301	- 36%

[45] The index is calculated by multiplying the AOT60 value for each grid cell with the population in the same grid cell belonging to the respective country.

Table 4. Vegetation-related ozone load estimated by vegetation (AOT40) exposure index[46]. The situation in 1990, in 2010 according to the reference scenario (REF), and after implementation of the national emission ceilings (NEC)

	Cumulative vegetation exposure index (million hectares.excess ppm.hours)			
	1990	2010 (REF)	2010 (NEC)	% reduction REF → NEC
Austria	468	257	213	- 17%
Belgium	177	141	115	- 18%
Denmark	141	53	36	- 32%
Finland	0	0	0	0%
France	4 158	2 345	1 816	- 23%
Germany	2 344	1 204	943	- 22%
Greece	231	170	137	- 19%
Ireland	25	8	3	- 62%
Italy	1 773	1 186	996	- 16%
Luxembourg	25	14	11	- 21%
Netherlands	109	79	63	- 20%
Portugal	379	274	233	- 15%
Spain	2 037	1 281	1 093	- 15%
Sweden	116	18	9	- 50%
UK	192	153	96	- 37%
EC15	12 175	7 183	5 764	- 20%

[46] The cumulative vegetation exposure index is calculated as the excess AOT40 multiplied by the area of ecosystems exposed to the excess concentration. The index is calculated on a grid resolution, with reference to agricultural land, natural vegetation and forest areas. The index is based on rural ozone concentrations.

Table 5. Eutrophication. Ecosystems where critical nutrient loads are exceeded. The situation in 1990, in 2010 according to the reference scenario (REF), and after implementation of the national emission ceilings (per cent of total ecosystem area)

Country	Unprotected ecosystem area % 1990	Unprotected ecosystem area % 2010 (REF)	Unprotected ecosystem area % 2010 (NEC)
Austria	90.0	57.6	46.5
Belgium	100	96.4	83.4
Denmark	63.0	37.6	28.9
Finland	45.0	15.4	13.1
France	92.0	79.2	70.9
Germany	99.0	89.5	72.9
Greece	12.0	9.6	8.6
Ireland	10.0	6.4	5.9
Italy	49.0	31.7	28.8
Luxembourg	100	91.3	75.1
Netherlands	98.0	91.0	87.0
Portugal	32.0	25.1	24.2
Spain	28.0	13.6	11.3
Sweden	14.0	4.7	3.9
UK	11.0	1.4	0.7
EC15	55.0	40.2	34.9

Table 6. Summary of the interim environmental objectives for scenarios H1, H2 and H3

	Low ambition (H2)	Central scenario (H1)	High ambition (H3)
Acidification			
Gap closure on accumulated excess acidity	90%	95%	95%
Maximum excess deposition over two percentile critical load for acidity	(900 eq/ha)	(850 eq/ha)	800 eq/ha
Health-related ozone			
Gap closure on AOT60	60%	67%	70%
Maximum AOT60, to be achieved in four out of five years	3.0 ppm.h	2.9 ppm.h	2.8 ppm.h
Vegetation-related ozone			
Gap closure on AOT40	30%	33%	35%
Maximum excess AOT40, mean over five years	10.5 ppm.h	10 ppm.h	9.5 ppm.h

Table 7. Costs of single-effect scenarios with same objectives as H1[47]

EC15	SO_2 EUR million	NO_x/VOC EUR million	NH_3 EUR million	Total costs EUR million
Scenario with acidification objectives only	942	464	2 240	3 646
Scenario with ozone objectives only	0	4 280	0	4 280
Central scenario (joint analysis)	860	4 508	2 146	7 514

Table 8. Additional cost of implementing the proposed Directive on national emission ceilings (million euro per year)

	SO_2	NO_x/VOC	NH_3	Total
Austria	0	119	0	119
Belgium	127	459	467	1 053
Denmark	5	0	0	5
Finland	0	0	0	0
France	136	739	41	916
Germany	244	1 048	854	2 146
Greece	0	338	0	338
Ireland	20	4	20	44
Italy	0	403	0	403
Luxembourg	1	4	0	5
Netherlands	19	211	741	971
Portugal	0	57	0	57
Spain	9	13	0	22
Sweden	0	87	0	87
UK	299	1 026	23	1 348
EC15	860	4 508	2 146	7 514

[47] The additional cost (on top of REF) of meeting the interim acidification objective is reduced in comparison with the analysis carried out for the acidification strategy. This reflects changes both in the input data and the modelling approach. Input data such as critical loads, cost curves and the reference scenario have been refined and updated. The compensation mechanism which allows a limited shortfall of the objective in the most difficult grid cells (see subsection 2.4) reduces the use of the most expensive measures in the cost curves.

Table 9. Additional cost per Member State of reducing ozone precursors (million Euro per year)

NO_x/VOC	
	Cost on top of REF
Austria	120
Belgium	459
Denmark	0
Finland	0
France	719
Germany	933
Greece	363
Ireland	0
Italy	420
Luxembourg	30
Netherlands	140
Portugal	57
Spain	10
Sweden	73
UK	957
EC15	4 281

Table 10. Total benefits for the H1 scenario under different sensitivities, with and without chronic mortality included. All results are in millions of Euro per year and are rounded to two significant figures

	without chronic effects on mortality		with chronic effects on mortality	
Country	VOLY	VOSL	VOLY	VOSL
Austria	130	390	440	790
Belgium	240	730	860	1 600
Denmark	36	95	110	190
Finland	8	26	23	46
France	1 300	3 200	3 500	6 100
Germany	1 200	3 700	4 400	8 000
Greece	110	260	230	390
Ireland	23	56	57	110
Italy	1 000	2 700	2 800	4 700
Luxembourg	36	140	160	300
Netherlands	390	1 200	1 500	2 700
Portugal	65	190	180	330
Spain	320	810	820	1 400
Sweden	39	130	140	260
United Kingdom	680	2 300	2 300	4 700
Totals	5 500	16 000	17 000	32 000

Table 11. Total benefits under the H1 scenario in each impacts category, when mortality is valued using value of statistical life (VOSL). All results are in millions of Euro per year and are rounded to two significant figures.

H1 Country	Morbidity	[48]Acute mortality	Chronic mortality	Materials	Agric.	Forests	Visibility	[48]Total VOSL
Austria	59	270	520	2	21	12	24	790
Belgium	120	510	1 000	9	43	6	44	1 600
Denmark	13	61	120	0	14	0	7	190
Finland	3	18	24	0	1	2	2	46
France	420	2 000	3 600	14	590	51	170	6 100
Germany	610	2 600	5 300	22	200	38	220	8 000
Greece	22	150	190	0	78	1	7	390
Ireland	7	34	59	1	8	0	6	110
Italy	330	1 700	3 000	5	500	9	120	4 700
Luxembourg	24	110	210	1	0	0	8	300
Netherlands	210	840	1 800	14	74	1	74	2 700
Portugal	22	130	190	0	25	6	9	330
Spain	94	510	830	2	160	7	39	1 400
Sweden	18	90	160	1	3	5	10	260
United Kingdom	330	1 700	2 700	41	110	3	150	4 700
Total	2 300	11 000	20 000	110	1 800	140	890	32 000

[48] Totals in final column are less than the sum of the other columns as some elements of acute effects on mortality cannot be combined with chronic mortality estimates because this would involve some double counting. However, the sensitivity analysis undertaken in the study required a full quantification of both acute and chronic effects on mortality.

Table 12. Total benefits under the H1 scenario in each impacts category, when mortality is valued using value of life years (VOLY). All results are in millions of Euro per year and are rounded to two significant figures.

H1 Country	Morbidity	[49]Acute mortality	Chronic mortality	Materials	Agric.	Forests	Visibility	[49]Total VOLY
Austria	59	7	320	2	21	12	24	440
Belgium	120	13	630	9	43	6	44	860
Denmark	13	2	71	0	14	0	7	110
Finland	3	0	15	0	1	2	2	23
France	420	50	2 200	14	590	51	170	3 500
Germany	610	64	3 300	22	200	38	220	4 400
Greece	22	4	120	0	78	1	7	230
Ireland	7	1	36	1	8	0	6	57
Italy	330	42	1 800	5	500	9	120	2 800
Luxembourg	24	3	130	1	0	0	8	160
Netherlands	210	21	1 100	14	74	1	74	1 500
Portugal	22	3	120	0	25	6	9	180
Spain	94	13	500	2	160	7	39	820
Sweden	18	2	98	1	3	5	10	140
United Kingdom	330	42	1 600	41	110	3	150	2 300
Total	2 300	270	12 000	110	1 800	140	880	17 000

[49] Totals in final column are less than the sum of the other columns as some elements of acute effects on mortality cannot be combined with chronic mortality estimates because this would involve some double counting. However, the sensitivity analysis undertaken in the study required a full quantification of both acute and chronic effects on mortality.

Figure 1. Acidification. Percentage reduction of unprotected ecosystem area achieved by H1 scenario compared with 1990 levels (by grid cell)

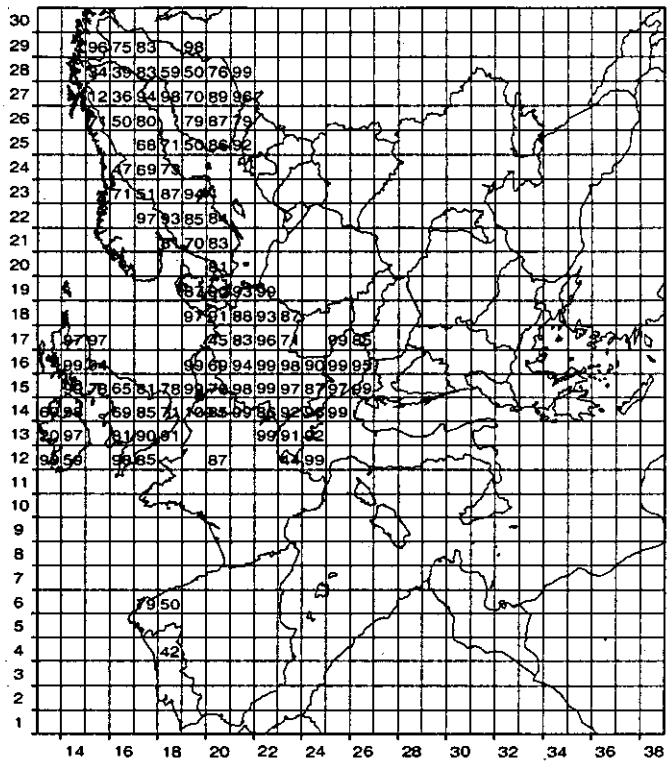


Figure 2. Acidification. Percentage of ecosystems with acid deposition in excess of critical loads after implementation of H1

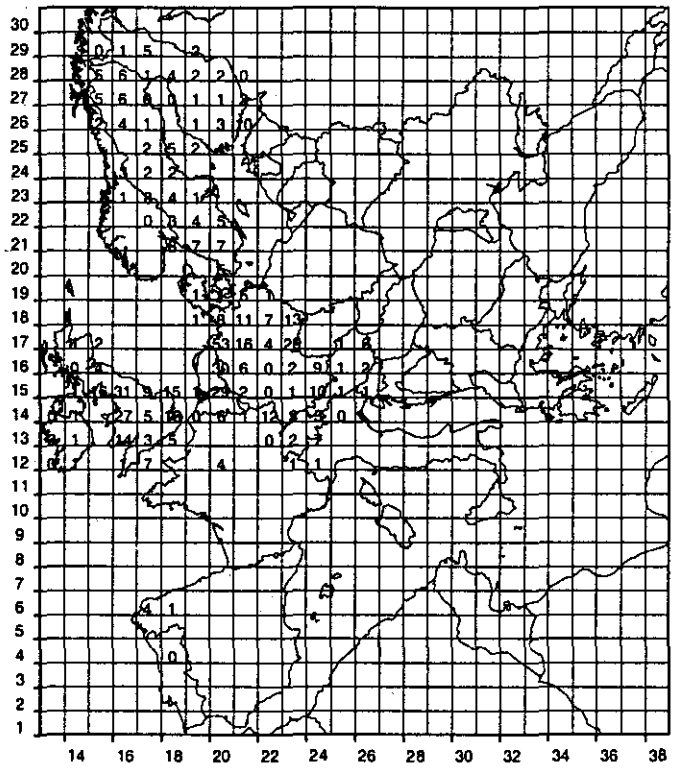


Figure 3. Health-related ozone. Percentage reduction of the AOT60 achieved by the H1 scenario, compared with 1990

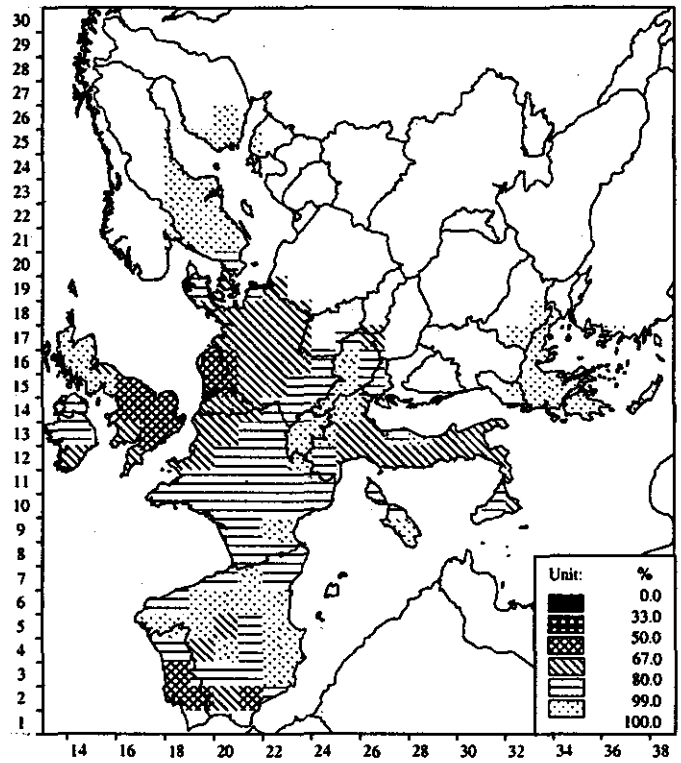


Figure 4. Vegetation-related ozone. Percentage reduction of the excess AOT40 achieved by the H1 scenario, compared with 1990

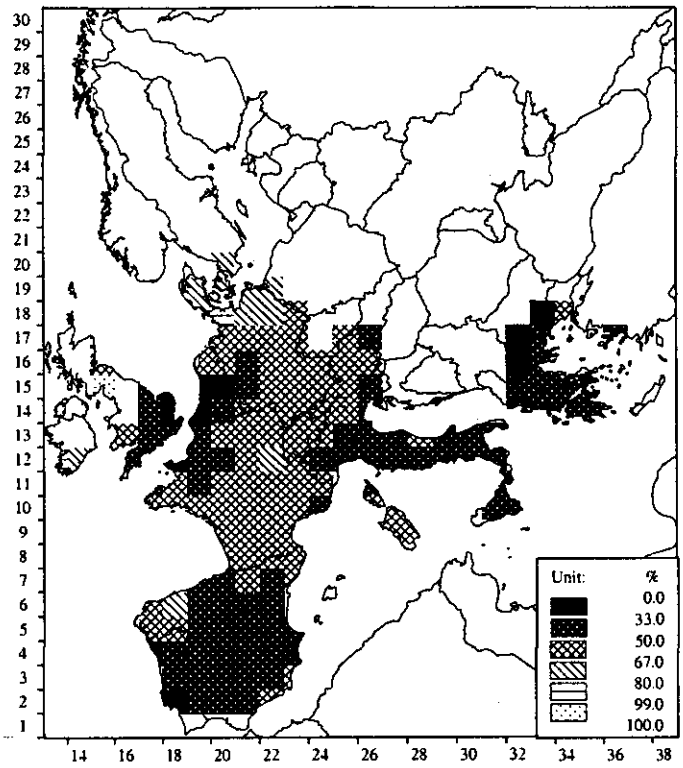


Figure 5. Eutrophication. Gap closure in terms of accumulated excess nitrogen deposition achieved by the emission reductions of the H1 scenario

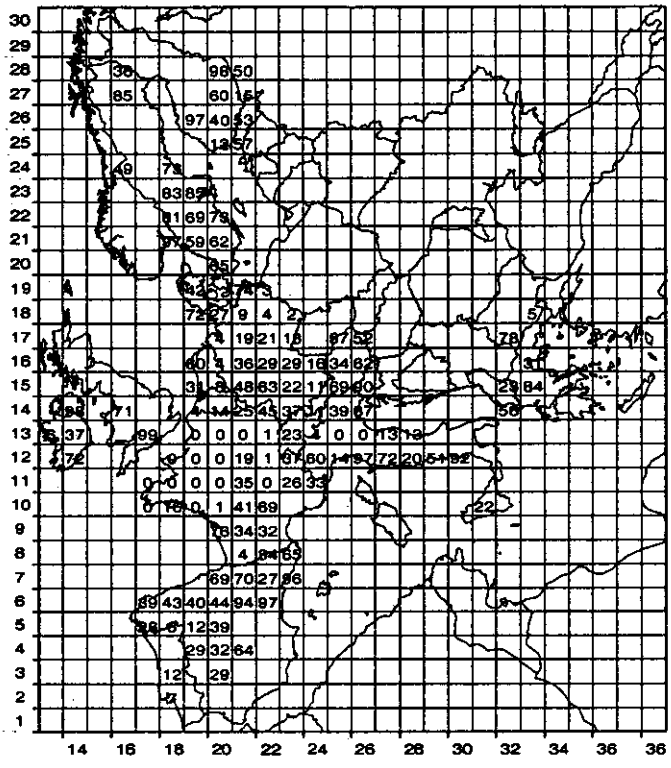


Figure 6. Critical loads: Acidification

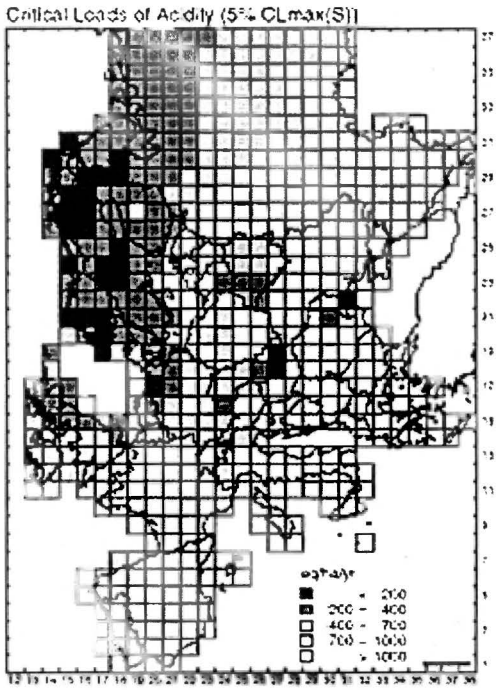


Figure 7. Critical loads: Eutrophication

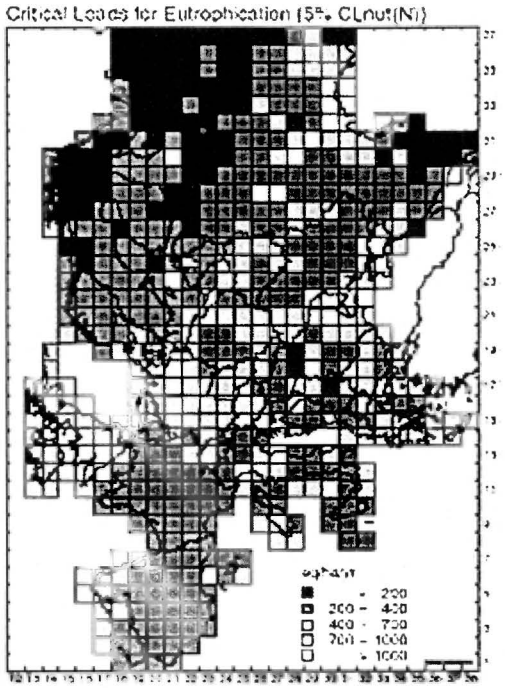


Figure 8. Health-related ozone load. Cost-effectiveness of scenarios H1, H2 and H3 in relation to changes in the cumulative population exposure index

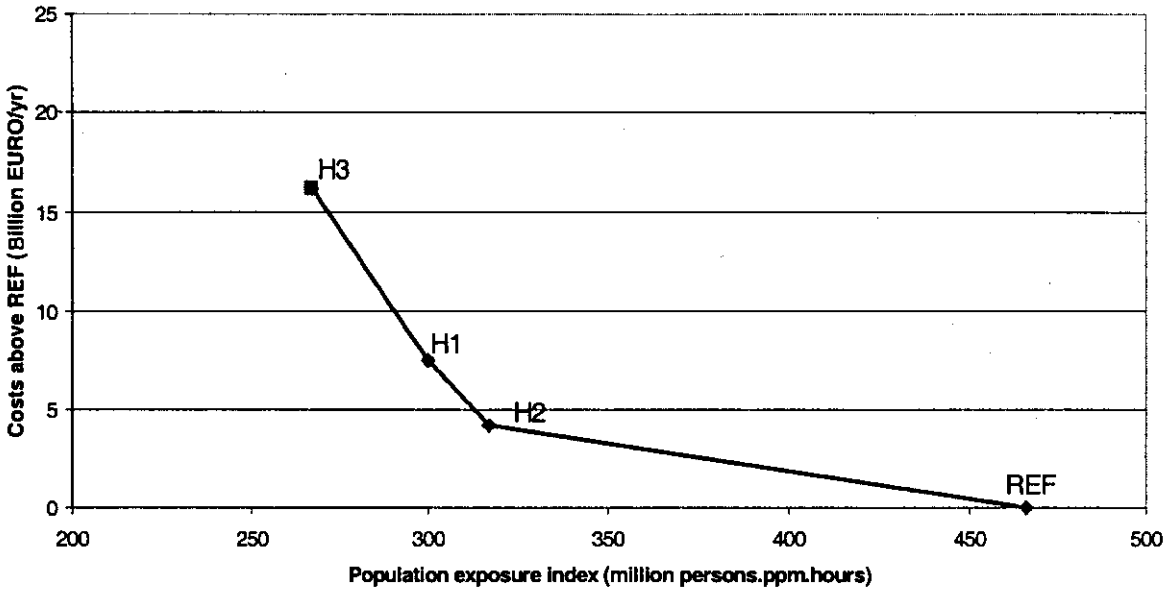


Figure 9. Vegetation-related ozone load. Cost-effectiveness of scenarios H1, H2 and H3 in relation to changes in the cumulative vegetation exposure index.

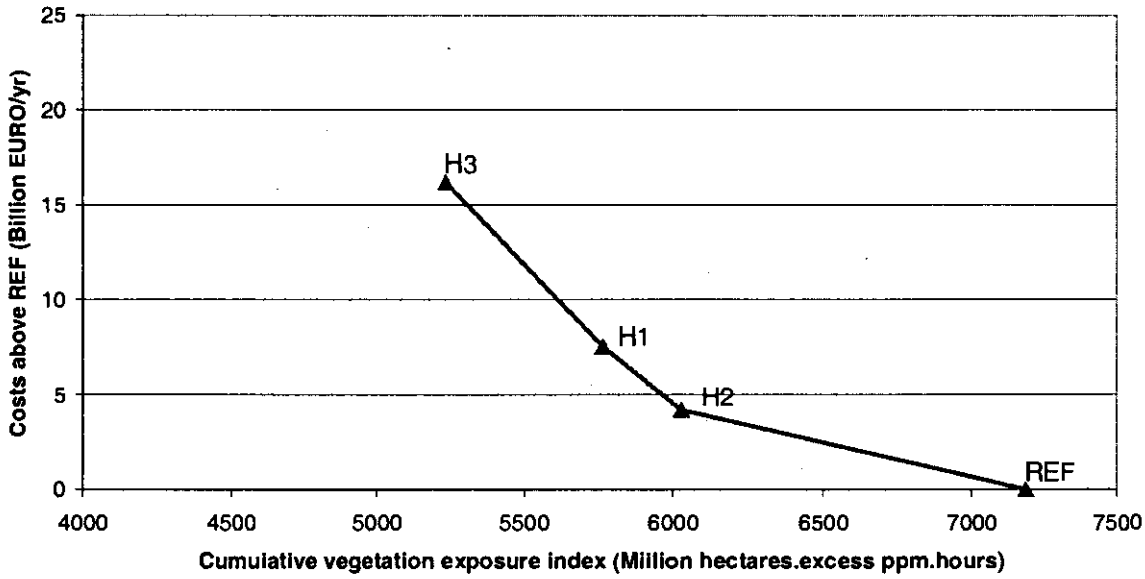


Figure 10. Acidification. Cost-effectiveness of scenarios H1, H2 and H3 in relation to the ecosystem area unprotected against acidification.

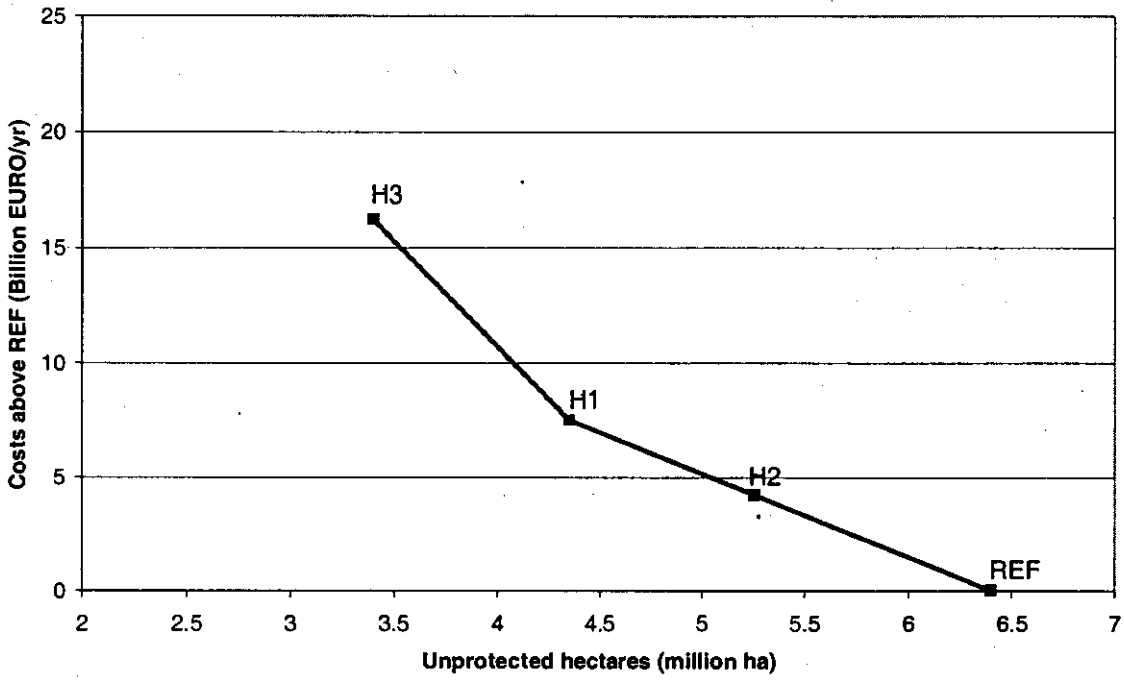


Figure 11. Soil eutrophication. Cost-effectiveness of scenarios H1, H2 and H3 in relation to the ecosystem area unprotected against eutrophication.

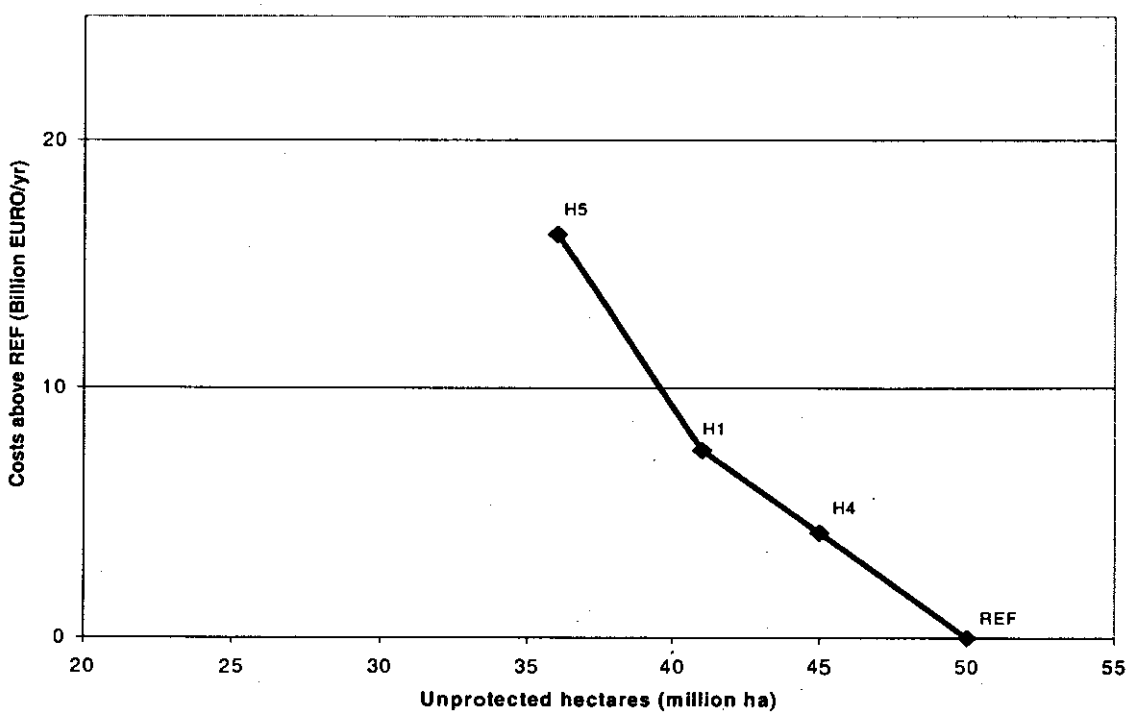


Figure 12. Grid cells where in the H1 scenario the acidification objective is exceeded (black), and grid cells where this shortfall is compensated (grey)

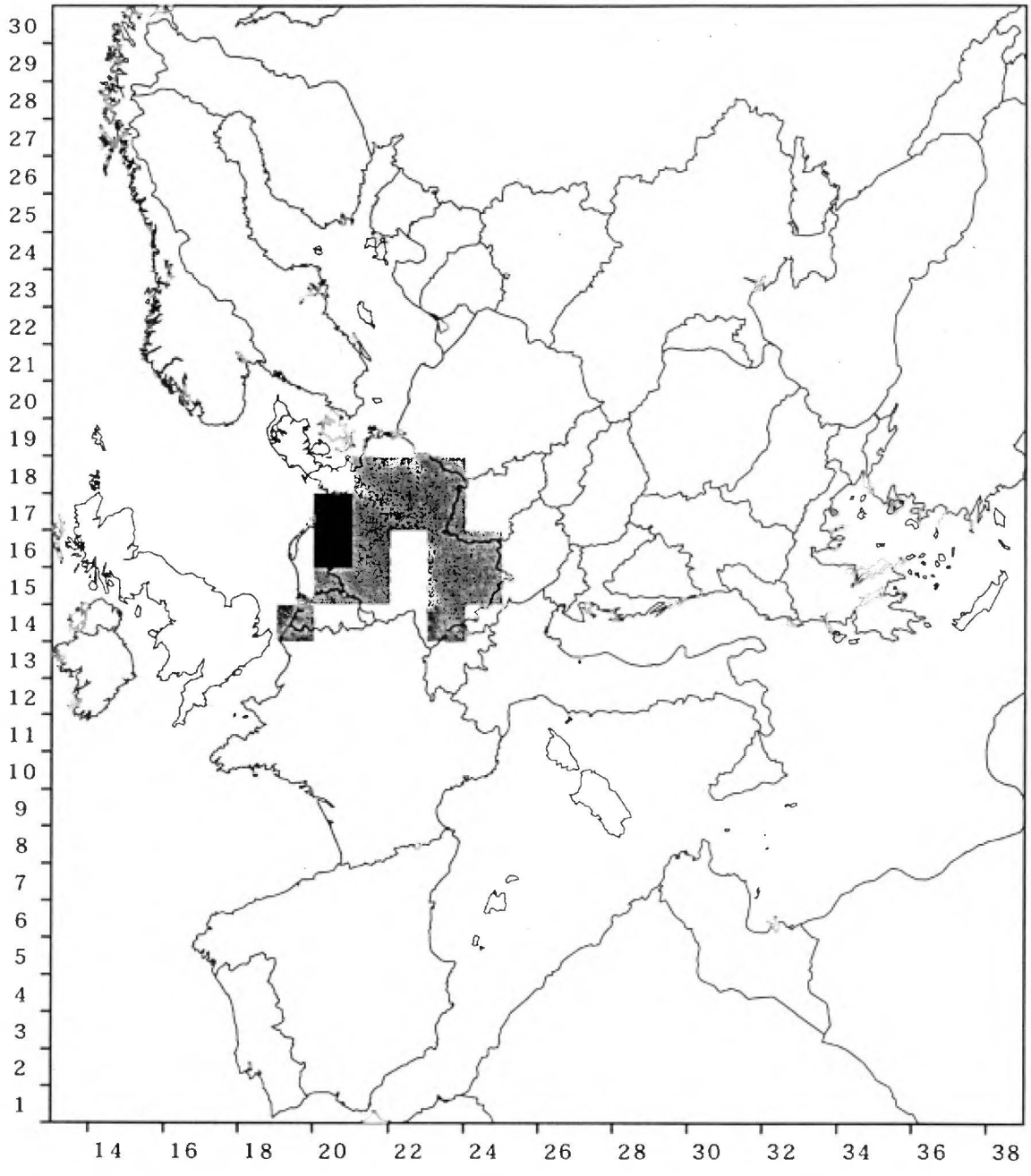


Figure 13. Grid cells where in the H1 scenario the health-related ozone objectives (AOT60) are exceeded in at least one year (black), which are compensated in other years in the same grid, or compensated in other grids (grey)

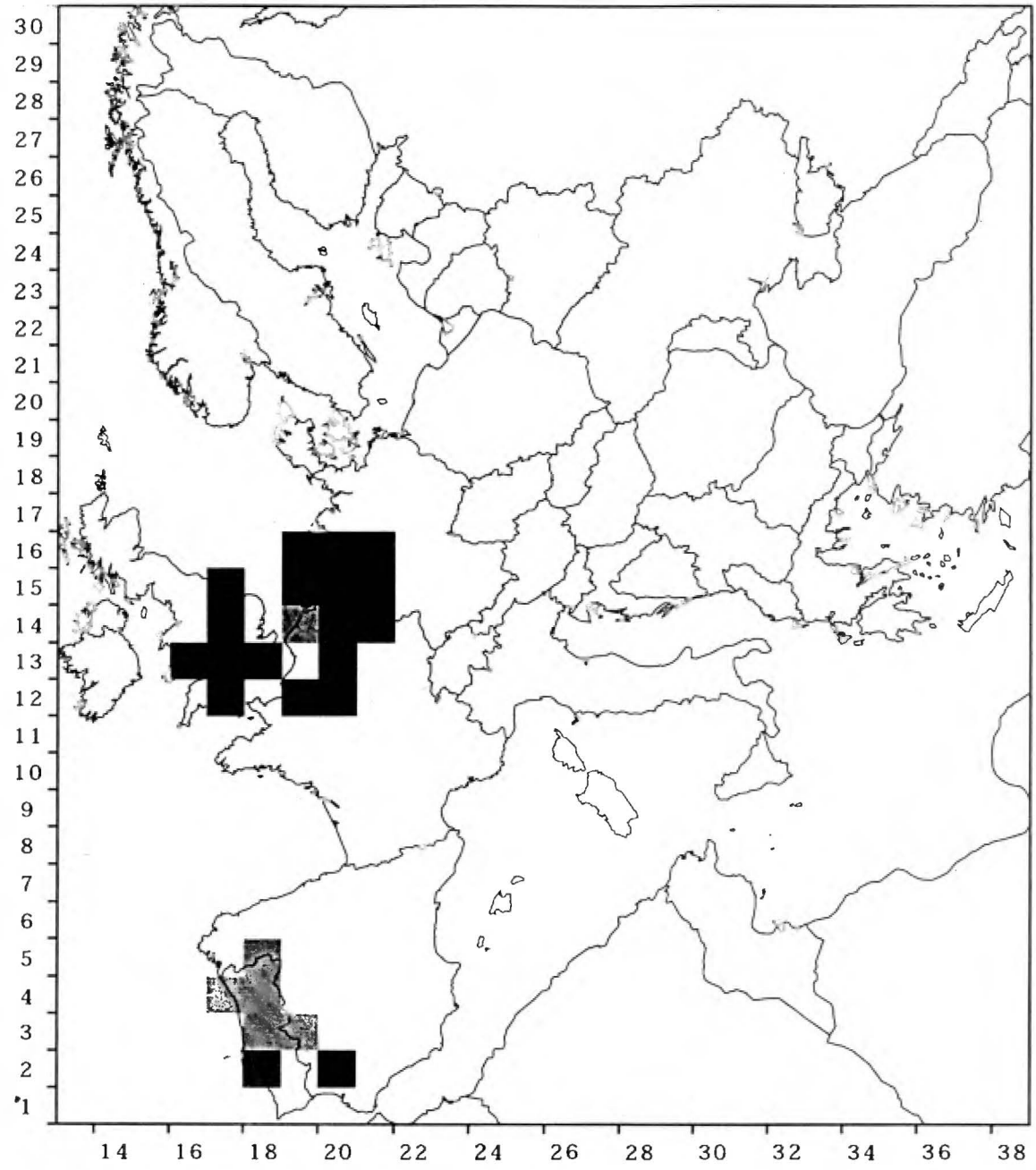


Figure 14. Grid cells where in the H1 scenario the vegetation-related ozone objectives (AOT40) are exceeded (black) and compensated (grey)

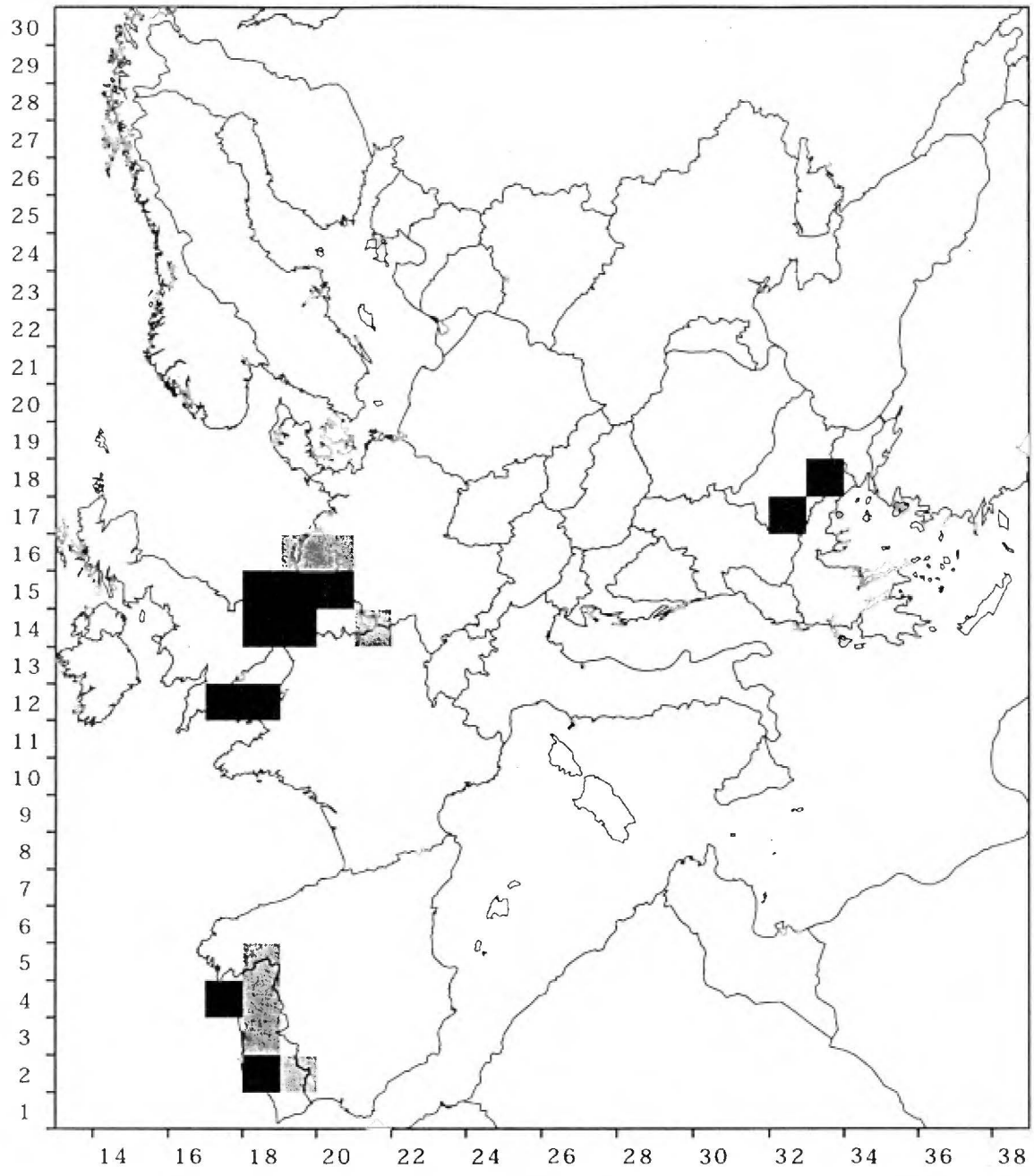


Figure 14. Grid cells where in the H1 scenario the vegetation-related ozone objectives (AOT40) are exceeded (black) and compensated (grey)

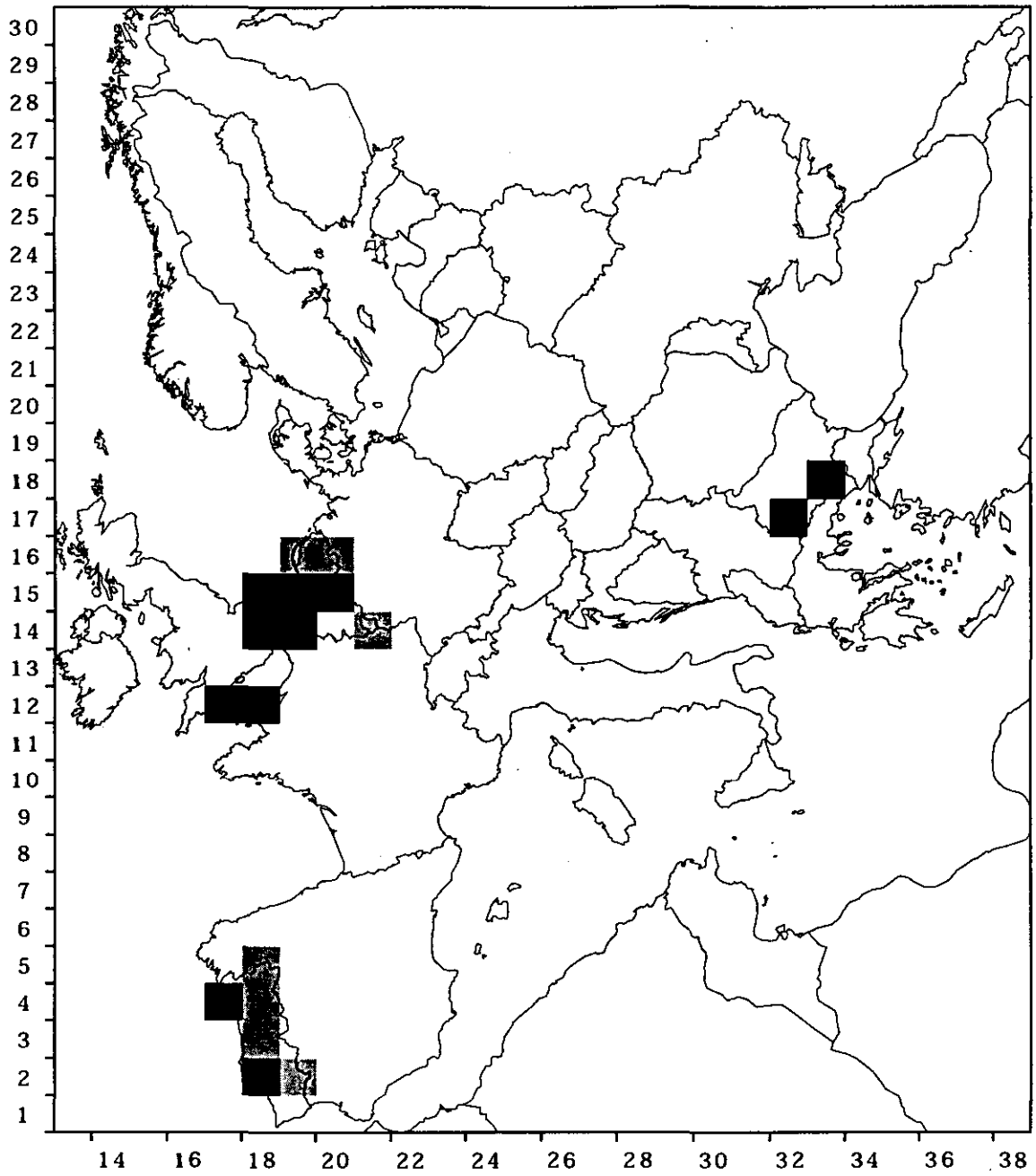


Figure 15. Grid cells for which no acidification objectives were specified in the H1 scenario

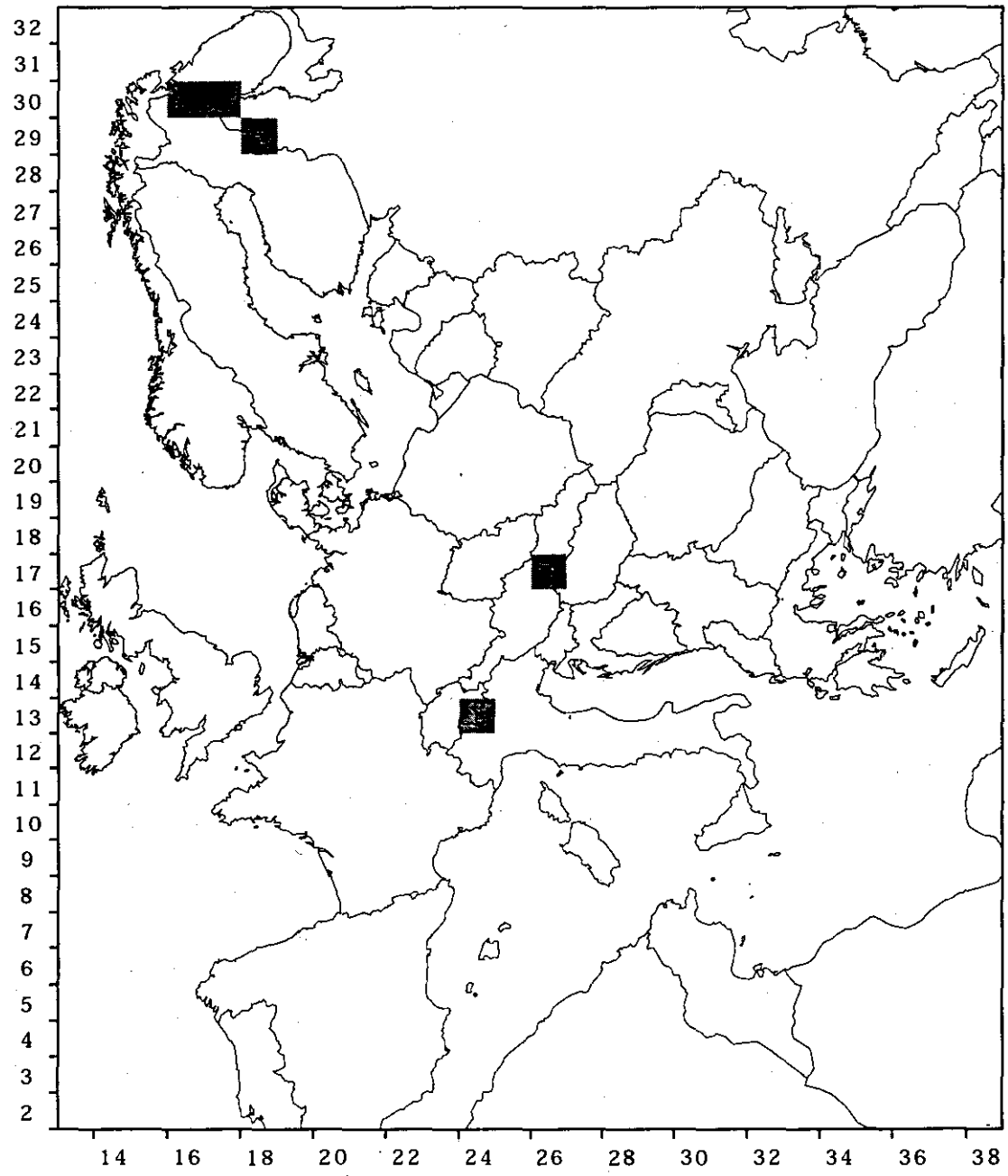


Figure 16. Grid cells where the environmental objectives are most difficult to attain

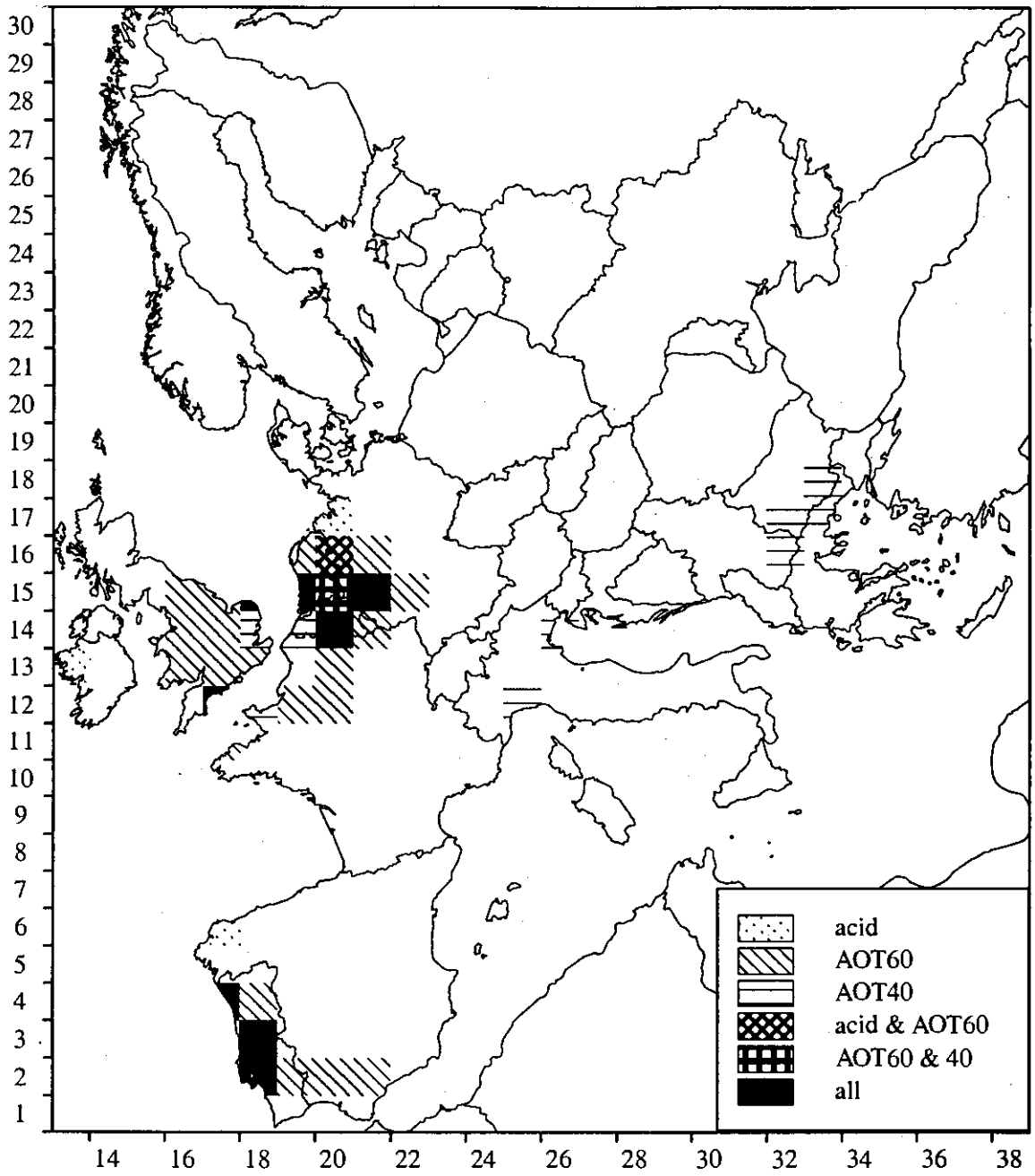
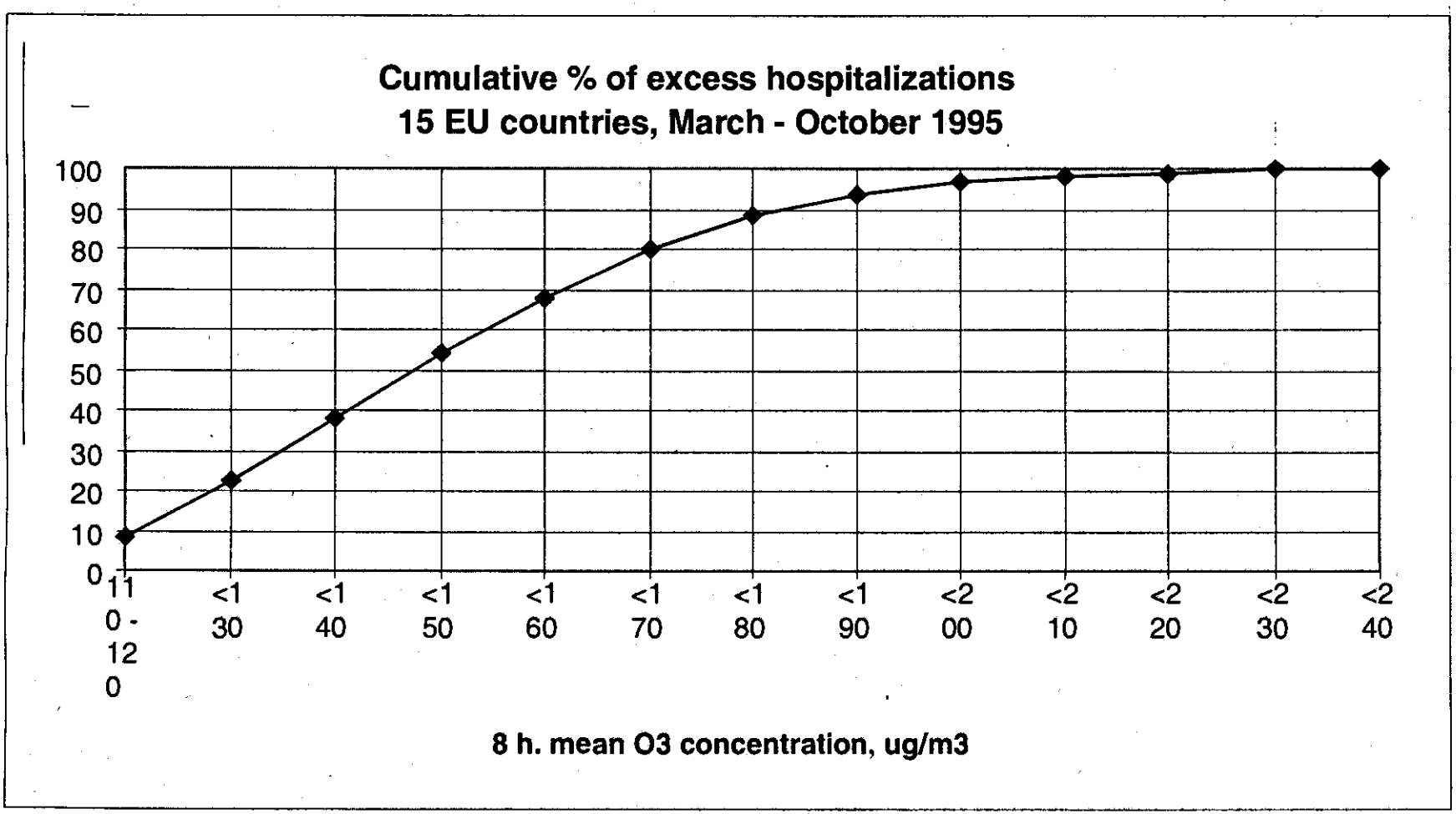


Figure 17. Cumulative distribution of the percentage of excess hospitalisations due to ozone exposure in the EU15 (March-October, 1995), source: WHO - ECEH



ANNEX II

EXPLANATION OF THE DETAILED PROVISIONS OF THE PROPOSED DAUGHTER DIRECTIVE ON OZONE

Article 1: Explains the purpose of the proposal.

Article 2: All the definitions of the Air Quality Framework Directive also apply in respect of this daughter directive. Article 2 adds definitions necessary for interpreting the daughter Directive, including definitions of the long-term objective and the information threshold.

Article 3: New ozone target values will be set to protect human health and the environment. They are to be met by 2010. Compliance with the target values will therefore be assessed as from that year, involving a number of subsequent years according to the averaging period defined for the particular target value. The Article also specifies what action must be taken if the target values are not attained. This includes a requirement to prepare and implement plans covering other pollutants.

Article 4: Requires Member States to specify zones and agglomerations which meet the target value, but do not comply with the long-term objectives set under this same Article. It also requires Member States to aim to achieve the long-term objectives as far as possible.

Article 5: Requires Member States to specify the zones and agglomerations where the long-term objectives are attained and to preserve this status.

Article 6: Requires Member States to ensure that up-to-date information on ozone concentrations and relevant precursor substances is readily available to the public. This information should be accompanied by a short assessment of exceedances of the thresholds set in the proposal and a few additional reference levels specified in Annex II. Paragraph 2 establishes an information threshold and an alert threshold, exceedance of which requires Member States to issue health-related advice to the population groups concerned. Details are set out in Annex II.

Article 7: Concerns short-term action plans to be devised by Member States in anticipation of exceedances of the alert threshold, provided that such measures reveal significant potential for reducing the severity and duration of such exceedances. Member States are required to perform an investigation to assess this potential. Guidance and an exchange of information about applying and implementing such plans will be provided. This will have to be arranged by the Commission involving the expert committee referred to in Article 12 of the Air Quality Framework Directive.

Article 8: Covers all aspects pertaining to transboundary pollution with a view to improving coordination between neighbouring Member States. This includes the devising of joint plans and programmes and the exchange of information for proper management of activities triggered by exceedances of the information and alert thresholds and the management of short-term measures.

Article 9: Deals with assessment of ozone concentrations and is supplemented by a number of Annexes establishing siting criteria, minimum numbers of stations, data quality objectives and reference methods for measurements. Regarding attainment of the long-term objective values, it prescribes the criteria for mandatory measurements of ozone concentration, and collocated recording of nitrogen dioxide values at 50% of sites. Where supplementary means of assessment and evaluation are employed, a reduction of the number of stations by one-third is possible. Full equipment with parallel nitrogen dioxide monitors is then required. Where long-term objectives are not exceeded, a minimum number of stations must be retained.

Article 10: Regulates the transfer of information between the Member States and the Commission, and the latter's obligation to publish this information.

Article 11: Requires the Commission to report to the Council and the European Parliament on the experience gained with the proposed directive. This includes the latest research findings on ozone effects as well as advances in assessment methods. The report will include a review of the provisions of the proposed directive. The report is considered part of an integrated air quality strategy which the Commission must present by the end of 2004 and which is designed to review and propose Community air quality, acidification and eutrophication objectives and develop implementing concepts to ensure those objectives are attained. The strategy must be based *inter alia* on information received from Member States pursuant to the provisions of this Proposal as well as on the conceptual requirements.

Article 12: Requires the Commission to develop guidance on the implementation of the proposed directive. An expert committee will be involved, acting in accordance with the procedure laid down in Article 12 of the Air Quality Framework Directive.

Articles 13, 14, 16, 17: Standard provisions.

Article 15: Sets the date for repeal of the present Directive 92/72/EEC. The date is fixed at the beginning of a calendar year so as to avoid introducing a complex transition scheme for data transfer between Member States and the Commission.

Annex I: Defines target values, long-term objectives and respective attainment periods for ozone.

Annex II: Sets an information threshold and an alert threshold for ozone and specifies minimum details to be supplied to the public if these thresholds are exceeded.

Annex III: Specifies the type and amount of information to be submitted by Member States monthly and annually to the Commission.

Annex IV: Sets out criteria for classifying and locating ozone monitoring stations. Separate criteria are given for macroscale and microscale siting.

Annex V: Section I specifies the criteria for determining the default number of monitoring stations for each class of site in agglomerations and other zones. Section II indicates the arrangements for areas where the long-term objective is met, and where fewer stations are therefore required.

Annex VI: Specifies the ozone precursor substances to be measured in accordance with Article 9. It also sets out the objectives, reference methods and siting criteria of such measurements.

Annex VII: Part I sets out guidelines for the quality of results Member States should aim to achieve using different air quality assessment methods. Part II sets out a minimum dataset, to be compiled where methods other than measurement are used to assess air quality.

Annex VIII: Deals with reference methods for monitoring and modelling. These requirements will be adapted to technical progress in accordance with Article 12 of the Air Quality Framework Directive.

Proposal for a **99/0067 (COD)**

DIRECTIVE OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL

on national emission ceilings for certain atmospheric pollutants

(Text with EEA relevance)

THE EUROPEAN PARLIAMENT AND THE COUNCIL OF THE EUROPEAN UNION,

Having regard to the Treaty establishing the European Community, and in particular Article 175(1) thereof,

Having regard to the proposal from the Commission[1],

Having regard to the opinion of the Economic and Social Committee[2],

Having regard to the opinion of the Committee of the Regions[3],

Acting in accordance with the procedure laid down in Article 251 of the Treaty[4],

Whereas:

(1) On the basis of principles enshrined in Article 174 of the Treaty, the Fifth Environmental Action Programme approved by the Resolution of the Council and the Representatives of the Governments of the Member States meeting within the Council of 1 February 1993 on a Community programme of policy and action in relation to the environment and sustainable development[5] sets the objective of no exceedance of critical loads and levels for acidification in the Community. That programme requires that all people should be effectively protected against health risks from air pollution and that permitted levels of pollution should take account of the protection of the environment. The programme requires that guideline values from the World Health Organisation (WHO) should become mandatory at Community level.

(2) Decision No 2179/98/EC of the European Parliament and of the Council of 24 September 1998 on the review of the European Community programme of policy and action in relation to the environment and sustainable development "Towards sustainability"[6] confirmed the commitment to the general approach and strategy of the Fifth Environmental Action Programme and specified that particular attention should be given to developing and implementing a strategy with the goal of ensuring that critical loads, in relation to exposure to acidifying, eutrophying and photochemical air pollutants, are not exceeded.

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5 OJ C 138, 17.5.1993, p. 1.
6 OJ L 275, 10.10.1998, p. 1.

(3) Council Directive 92/72/EEC of 21 September 1992 on air pollution by ozone[7] requires the Commission to submit to the Council a report on the evaluation of photochemical pollution in the Community, accompanied by any proposals the Commission deems appropriate on the control of air pollution by ozone and, if necessary, for reducing emissions of ozone precursors.

(4) Acidification, soil eutrophication and ozone formation are caused in particular by transboundary pollution, the abatement of which requires coordinated Community action.

(5) Significant areas of the Community are exposed to depositions of acidifying and eutrophying substances at levels which have adverse effects on the environment. The WHO guideline values for the protection of human health and vegetation from photochemical pollution are substantially exceeded in all Member States. Those exceedances of critical loads and guideline levels should therefore be eliminated.

(6) It is currently not technically feasible to eliminate the adverse effects of acidification or to reduce exposure to ozone of man and the environment to the guideline values established by the WHO. It is therefore necessary to base measures to reduce pollution on interim environmental objectives for acidification and ozone pollution.

(7) Interim environmental objectives and the measures to meet them should take account of technical feasibility and the associated costs and benefits. Such measures should ensure that any action taken is cost-effective for the Community as a whole.

(8) It is most cost-effective to address jointly the pollutants causing acidification and exposure to ozone. Addressing those pollutants will also reduce soil eutrophication.

(9) A set of national ceilings for each Member State for emissions of SO_2, NO_x, VOC and NH_3 is a cost-effective way of meeting the interim environmental objectives. Such emission ceilings will allow the Community and the Member States flexibility in determining how to comply with them.

(10) The Commission should continue to examine further appropriate Community measures which may be cost-effective means of attaining the environmental objectives.

(11) Member States should be responsible for implementing measures to comply with national emission ceilings. It will be necessary to evaluate progress towards compliance with the emission ceilings. National programmes for the reduction of emissions must therefore be drawn up and must be reported on to the Commission in a comprehensive and transparent manner. Such programmes should include information on the measures adopted or envisaged to comply with the emission ceilings.

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7 OJ L 297, 13.10.1992, p. 1.

(12) The provisions of this Directive should apply without prejudice to the Community legislation regulating emissions of those pollutants from specific sources and to the Member States' obligation to ensure the use of best available techniques in accordance with Council Directive 96/61/EC of 24 September 1996 concerning integrated pollution prevention and control[8].

(13) Emission inventories are necessary to monitor progress towards compliance with the emission ceilings and must be calculated in accordance with internationally agreed methodology and reported on regularly to the Commission and the European Environment Agency (EEA).

(14) A timely review is required of the progress in the Community towards the emission ceilings for 2010, as well as of scientific and technical progress, developments in Community legislation and emission reductions outside the Community. In that review, the Commission should undertake a further examination of the costs and benefits of the emission ceilings, including their cost-effectiveness, marginal costs and benefits and socio-economic impact. The review should also consider the limitations on the scope of this Directive. The Commission should for this purpose prepare a report to the European Parliament and the Council and if necessary propose appropriate amendments to this Directive. An interim objective for soil eutrophication should be established in the review of the Directive in 2004.

(15) The Community should cooperate internationally with a view to achieving the objectives of this Directive and to promote the necessary technical and scientific research and development. For this purpose, the Commission should pursue the necessary bilateral and multilateral cooperation.

(16) Member States should lay down rules on penalties applicable to infringements of the provisions of this Directive and ensure that they are implemented. Those penalties must be effective, proportionate and dissuasive.

(17) The format and methods for reporting national programmes and emission inventories will require more detailed technical specifications. Those methods and formats should be updated as necessary. The Committee set up by Council Directive 96/62/EC of 27 September 1996 on ambient air quality assessment and management[9] should assist the Commission in setting out the specifications for such formats and methods.

(18) In accordance with the principles of subsidiarity and proportionality as set out in Article 5 of the Treaty, the objective of the proposed measure, limitation of emissions of acidifying and eutrophying pollutants and ozone precursors, cannot be sufficiently achieved by the Member States because of the transboundary nature of the pollution and can therefore be better achieved by the Community; this Directive confines itself to the minimum required in order to achieve that objective and does not go beyond what is necessary for that purpose,

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8 OJ L 257, 10.10.1996, p. 26.

9 OJ L 296, 21.11.1996, p. 55.

HAVE ADOPTED THIS DIRECTIVE:

Article 1

Objective

The aim of this Directive is to limit emissions of acidifying and eutrophying pollutants and ozone precursors in order to improve the protection of the environment and human health against risks of adverse effects from acidification, soil eutrophication and tropospheric ozone towards the long-term objective of no exceedance of critical levels and loads and the effective protection of all people against recognised health risks from air pollution.

Article 2

Scope

This Directive covers emissions in the territory of the Member States and their Exclusive Economic Zones from all anthropogenic sources of the pollutants referred to in Article 4.

It does not cover:

(a) emissions from international maritime traffic;

(b) aircraft emissions beyond the landing and take-off cycle;

(c) for Spain, emissions in the Canary Islands.

(d) for France, emissions in the overseas departments (DOMs);

(e) for Portugal, emissions in Madeira and the Azores.

Article 3

Definitions

For the purposes of this Directive:

(1) "critical load" means a quantitative estimate of an exposure to one or more pollutants below which significant adverse effects on specified sensitive elements of the environment do not occur, according to present knowledge;

(2) "critical level" means the concentration of pollutants in the atmosphere above which direct adverse effects on receptors, such as human beings, plants, ecosystems or materials, may occur, according to present knowledge;

(3) "emission" means the discharge of substances into the atmosphere;

(4) "exceedance" means the difference between a critical load or level and the observed or estimated deposition or concentration;

(5) "landing and take-off cycle" means a cycle represented by the following time in each operating mode: approach 4.0 minutes; taxi/ground idle 26.0 minutes, take-off 0.7 minutes; climb 2.2 minutes;

(6) "national emission ceiling" means the maximum amount of a substance expressed in kilotonnes which may be emitted from a Member State in a calendar year;

(7) "volatile organic compounds" (VOC) means all organic compounds of anthropogenic nature, other than methane, that are capable of producing photochemical oxidants by reactions with nitrogen oxides in the presence of sunlight.

Article 4

National emission ceilings

1. By the year 2010 at the latest, Member States shall limit their annual national emissions of the pollutants sulphur dioxide (SO_2), nitrogen oxides (NO_x), volatile organic compounds (VOC) and ammonia (NH_3) to amounts not greater than the emission ceilings laid down in Annex I.

2. Member States shall ensure that the emission ceilings laid down in Annex I are not exceeded in any year after 2010.

Article 5

Interim environmental objectives

The interim environmental objectives of this Directive are those set out in Annex II.

Article 6

National programmes

1. Member States shall, by 1 October 2002 at the latest, draw up programmes for the progressive reduction of annual national emissions of the pollutants referred to in Article 4 with the aim of complying at least with the national emission ceilings laid down in Annex I by 2010 at the latest.

2. The national programmes shall include information on adopted and envisaged policies and measures and quantified estimates of the effect of these policies and measures on emissions of the pollutants in 2010. Anticipated significant changes in the geographical distribution of national emissions shall be indicated.

3. Member States shall update and revise the national programmes as necessary by 1 October 2006.

4. Member States shall make available to the public and to appropriate organisations such as environmental organisations the programmes drawn up in accordance with paragraphs 1, 2 and 3. Information made available to the public and to organisations under this paragraph shall be clear, comprehensible and accessible.

Article 7

Emission inventories and projections

1. Member States shall prepare and regularly update national emission inventories and emission projections for 2010 for the pollutants referred to in Article 4.

2. Member States shall establish their emission inventories and projections using the methodologies specified in Annex III.

3. The Commission, assisted by the European Environment Agency, shall, in cooperation with the Member States and on the basis of the information provided by them, establish inventories and projections of the pollutants referred to in Article 4. The inventories and projections shall be made publicly available.

4. The requirements set out in Annex III may be changed in accordance with the procedure set out in Article 11.

Article 8

Reports by the Member States

1. Member States shall each year, by 31 December at the latest, report their national emission inventories and their emission projections for 2010 established in accordance with Article 7(1) and (2) to the Commission and the European Environment Agency.

   They shall report their final emission inventories for the previous year but one and their provisional emission inventories for the previous year.

   Emission projections shall include information for a quantitative understanding of the key socio-economic assumptions used in their preparation.

2. Member States shall, by 31 December 2002 at the latest, inform the Commission of the programmes drawn up in accordance with Article 6(1) and (2).

   Member States shall, by 31 December 2006 at the latest, inform the Commission of the updated programmes drawn up in accordance with Article 6(3).

3. The Commission shall forward the national programmes received to the other Member States within one month of their reception.

4. The Commission shall establish provisions to ensure consistent and transparent reporting of national programmes in accordance with the procedure set out in Article 11.

Article 9

Reports by the Commission to the European Parliament and the Council

1. In 2004 and 2008 the Commission shall report to the European Parliament and the Council on progress in the implementation of the national emission ceilings laid down in Annex I and in relation to the interim environmental objectives set out in Annex II. The reports shall include an economic assessment, including cost-effectiveness, benefits, an assessment of marginal costs and benefits and the socio-economic impact of the implementation of the national emission ceilings on particular Member States and sectors. They shall also include a review of the limitations of the scope of this Directive as defined in Article 2 and take into account the reports made by Member States pursuant to Article 8(1) and (2), as well as:

   (a) emission reductions and reduction commitments by third countries;

   (b) the enlargement process;

   (c) new Community legislation and any international regulations concerning ship emissions;

   (d) new technical and scientific data;

   (e) assessment of current and projected exceedance of critical loads and the WHO's guideline values for tropospheric ozone;

   (f) the identification of an interim objective for reducing soil eutrophication;

   (g) new livestock projections reflecting developments in the Common Agricultural Policy;

   (h) new energy forecasts reflecting the actions taken by the Member States to comply with their international obligations in relation to climate change.

2. In 2012 the Commission shall report to the European Parliament and the Council on compliance with the ceilings in Annex I and on progress in relation to the interim environmental objectives in Annex II. Its report shall take account of the reports made by Member States pursuant to Article 8(1) and (2) as well as the matters listed in points (a) to (e) of paragraph 1 of this Article.

3. The reports referred to in paragraphs 1 and 2 shall take into account the factors listed in paragraph 1 and if appropriate, be accompanied by proposals for modifications of the ceilings in Annex I, for measures to ensure compliance with the ceilings, and for possible further emission reductions.

Article 10

Cooperation with third countries

To promote the achievement of the objective set out in Article 1, the Commission shall pursue bilateral and multilateral cooperation with third countries and relevant international organisations such as the UN/ECE and IMO concerning technical and scientific research and development and the facilitation of emission reductions.

Article 11

Committee

The Commission shall be assisted by the committee set up by Article 12 of Directive 96/62/EC.

The representative of the Commission shall submit to the committee a draft of the measures to be taken. The Committee shall deliver its opinion on the draft within a time limit which the chairman may lay down according to the urgency of the matter. The opinion shall be delivered by the majority laid down in Article 205(2) of the Treaty in the case of decisions which the Council is required to adopt on a proposal from the Commission. The votes of the representatives of the Member States within the committee shall be weighted in the manner set out in that Article. The chairman shall not vote.

The Commission shall adopt the measures envisaged if they are in accordance with the opinion of the committee.

If the measures envisaged are not in accordance with the opinion of the committee, or if no opinion is delivered, the Commission shall, without delay, submit to the Council a proposal relating to the measures to be taken. The Council shall act by a qualified majority.

If on the expiry of three months from the date of referral to it the Council has not acted, the proposed measures shall be adopted by the Commission.

Article 12

Penalties

Member States shall lay down the rules on penalties applicable to infringements of the national provisions adopted pursuant to this Directive and shall take all measures necessary to ensure that they are implemented. The penalties provided for must be effective, proportionate and dissuasive.

Article 13

Transposition

1. Member States shall progressively bring into force the laws, regulations and administrative provisions necessary to comply with Article 4 not later than 31 December 2009. They shall forthwith inform the Commission thereof.

   When Member States adopt those provisions, they shall contain a reference to this Directive or be accompanied by such a reference on the occasion of their official publication. Member States shall determine how such reference is to be made.

2. Member States shall communicate to the Commission the text of the main provisions of national law which they adopt in the field covered by this Directive.

Article 14

Entry into force

This Directive shall enter into force on the twentieth day following that of its publication in the *Official Journal of the European Communities*.

Article 15

Addressees

This Directive is addressed to the Member States.

Done at Brussels,

For the European Parliament
The President

For the Council
The President

ANNEX I

National emission ceilings for SO_2, NO_x, VOC and NH_3 (thousand tonnes), to be attained by 2010

Country	SO_2 Kilotonnes	NO_x Kilotonnes	VOC Kilotonnes	NH_3 Kilotonnes
Austria	40	91	129	67
Belgium	76	127	102	57
Denmark	77	127	85	71
Finland	116	152	110	31
France	218	679	932	718
Germany	463	1 051	924	413
Greece	546	264	173	74
Ireland	28	59	55	123
Italy	566	869	962	430
Luxembourg	3	8	6	7
Netherlands	50	238	156	104
Portugal	141	144	102	67
Spain	746	781	662	353
Sweden	67	152	219	48
UK	497	1 181	964	264
EC15	3 634	5 923	5 581	2 827

ANNEX II

Interim environmental objectives[1]

The national emission ceilings aim at broad achievement of the following interim environmental objectives by 2010:

Acidification

- A reduction of areas with exceedance of critical loads for acidity by at least 50 per cent (in each grid cell[2]) compared with the 1990 situation.

Health-related ozone exposure

- The ozone load above the health-related criterion (AOT60[3]= 0) is to be reduced by two-thirds in all grid cells compared with the 1990 situation. In addition, the ozone load is not to exceed an absolute limit of 2.9 ppm.h in any grid cell.

Vegetation-related ozone exposure

- The ozone load above the critical level for crops and semi-natural vegetation (AOT40[4]= 3ppm.h) is to be reduced by one-third in all grid cells compared with the 1990 situation. In addition, the ozone load is not to exceed an absolute limit of 10 ppm.h, expressed as an excess of the critical level of 3 ppm.h in any grid cell.

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1 Improvements with regard to soil eutrophication: As a result of the national emission ceilings, the Community area with depositions of nutrient nitrogen in excess of the critical loads will be reduced by about 30 per cent compared with the situation in 1990.

2 A grid cell is 150 km x 150 km, which is the resolution used when mapping critical loads on a European scale, and also when monitoring emissions and depositions of air pollutants by the Co-operative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe (EMEP).

3 Measure of excess ozone accumulated over a threshold of 60 ppb.

4 Measure of excess ozone accumulated over a threshold of 40 ppb.

ANNEX III

Methodologies for emission inventories and projections

Member States shall establish emission inventories and projections using the methodologies agreed upon by the Convention on Long-range Transboundary Air Pollution and are requested to use the joint EMEP/CORINAIR[1] guidebook in preparing these inventories and projections.

[1] Air emissions inventory of the European Environment Agency.

Proposal for a **99/0068 (COD)**

DIRECTIVE OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL

relating to ozone in ambient air

(Text with EEA relevance)

THE EUROPEAN PARLIAMENT AND THE COUNCIL OF THE EUROPEAN UNION,

Having regard to the Treaty establishing the European Community, and in particular Article 175(1) thereof,

Having regard to the proposal from the Commission[1],

Having regard to the opinion of the Economic and Social Committee[2],

Having regard to the opinion of the Committee of the Regions[3],

Acting in accordance with the procedure laid down in Article 251 of the Treaty[4],

Whereas:

(1) On the basis of principles enshrined in Article 174 of the Treaty, the Fifth Environmental Action Programme approved by the Resolution of the Council and the Representatives of the Governments of the Member States meeting within the Council of 1 February 1993 on a European Community programme of policy and action in relation to the environment and sustainable development[5] envisages in particular amendments to existing legislation on air pollutants. The said programme recommends the establishment of long-term air quality objectives.

(2) Pursuant to Article 4(5) of Council Directive 96/62/EC of 27 September 1996 on ambient air quality assessment and management[6], the Council is to adopt the legislation provided for in paragraph 1 and the provisions laid down in paragraphs 3 and 4 of the same Article.

(3) It is important to ensure effective protection against effects on human health from exposure to ozone. The adverse effects of ozone on vegetation, ecosystems and the environment as a whole should be reduced, as far as possible. The transboundary nature of ozone requires action to be taken at Community level.

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5 OJ C 138, 17.5.1993, p. 1.
6 OJ L 296, 21.11.1996, p. 55.

(4) Directive 96/62/EC provides that numerical thresholds are to be based on the findings of work carried out by international scientific groups active in the field. The Commission is to take account of the most recent scientific research data in the epidemiological and environmental fields concerned and of the most recent advances in metrology with a view to re-examining the elements on which such thresholds are based.

(5) Directive 96/62/EC requires limit and/or target values to be set for ozone. In view of the transboundary nature of ozone, target values should be set for the protection of human health and for the protection of vegetation. Those target values should relate to the interim objectives derived from the Community strategy to combat tropospheric ozone.

(6) Directive 96/62/EC requires action to be taken in respect of zones and agglomerations within which ozone concentrations exceed target values in order to ensure that target values are met as far as possible by the date specified. Such action will to a large extent refer to control measures to be implemented in accordance with relevant Community legislation.

(7) Specific local circumstances will in some cases require additional local measures to be implemented if the target values are to be met. Local measures should not be required where examination of benefits and costs shows them to be disproportionate.

(8) Long-term objectives should be set with the aim of providing effective protection of human health and the environment. Long-term objectives should relate to the ozone strategy and its aim of closing the gap between current ozone levels and the long-term objective as far as possible.

(9) Measurements should be mandatory in zones with exceedances of the long-term objectives. Supplementary means of assessment and collocated measurements of nitrogen dioxide may reduce the required number of sampling points.

(10) An alert threshold for ozone should be set for the protection of the general population. An information threshold should be set as an alert threshold to protect sensitive sectors of the population. Up-to-date information on concentrations of ozone in ambient air should be readily available to the public.

(11) Short-term action plans should be drawn up where the risk of exceedances of the alert threshold can be reduced significantly. The potential for reducing the number, duration and severity of exceedances should be investigated and assessed.

(12) The transboundary nature of ozone pollution may require certain coordination between neighbouring Member States in drawing up and implementing action plans and in informing the public.

(13) As a basis for regular reports, information on measured concentrations should be submitted to the Commission.

(14) The Commission should review the provisions of this Directive in the light of the most recent scientific research concerning in particular the effects of ozone on human health and the environment. Such review should be part of an integrated air quality strategy designed to review and if necessary revise Community air quality objectives, including those for acidification and eutrophication. That strategy should include measures to reduce emissions across all sources, taking into account technical

feasibility and cost-effectiveness, in order to ensure achievement of those objectives. For ozone, the review should aim if possible at achieving the long-term objectives within a foreseeable time period.

(15) Member States should lay down rules on penalties applicable to infringements of the provisions of this Directive and ensure that they are implemented. Those penalties must be effective, proportionate and dissuasive.

(16) In accordance with the principles of subsidiarity and proportionality as set out in Article 5 of the Treaty, the objectives of the proposed measure, ensuring effective protection against effects on human health from ozone and reducing the adverse effect of ozone on vegetation, ecosystems and the environment as a whole, cannot be sufficiently achieved by the Member States because of the transboundary nature of ozone and can therefore be better achieved by the Community; this Directive confines itself to the minimum required in order to achieve those objectives and does not go beyond what is necessary for that purpose.

(17) Council Directive 92/72/EEC of 21 September 1992 on air pollution by ozone[7] should therefore be repealed,

HAVE ADOPTED THIS DIRECTIVE:

Article 1

Objectives

The purpose of this Directive is:

(a) to establish long-term objectives, target values, an alert threshold and an information threshold for concentrations of ozone in ambient air in the Community, designed to avoid, prevent or reduce harmful effects on human health and the environment as a whole;

(b) to ensure that common methods and criteria are used to assess concentrations of ozone and, as appropriate, ozone precursors (oxides of nitrogen and volatile organic compounds) in ambient air in the Member States;

(c) to ensure that adequate information is obtained on ambient levels of ozone and that it is made available to the public;

(d) to ensure that, with respect to ozone, ambient air quality is maintained where it is good, and improved in other cases.

[7] OJ L 297, 13.10.1992, p. 1.

Article 2

Definitions

For the purposes of this Directive:

(1) "ambient air" means outdoor air in the troposphere, excluding work places;

(2) "pollutant" means any substance introduced directly or indirectly by man into the ambient air and likely to have harmful effects on human health and/or the environment as a whole;

(3) "level" means the concentration of a pollutant in ambient air or the deposition thereof on surfaces in a given time;

(4) "assessment" means any method used to measure, calculate, predict or estimate the level of a pollutant in the ambient air;

(5) "fixed measurements" means measurements taken in accordance with Article 6(5) of Directive 96/62/EC;

(6) "zone" means part of their territory delimited by the Member States;

(7) "agglomeration" means a zone with a population concentration in excess of 250 000 inhabitants or, where the population concentration is 250 000 inhabitants or less, a population density per km^2 which for the Member State justifies the need for ambient air quality to be assessed and managed;

(8) "target value" means a level fixed with the aim in the long term of avoiding harmful effects on human health and/or the environment as a whole, to be attained as far as possible within a given period;

(9) "long-term objective" means an ozone concentration in the atmosphere below which, according to current scientific knowledge, direct adverse effects on human health and/or the environment as a whole are unlikely, to be attained as far as possible in the long term with the aim of providing effective protection of human health and the environment;

(10) "alert threshold" means a level beyond which there is a risk to human health in the general population from brief exposure and at which immediate steps must be taken by the Member States as laid down in this Directive;

(11) "information threshold" means an alert threshold for sensitive sections of the population;

(12) "Volatile organic compounds" (VOC) means all organic compounds capable of producing photochemical oxidants by reaction with nitrogen oxides in the presence of sunlight.

Article 3

Target values

1. The target values to be achieved by 2010 in respect of ozone concentrations in ambient air are those set out in Section II of Annex I.

2. Member States shall draw up a list of zones and agglomerations in which the levels of ozone in ambient air, as assessed in accordance with Article 9, are higher than the target values referred to in paragraph 1.

3. In the zones and agglomerations referred to in paragraph 2, Member States shall take steps to ensure that a plan or programme is prepared and implemented for attaining as far as possible the target value as from the date specified in Section II of Annex I.

   Where, in accordance with Article 8(3) of Directive 96/62/EC, plans or programmes must be prepared or implemented in respect of other pollutants, Member States shall prepare and implement integrated plans or programmes covering all the pollutants concerned. Those plans or programmes shall incorporate at least the information listed in Annex IV to Directive 96/62/EC and shall be made available to the public and to appropriate organisations such as environmental organisations, consumer organisations, organisations representing the interests of sensitive population groups and other relevant health care bodies.

Article 4

Long-term objectives

1. The long-term objectives for ozone concentrations in ambient air are those set out in Section III of Annex I.

2. Member States shall draw up a list of the zones and agglomerations in which the levels of ozone in ambient air, as assessed in accordance with Article 9, are higher than the long-term objectives referred to in paragraph 1 but below or equal to the target values set out in Section II of Annex I. Within such zones and agglomerations Member States shall implement measures with the aim of achieving the long-term objectives as far as possible.

Article 5

Requirements in zones and agglomerations where ozone levels meet the long-term objectives

Member States shall draw up a list of zones and agglomerations in which ozone levels meet the long-term objectives. They shall maintain the levels of ozone in those zones and agglomerations below the long-term objectives and shall endeavour to preserve the best ambient air quality compatible with sustainable development.

Article 6

Dissemination of up-to-date information, information thresholds and alert thresholds

1. Member States shall take appropriate steps to disseminate up-to-date information on ambient concentrations of ozone to the public as well as to appropriate organisations representing the interests of sensitive population groups and other relevant health care bodies, by means, for example, of the broadcasting media, the press, information screens or computer network services. This shall include information on relevant precursor substances in so far as these are not covered by existing Community legislation.

   This information shall be updated on at least a daily basis and, wherever appropriate and practicable, on an hourly basis.

   Such information shall at least indicate all exceedances of concentrations in the long-term objectives, target values and information and alert thresholds and, where appropriate, the reference levels given in Section III of Annex II, for the relevant averaging period. It shall also provide a short assessment in relation to the long-term objectives and the information and alert thresholds, and appropriate information regarding effects on health.

2. The information threshold and the alert threshold for concentrations of ozone in ambient air are given in Section I of Annex II. Details supplied to the public in accordance with Article 10 of Directive 96/62/EC when either threshold is exceeded shall include as a minimum the items listed in Section II of Annex II. Member States shall where practicable also take steps to supply such information when an exceedance of the information threshold or alert threshold is predicted.

3. Information supplied under paragraphs 1 and 2 shall be clear, comprehensible and accessible.

Article 7

Short-term action plans

In accordance with Article 7(3) of Directive 96/62/EC, Member States shall draw up action plans indicating measures to be taken in the short term where there is a risk of exceedances of the alert threshold and where there is likely to be significant potential for reducing that risk or for reducing the duration and severity of any exceedance.

For this purpose, Member States shall investigate and assess the reduction potential of those short-term measures, taking into account the criteria specified in the guidance referred to in Article 12.

Member States shall also have regard to that guidance when developing and implementing the short-term action plans.

Article 8

Transboundary pollution

1. Where ozone concentrations exceeding target values or long-term objectives are due largely to precursor emissions in other Member States, the Member States concerned shall cooperate, where appropriate, in drawing up joint plans and programmes in order to attain the target values or long-term objectives as far as possible. The Commission may assist in those efforts. In carrying out its obligations under Article 11, the Commission shall consider whether further action should be taken at Community level in order to reduce precursor emissions responsible for such transboundary ozone pollution.

2. Member States shall, if appropriate, prepare and implement joint short-term action plans under Article 7 covering neighbouring zones in different Member States. Member States shall ensure that neighbouring zones in different Member States which have developed short-term action plans receive all appropriate information.

3. Where exceedances of the information threshold or alert threshold occur in zones close to national borders, information should be provided as soon as possible to the competent authorities in the neighbouring Member States concerned in order to facilitate the provision of information to the public in those States.

Article 9

Assessment of concentrations of ozone and precursor substances in ambient air

1. Measurements are mandatory in zones where exceedance of a long-term objective for ozone has occurred during the previous five years of measurements. Where fewer than five years' data are available Member States may, to determine exceedances, combine measurement campaigns of short duration at times and locations likely to be typical of the highest pollution levels with results obtained from emission inventories and modelling.

2. Annex IV sets out criteria for determining the location of sampling points for the measurement of ozone and relevant precursor substances.

3. Section I of Annex V sets out the minimum number of fixed sampling points for continuous measurement of ozone in each zone or agglomeration within which measurement mandatory, if measurement is the sole source of information for assessing air quality.

4. In zones and agglomerations within which measurements of ozone are mandatory, continuous measurements of nitrogen dioxide shall also be made at a minimum of 50% of the ozone sampling points to be located in each zone or agglomeration in accordance with Section I of Annex V.

5. For zones and agglomerations within which information from fixed measurement stations is supplemented by information from other sources such as objective estimation, modelling, random sampling and indicative measurement, the total number of sampling points specified in Section I of Annex V may be reduced by

one-third. The number of stations remaining shall be sufficient to enable assessment within the accuracy limits specified in Annex VII, and at least one sampling point must be retained in each zone or agglomeration. In this case nitrogen dioxide shall be measured at all such remaining sampling points except at rural background stations.

6. Measurements shall also be made in zones where concentrations are below the long-term objectives. In this case the number of continuous measurement stations shall be determined in accordance with Section II of Annex V.

7. Each Member State shall ensure that at least one measuring station to supply data on concentrations of the ozone precursor substances listed in Annex VI is installed and operated in its territory. Each Member State shall choose the number and siting of the stations at which ozone precursor substances are to be measured, taking into account the objectives, methods and recommendations laid down in the said Annex.

As part of the guidance developed under Article 12, guidelines for an appropriate strategy to measure ozone precursor substances shall be developed, taking into account existing requirements in Community legislation and the EMEP[8] programme.

8. Reference methods for analysis of ozone are set out in Section I of Annex VIII. Section II of Annex VIII sets out reference techniques for air quality modelling and objective estimation.

9. Any amendments necessary to adapt this Article and Annexes IV to VIII to scientific and technical progress shall be adopted in accordance with the procedure set out in Article 12 of Directive 96/62/EC.

Article 10

Transmission of information and reports

1. When forwarding information to the Commission under Article 11 of Directive 96/62/EC, Member States shall also:

(a) send to the Commission annually and no later than nine months following the end of each calendar year the lists of zones and agglomerations referred to in Article 3(2), Article 4(2) and Article 5 of this Directive;

(b) send to the Commission the plans or programmes referred to in Article 3(3) of this Directive no later than two years after the end of the year during which exceedances of the target values for ozone were observed;

(c) inform the Commission every three years of the progress of any such plan or programme.

[8] The cooperative programme for monitoring and evaluation of the long-range transmission of air pollution in Europe.

2. Member States shall also:

(a) for each month from April to September each year, send to the Commission, on a provisional basis, by no later than the end of the following month, the information specified in Annex III to this Directive;

(b) for each year, send to the Commission by no later than 1 July of the following calendar year the validated information specified in Annex III;

(c) within nine months of the end of each year, send the Commission the annual average concentration for that year of the ozone precursor substances specified in Annex VI;

(d) forward to the Commission every three years within the framework of the sectoral report referred to in Article 4 of Council Directive 91/692/EEC[9] and no later than 9 months after the end of each three-year period:

(i) information reviewing the levels of ozone observed or assessed, as appropriate, in the zones and agglomerations referred to in Articles 3(2), Article 4(2) and Article 5 of this Directive;

(ii) information on any measures taken or planned under Article 4(2) of this Directive;

(iii) information regarding decisions on short-term action plans and concerning the design of any such plans prepared in accordance with Article 7 of this Directive.

3. The Commission shall:

(a) publish annually a list of the zones and agglomerations submitted pursuant to paragraph 1(a) and, by the end of October each year, a report on the ozone situation during the current summer and the preceding calendar year;

(b) check the implementation of the plans or programmes submitted pursuant to paragraph 1(b) by examining their progress and the trends in air pollution;

(c) take into account the information provided under paragraphs 1 and 2 in preparing three-yearly reports on ambient air quality in accordance with Article 11(2) of Directive 96/62/EC;

(d) arrange appropriate exchange of information and experience forwarded in accordance with paragraph 2(d)(iii) regarding the design and implementation of short-term action plans.

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9 OJ L 377, 31.12.1991, p. 48.

4. The Commission will, as necessary, call upon the expertise available in the European Environment Agency in drafting the reports referred to in paragraph 3(a) and (c).

5. The date by which Member States shall inform the Commission of the methods used for the preliminary assessment of air quality under Article 11(1)(d) of Directive 96/62/EC shall be 18 months after the entry into force of this Directive.

Article 11

Review and reporting

1. The Commission shall submit to the European Parliament and the Council by [31 December 2004] at the latest a report based on experience of the application of this Directive, and in particular on the findings of the most recent scientific research into the effects on human health and the environment of exposure to ozone, and on technological developments, including progress achieved in methods of measuring and otherwise assessing concentrations.

2. The report shall include a review of the provisions of this Directive in the light of the most recent scientific research concerning in particular the effects of ozone on human health and the environment.

3. The report shall be presented as an integral part of an air quality strategy designed to review and propose Community air quality objectives and develop implementing strategies to ensure achievement of those objectives.

The strategy shall take into account:

(a) the implementation of existing requirements relating to air quality, acidification and eutrophication, including progress in implementing limit values and target values established in accordance with Article 4 of Directive 96/62/EC, in particular the information received from Member States regarding plans and programmes developed and implemented in accordance with Articles 3 and 4 of this Directive, experience in implementing short-term action plans under Article 7 of this Directive and the conditions under which air quality measurement has been carried out;

(b) transport of pollution across national boundaries;

(c) the need for new or revised objectives relating to air quality, acidification and eutrophication;

(d) current air quality, and trends up to and beyond the year 2010;

(e) the broad scope for making further reductions in polluting emissions across all relevant sources, taking account of technical feasibility and cost-effectiveness;

(f) relationships between pollutants, and opportunities for combined strategies to achieve Community air quality and related objectives;

(g) the experience acquired in the application of this Directive in Member States including, in particular, the conditions as laid down in Annex IV under which measurement has been carried out;

(h) current and future requirements for informing the public and for the exchange of information between Member States and the Commission;

(i) with specific regard to ozone, the potential to achieve the long-term objective, based on the guidelines of the WHO, within a foreseeable time period.

4. The report shall be accompanied as appropriate by proposals to amend this Directive.

Article 12

Guidance

1. The Commission shall develop guidance for implementing the provisions of this Directive. In so doing, it will call upon the expertise available in the Member States, the European Environment Agency and other expert bodies, as appropriate.

2. The guidance shall be adopted in accordance with the procedure laid down in Article 12(2) of Directive 96/62/EC. Such guidance shall not have the effect of modifying the target values, long-term objectives, alert threshold or information threshold either directly or indirectly.

Article 13

Penalties

Member States shall lay down the rules on penalties applicable to infringements of the national provisions adopted pursuant to this Directive and shall take all measures necessary to ensure that they are implemented. The penalties provided for must be effective, proportionate and dissuasive.

Article 14

Transposition

1. Member States shall bring into force the laws, regulations and administrative provisions necessary to comply with this Directive and shall apply those provisions from 1 January [2001]. They shall forthwith inform the Commission thereof.

When Member States adopt those provisions, they shall contain a reference to this Directive or be accompanied by such a reference on the occasion of their official publication. Member States shall determine how such reference is to be made.

2. Member States shall communicate to the Commission the text of the main provisions of national law which they adopt in the field covered by this Directive.

Article 15

Repeal

Directive 92/72/EC shall be repealed from [date in Article 14].

Article 16

Entry into force

This Directive shall enter into force on the twentieth day following that of its publication in the *Official Journal of the European Communities*.

Article 17

Addressees

This Directive is addressed to the Member States.

Done at Brussels,

For the European Parliament
The President

For the Council
The President

ANNEX I

Definitions, target values and long-term objectives for ozone

I. Definitions

All values are to be expressed in $\mu g/m^3$. The volume must be standardised at the following conditions of temperature and pressure: 293 K and 101.3 kPa. The time is to be specified in Central European Time.

AOT40 means the sum of the difference between hourly concentrations greater than 80 $\mu g/m^3$ (= 40 parts per billion) and 80 $\mu g/m^3$ over a given period using only the 1 hour values measured between 8 a.m. and 8 p.m. 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 laid down in Section II of Annex III.

II. Target values for ozone

	Parameter	Target value	Year by which the target value must be attained as far as possible[1]
1. Target value for the protection of human health	Highest 8-hour mean within one day, calculated from hourly running 8-hour averages	120 $\mu g/m^3$ not to be exceeded on more than 20 days per calendar year averaged over three years[2]	2010
2. Target value for the protection of vegetation	AOT40, calculated from 1h values from May to July	17000 $\mu g/m^3.h$ averaged over five years[2]	2010

[1] Compliance with target values will be assessed as of this date. That is, 2010 will be the first year the data for which is used in calculating compliance over the following three or five years, as appropriate.

[2] 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 will be as follows:

- for the target value for the protection of human health: valid data for one year
- for the target value for the protection of vegetation: valid data for three years.

III. Long-term objectives for ozone

	Parameter	Long-term objective not to be exceeded
1. Long-term objective for the protection of human health	Highest 8-hour mean within a calendar year, calculated from hourly running 8-hour averages	120 $\mu g/m^3$
2. Long-term objective for the protection of vegetation	AOT40, calculated from 1h values from May to July	6 000 $\mu g/m^3.h$

Information and alert thresholds; additional reference levels for informing the public

I. Information and alert thresholds for ozone

	Parameter	Threshold
Information threshold	1h average	180 $\mu g/m^3$
Alert threshold	1h average	240 $\mu g/m^3$

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 as a minimum:

(1) Information on observed exceedance(s):

- Location or area of the exceedance;
- Type of threshold exceeded (information or alert);
- Time and duration of the exceedance;
- Highest 1-hour and 8-hour mean concentration.

(2) Forecast for the following afternoon/day(s):

- Time period and geographical area of expected exceedances of information and/or alert threshold;
- Predicted 1h maximum concentration or range of concentration;
- Expected change in pollution (improvement, stabilisation, or deterioration);
- Reason for occurrence and/or expected change in the situation.

(3) Information on type of population concerned, possible health effects and recommended conduct:

- Information on population groups at risk;
- Description of likely symptoms;
- Recommended precautions to be taken by the population concerned;
- Where to find further information.

(4) Information on preventive action to reduce pollution:

Indication of main source sectors; recommendations for action to reduce emissions.

III. Reference levels relating to damage to materials and forests, and visible damage to crops

Target	Reference level	Averaging/ accumulation time	Type of station	Recommended frequency of publication
Visible damage to crops	AOT40 = 400 $\mu g/m^3.h$ and AOT40 = 1 000 $\mu g/m^3.h$	Daily running period of 5 consecutive days; maximum value	Station targeted at protection of vegetation	Monthly, yearly
Damage to materials	40 $\mu g/m^3$	Yearly mean	Any	Yearly
Damage to forests	AOT40 = 20 000 $\mu g/m^3.h$	April-September	Station targeted at protection of vegetation	Yearly

ANNEX III

Information submitted by Member States to the Commission and criteria for aggregating data and calculating statistical parameters

I. Information to be submitted to the Commission

The following table stipulates the type and amount of data Member States are to submit to the Commission:

Target	Type of station	Reference level	Averaging/accumulation time	Reports for each month from April to September	Report for each year
Information threshold	Any	180 $\mu g/m^3$	1h	- for each day with exceedance(s): date, total hours of exceedance, maximum 1h ozone and related NO_2 values; -monthly 1h max. ozone	- for each day with exceedance(s): date, total hours of exceedance, maximum 1h ozone and related NO_2 values;
Alert threshold	Any	240 $\mu g/m^3$	1h	- for each day with exceedance(s): date, total hours of exceedance, maximum 1h ozone and related NO_2 values;	- for each day with exceedance(s): date, total hours of exceedance, maximum 1h ozone and related NO_2 values;
Health protection	Any	120 $\mu g/m^3$	8 hour	- for each day with exceedance(s): date, 8h max	- for each day with exceedance(s): date, 8h max
Vegetation protection	Suburban, rural, rural background	AOT40* = 6 000 $\mu g/m^3.h$	1h, accumulated from May-July	Once in September	Value
Short-term vegetation protection	Suburban, rural, rural background	AOT40* = 400 $\mu g/m^3.h$ and AOT40* = 1 000 $\mu g/m^3.h$	1h, accumulated over five-day period	-	Max., 98%, 50% value from the daily running AOT40 values
Forest protection	Suburban, rural, rural background	AOT40* = 20 000 $\mu g/m^3.h$	1h, accumulated from April-September	-.	Value
Materials	Any	40 $\mu g/m^3$	Year	-	Value

* sum of the difference between hourly concentrations greater than 80 $\mu g/m^3$ and 80 $\mu g/m^3$ using the values measured between 8.00 and 20.00 Central European Time each day.

As part of the yearly reporting, the following must also be provided:

- for ozone and the sum of ozone and nitrogen dioxide (expressed in $\mu g/m^3$), the maximum, 99.9th, 98th, 50th percentile and number of valid data from hourly series,
- the maximum, 98th, and 50th percentile from the series of daily 8-hour maxima,
- the annual average of nitrogen dioxide and nitrogen oxide[1] (NO_x).

The information specified in Annex II of Council Decision 97/101/EC[2] concerning new stations is to be submitted together with the first data submission, if it has not already been delivered under the framework of the said Council Decision.

Data submitted in the monthly reports are considered provisional and are to be updated, if necessary, in subsequent submissions.

II. Criteria for aggregating data and calculating statistical parameters

Percentiles are to be calculated using the method specified in Council Decision 97/101/EC

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

Parameter	Required proportion of valid data
1h values	75% (i.e. 45 minutes)
8h values	75% of 1h values (i.e. 6 hours)
AOT40	90% of the 1h values over the time period defined for calculating the AOT40 value
Annual mean	75% of the 1h values over summer (April-September) and winter (January – March, October – December) seasons separately
Number of exceedances and maximum values per month	90% of the daily maximum 8h mean values (23 available daily values per month) 90% of the 1h values between 8.00 and 20.00 Central European Time
Number of exceedances and maximum values per year	five out of six months over the summer season (April – September)

1 Sum of nitric oxide and nitrogen dioxide added as parts per billion and expressed as nitrogen dioxide in $\mu g/m^3$.

2 OJ L 35, 5.2.1997, p. 14.

ANNEX IV

Criteria for classifying and locating sampling points for assessments of ozone concentrations

The following considerations apply to fixed measurements:

I. Macroscale siting

TYPE OF STATION	OBJECTIVES OF MEASUREMENT	REPRESENTATIVENESS	MACROSCALE SITING CRITERIA
URBAN	**Protection of human health**: to assess the exposure of the urban population to ozone, i.e. where population density and ozone concentration are relatively high	A few km^2	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 educational, sports or recreation facilities
SUB-URBAN	**Protection of human health and vegetation**: to determine the exposure of the population and vegetation located in the outskirts of the agglomeration, where ozone levels tend to be highest.	Some tens of km^2	At a certain distance from the area of maximum emissions, downwind following the main wind direction/directions during conditions favourable to ozone formation; Where population, sensitive crops or natural ecosystems located in the outer fringe of an agglomeration are exposed to high ozone levels; Where appropriate, some suburban stations also upwind of the area of maximum emissions, in order to determine the regional background levels of ozone.
RURAL	**Protection of human health and vegetation**: to determine the exposure of population, crops and natural ecosystems to sub-regional scale ozone concentrations	Sub-regional levels (a few 100 km^2)	Stations can be located in small settlements and/or areas with natural ecosystems, forests or crops; Representative for ozone away from the influence of immediate local emissions such as industrial installations and roads; At open area sites, but not on higher mountain tops.
RURAL BACK-GROUND	**Protection of vegetation and human health**: to assess the exposure of crops and natural ecosystems to regional-scale ozone concentrations as well as exposure of the population	Regional/national/continental levels (1 000 to 10 000 km^2)	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; Avoid locations which are subject to locally enhanced formation of ground-near inversion conditions, also summits of higher mountains; Coastal sites with pronounced diurnal wind cycles of local character are not recommended.

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

[1] OJ L 125, 18.5.1994, p. 1.

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 re-circulation of exhaust air to the sampler inlet.

The following factors may also be taken into account:

(1) interfering sources;

(2) security;

(3) access;

(4) availability of electrical power and telephone communications;

(5) visibility of the site in relation to its surroundings;

(6) safety of public and operators;

(7) the desirability of collocating sampling points for different pollutants;

(8) planning requirements.

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.

Criteria for determining the minimum number of sampling points for fixed measurement of concentrations of ozone and relevant precursor substances

I. Minimum number of sampling points for fixed continuous measurements to assess compliance with the target values, long-term objectives and information and alert thresholds where continuous measurement is the sole source of information

	Agglomerations		Other zones		
Population (x1000)	urban	suburban	Suburban	rural	rural background
< 250				1	1 station/50 000* km^2 as an average density over all zones per country
< 500		1	1	1	
< 1 000		2	1	2	
< 1 500	1	2	1	3	
< 2 000	1	3	1	4	
< 2 750	2	3	1	5	
< 3 750	2	4	1	7	
> 3 750	2	1 additional station per 2 m inhabitants	1	1 additional station per 0.5 m inhabitants	

* 1 station per 25 000 km^2 for complex terrain in regions below 55°N latitude

II. Minimum number of sampling points for fixed measurements for zones and agglomerations 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 collocated 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 suburban areas of agglomerations and in rural areas around agglomerations may be reduced to one-third of the number specified in Section I. If the result of this is that a zone has no remaining station, coordination 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^2.

ANNEX VI

Measurements of ozone precursor substances

Objectives

The main objectives of such measurements are to analyse any trend in ozone precursors, to check the efficiency of emission reduction strategies, to check the consistency of emission 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

Measurement of ozone precursor substances must include at least nitrogen oxide, carbon monoxide and appropriate volatile organic compounds (VOC). A list of volatile organic compounds recommended for measurement is given below.

Methane	1-Butene	Isoprene	Ethyl benzene
Ethane	trans-2-Butene	n-Hexane	m+p-Xylene
Ethylene	cis-2-Butene	i-Hexene	o-Xylene
Acetylene	1.3-Butadiene	n-Heptane	1.2.4-Trimeth. Benzene.
Propane	n-Pentane	n-Octane	1.2.3-Trimeth. Benzene
Propene	i-Pentane	i-Octane	1.3.5-Trimeth. Benzene
n-Butane	1-Pentene	Benzene	Formaldehyde
i-Butane	2-Pentene	Toluene	Total non-methane Hydrocarbons

Reference methods

The reference method specified in Directive 85/203/EEC or in subsequent Community legislation will apply for nitrogen oxides.

The method to be specified in future legislation pursuant to Directive 96/62/EC is to be used for carbon monoxide once it has entered into force.

Each Member State must inform the Commission of the methods it uses to sample and measure VOC. The Commission must carry out intercomparison exercises as soon as possible and investigate the potential for defining reference methods for precursor sampling and measurement in order to improve the comparability and precision of measurements for the review of this Directive in accordance with Article 11.

Siting

Measurements should be taken in particular in urban and suburban areas at any monitoring site set up in accordance with the requirements of Directive 96/62/EC and considered appropriate with regard to the above monitoring objectives.

ANNEX VII

Data quality objectives and compilation of the results of air quality assessment

I. Data quality objectives

The following data quality objectives are proposed to ensure the requisite accuracy of assessment methods:

	For ozone, NO and NO_2
Continuous measurement	
Accuracy of individual measurements	15%
Minimum data capture	90% during summer 75% during winter
Indicative measurement	
Accuracy of individual measurements	30%
Minimum data capture	90%
Minimum time coverage	> 10% during summer period
Modelling	
Accuracy	
1h averages (daytime)	*50%*
8h daily maximum	*50%*
Objective estimation	
Accuracy	*75%*

Accuracy of measurement has the definition given in the "Guide to the Expression of Uncertainty of Measurements (ISO 1993), or in ISO 5725-1 "Accuracy (trueness and precision) of measurement methods and results" (1994). The percentages 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 accuracy for continuous measurements should be interpreted as being applicable in the region of the concentration used for the appropriate threshold.

The accuracy for modelling and objective estimation is defined as 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 the events.

Time coverage is defined as the percentage of the time considered for setting the threshold value during which the pollutant is measured. Data capture is defined as the percentage of the time of measurement during which the instrument produces valid data. 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.

II. Results of air quality assessment

The following information should be compiled for zones or agglomerations within which sources other than measurement 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 accuracies and, in particular, the extent of any area within the zone or agglomeration 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.

Where possible, Member States should compile maps showing concentration distributions within each zone and agglomeration.

III. Standardisation

For ozone the volume must be standardised at the following conditions of temperature and pressure: 293 K, 101.3 kPa. For nitrogen oxides the standardisation specified in Directive 85/203/EEC or in subsequent Community legislation will apply.

ANNEX VIII

Reference method for analysis of ozone and calibration of ozone instruments

I. Reference method for analysis of ozone and calibration of ozone instruments

- Analysis method: UV photometric method (ISO FDIS 13964)
- Calibration method: Reference UV photometer (ISO FDIS 13964, VDI 2468, Bl. 6)

This method is being standardised by the CEN[1]. Once the latter has published the relevant standard, the method and techniques described therein will constitute the reference and calibration method in this Directive.

Member States may use any other method for analysing ozone which they can demonstrate as giving equivalent results to the above method.

II. Reference modelling technique for ozone

Reference modelling techniques cannot be specified at present. Any amendments to adapt this point to scientific and technical progress will be adopted in accordance with the procedure laid down in Article 12(2) of Directive 96/62/EC.

[1] European Committee for Standardisation.

BUSINESS IMPACT ASSESSMENT

The impact of the Proposal on Business with Special Reference to Small and Medium-sized Enterprises (SMEs)

Ref. No. 99003

TITLE OF THE PROPOSALS

1. Proposal for a European Parliament and Council Directive on National Emission Ceilings for Certain Atmospheric Pollutants

2. Proposal for a European Parliament and Council Directive relating to Ozone in Ambient Air

The two proposals are very closely linked in terms of objectives and implementation measures and are therefore discussed jointly.

1 TAKING INTO ACCOUNT THE PRINCIPLE OF SUBSIDIARITY, WHY IS COMMUNITY LEGISLATION NECESSARY IN THIS AREA AND WHAT ARE ITS MAIN AIMS?

In line with the principles of Article 174 of the Treaty, the European Community programme of policy and action in relation to the environment and sustainable development (the Fifth Environmental Action Programme[1]) sets the objective of no exceedance of critical loads and levels for acidification in the Community. It also requires that all people should be effectively protected against health risks from air pollution and that permitted levels of pollution should take account of the protection of the environment. The programme requires that guideline values from the World Health Organisation (WHO) should become mandatory at Community level.

Emissions of sulphur dioxide, nitrogen oxides, volatile organic compounds and ammonia are transported by winds for hundreds and even thousands of kilometres before being deposited in the environment or forming tropospheric ozone. Thus, emissions generated in one Member State contribute to environmental degradation and have effects on human health in other Member States. It is therefore necessary to take coordinated Community measures to reduce acidification, tropospheric ozone and soil eutrophication.

Since it is not at present technically feasible to eliminate the adverse effects of acidification and to reduce ozone exposure to the guideline values established by the WHO, the proposals are based on interim environmental and health objectives for acidification and ozone pollution.

The proposals will, together with other measures already decided, ensure a substantial reduction in environmental and human exposure to excess pollution. If adopted, they will ensure that, in 2010, only 3% of ecosystem areas in the Community are exposed to acidifying depositions in excess of their carrying capacity, compared with 25% in 1990.They will also ensure that, in 2010, the exposure of the Community population to ozone concentrations in excess of the WHO health-related guideline value is reduced by 75% compared with 1990 and that exposure of vegetation to concentrations in excess of the WHO guideline value for

[1] OJ C 138, 17.5.1993, p. 1.

vegetation is reduced over the same period by 50%. Concurrently, an additional benefit will be that the proportion of Community ecosystem area exposed to further soil eutrophication is reduced from 55% in 1990 to 35% in 2010.

Introducing national emission ceilings for these pollutants will allow the interim objectives to be achieved in a cost-effective manner. The national emission ceilings will allow the Member States substantial flexibility to determine the most appropriate measures to achieve the ceilings. The proposal would also allow Member States which so wish, to reduce emissions further than prescribed by the proposed Directive.

The proposal for a Directive on ozone in ambient air proposes a combination of long-term objectives and interim target values. The target values are derived from the analysis done for the Commission's proposal for a Community approach to combat acidification, tropospheric ozone and soil eutrophication, and are compatible with the interim objective for ozone used in the calculation of the national emission ceilings. The proposed health protection target for ozone is linked to the WHO air quality guideline and is expressed in terms of a number of allowed exceedances of the guideline value.

Implementation of the proposed national emission ceilings should go a long way towards achieving the interim target values and Member States would be required to ensure that plans or programmes are prepared and implemented for attaining the target values as far as possible at the local scale. The target values would also provide a transparent and comprehensible benchmark (in terms of an ozone concentration) against which to measure real air quality improvements.

2. WHO WILL BE AFFECTED BY THE PROPOSAL?

- Which sectors of industry?

The proposal for a national emission ceilings directive proposes ceilings in kilotons per year for each Member State for emissions of sulphur dioxide, nitrogen oxides, volatile organic compounds and ammonia.

Existing and planned EC legislation on emissions from vehicles, fuels and industry will contribute substantially towards compliance with the ceilings. The Commission will also continue to explore and consider the need for Community legislation and make appropriate proposals which can assist the Member States in achieving the national emission ceilings.

While the proposed Directive would in itself not impose specific requirements on any particular sectors, it is possible to identify the broad sectors affected. In general, the most important sectors are: for SO_2, energy production; for NOx, energy production and transport; for VOC, transport and industry; for ammonia, (almost exclusively) agriculture.

The proposed emission ceilings are based on a cost-effectiveness analysis reflecting varying environmental sensitivities, atmospheric transmission of pollution, and differences in control costs in Europe. The analysis performed gives an indication of the sectors and measures that will be cost-effective to pursue on the national or Community level. It will, however, be up to the Member States to assess what is appropriate action in their particular circumstances and to introduce measures on this basis. Given this degree of local flexibility it is not possible to identify which sub-sectors will be most affected.

However, the model calculations carried out in support of the proposal show that most of the cost-effective measures to reduce emissions beyond the "business as usual" reference scenario relate predominantly to sources other than road transport. The focus on these sources reflects the fact that new and ambitious measures will be implemented in the road transport sector as part of adopted policies, in particular the "Auto Oil I" package. The road transport sector costs are estimated to represent around 80% of the total cost of the reference scenario in 2010.

The cost of the additional measures (i.e. beyond the reference scenario) required to implement the emission ceilings, mainly for sources other than road transport, should be seen in relation to the significant reduction efforts and costs which already have been and will be undertaken in the road transport sector.

The ozone directive also imposes no direct requirements on industry. The emission ceilings directive is the principal means by which the targets in the ozone Directive will be implemented. There may be a limited number of areas where the emission ceilings would not be sufficient to ensure that the target values of the ozone directive are met. In such cases, Member States would have to assess whether further national or local action would be effective and should be taken. A small additional cost could arise from these instances.

Cost-effective local measures might include traffic management (e.g. road pricing) and the introduction of environmentally friendly buses fuelled with Liquid Petroleum Gas (LPG) or Compressed Natural Gas (CNG).

- **Which sizes of business?**

As mentioned, it is not possible at this stage to give precise indications of the sectors that will be affected. The Commission can therefore not predict the size of business potentially affected by measures to comply with the emission ceilings. However, given the information on the measures which could be cost-effective, it seems likely that the sectors most likely to be affected are power generation, oil refining and energy-intensive industry.

- **Overall impact**

The estimated implementation costs for the proposed directives could be up to about EUR 7.5 billion per year (see Table 1 for details). However, due to the fact that the cost calculations model could not take into account structural measures, these costs are very likely to be on the high side, with actual implementation costs significantly lower. In addition, the model calculations show that implementation of the Kyoto protocol could reduce the additional costs of these proposals by as much as 40%.

The national emission ceilings directive has a number of important advantages as a means of meeting environmental targets for ozone and acidification. First, it allows emission reductions to be differentiated by country. This means that the overall environmental targets can be met by reducing emissions where it is cheapest to do so, and gives greater weight to reducing emissions where their environmental impact is greatest. This is the most cost-effective approach, and significantly reduces the overall cost of meeting these environmental targets, thereby lowering the overall burden on business.

Secondly, the emission ceiling allows Member States considerable flexibility to implement cost-effective local solutions that could not be captured in the modelling work. This is likely to lower the overall implementation costs. In addition though, this flexibility allows Member States to take into account the sectoral distribution of costs when considering how to implement this proposal. Member States therefore have the flexibility to take specific account of the impacts on different sizes of business.

It should be noted that the sectors most likely to be affected by this proposal are those which are broadly defined, such as energy production and distribution, which operate at the bottom of the value chain and provide significant input to the productive activities of other sectors. Over time, therefore, the additional costs of this proposal are likely to be very widely diffused across the economy as a whole, rather than being heavily concentrated in one or two specific sub-sectors.

An additional evaluation was made of the estimated economic benefits of meeting the emission ceilings. The main effects accounted for were reductions in damage to human health, buildings and crops. For those effects which could be monetised, the estimated benefits are in the order of EUR 17.5 – EUR 30 billion per year, if chronic health effects are included. The monetised benefits exclude all ecological benefits, as these cannot currently be monetised. It can be concluded that the benefits of these proposals clearly outweigh the costs.

- **Are there particular geographical areas of the Community where these businesses are found?**

As can be seen from Table 1, the total costs of implementing the proposed directive on national emission ceilings are estimated to be highest in Germany, UK, Belgium, France, and the Netherlands.. The emphasis on reductions in these areas reflects that they are in the geographical region where the problems of acidification and exposure to high ozone levels are most pronounced and therefore most difficult to solve. The density of emissions in these areas is very high, reflecting high population densities, high concentrations of industrial activity and, for some areas, very intensive animal husbandry.

In developing the proposals the Commission carefully considered both the need for proposals which are cost-effective at the Community scale and the potential distribution of effort between Member States. From the analysis carried out it was concluded that if, at the Community scale, the environmental benefits are to be maximised for a given level of costs (or, conversely, if costs are to be minimised for a given environmental objective) there must be a differentiation of Member State emissions. Differentiation is not only cost-effective, but is also fully in line with the polluter-pays principle, as those countries whose emissions cause most damage are required to go the furthest.

Whilst the emission source-receptor relationship is an important factor influencing the identification of national emission ceilings, the fact remains that those Member States which would be obliged to make the greatest efforts are also generally those with some of the highest levels of economic activity, benefiting at least in part from their proximity to markets and access to good transport infrastructure.

3. WHAT WILL BUSINESS HAVE TO DO TO COMPLY WITH THE PROPOSAL

It would be for the Member States and the Community to determine the appropriate sectors and measures to ensure compliance with the proposed directive. The sectors thus identified will have to implement measures that will ensure that emissions are reduced to the required level.

4. WHICH ECONOMIC EFFECT IS THE PROPOSAL LIKELY TO HAVE?

- **On employment and investment and the creation of new businesses**

Growth and increased value added and employment in the sectors supplying pollution abatement technologies should offset the effects on those sectors required to implement measures. Technological progress may be stimulated by new requirements, and strengthened demand for improved technologies should have a positive impact on the creation of new business in those sectors.

- **On the competitiveness of business**

No significant impact is expected on the competitiveness of business. The measures taken would be expected to impact diffusely on a range of sources of pollution in all sectors.

5. DOES THE PROPOSAL CONTAIN MEASURES TO TAKE INTO ACCOUNT THE SPECIFIC SITUATION OF SMALL AND MEDIUM SIZED FIRMS (REDUCED OR DIFFERENT REQUIREMENTS ETC)

Member States should take appropriate account of the situation of SMEs when taking measures to implement the proposed directives. For its part, the Commission will take account of the situation of SMEs when considering the need for further sectoral Community legislation to help Member States achieve the proposed emission ceilings.

6. CONSULTATION

On the national emission ceilings

Industry *(Unice, Eurelectric, Europia/Concawe, and Cecso)* has questioned whether the environmental improvements which can be expected from the proposal are justified in terms of their costs. In this context, uncertainties linked to the model framework and input data used to derive the emission ceilings have been pointed out, as have uncertainties regarding the actual benefits of the proposal. Furthermore, industry sees the stringency and costs of the reference scenario as already involving a very considerable effort which poses national and sectoral economic and competitiveness concerns.

The Commission considers that the analysis of costs and benefits clearly demonstrates the added value of this action, even when considering the inherent uncertainties of such analysis. The Commission does not consider that the proposals pose significant national and sectoral economic and competitiveness concerns.

On the ozone directive

Unice questions the long-term objective and the scientific basis on which the WHO derived its guideline. Unice proposes setting a less stringent target value with a higher compliance requirement and questions the approach used to derive the target value. Unice also questions the inclusion in the benefits analysis of mortality effects of ozone in the estimation of the monetary benefits of meeting the proposed targets and objectives.

The Commission considers that currently available scientific advice regarding the effects of ozone exposure justifies the link between the WHO guideline and the standards in air quality legislation for ozone, as well as the proposed target values for ozone. Current scientific advice indicates that setting a higher nominal target value and concentrating on the peak values, as suggested by Unice, would undermine the ability of the target value to provide adequate and effective protection of health. The Commission furthermore considers that the available information on costs and benefits fully justifies the proposed directive.

7. CONTACT POINTS

Martin Lutz, desk officer, ozone directive

Katja Löfgren, desk officer, NEC directive

Table 1: Additional cost of implementing the proposed Directive on national emission ceilings (million Euro per year)

	SO_2	NO_x/VOC	NH_3	Total
Austria	0	119	0	119
Belgium	127	459	467	1 053
Denmark	5	0	0	5
Finland	0	0	0	0
France	136	739	41	916
Germany	244	1 048	854	2 146
Greece	0	338	0	338
Ireland	20	4	20	44
Italy	0	403	0	403
Luxembourg	1	4	0	5
Netherlands	19	211	741	971
Portugal	0	57	0	57
Spain	9	13	0	22
Sweden	0	87	0	87
UK	299	1 026	23	1 348
EC15	860	4 508	2146	7 514

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113