IV.3 Air

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IV.3.1 Introduction

Air, like water, is an environmental medium, which circulates freely though the environment and together with soil/land and water forms the habitat for all flora and fauna. The different elements contained in the air we breathe every day and deposited on water and soil are influenced by an array of different factors such as weather patterns, complex atmospheric chemistry and anthropogenic activities leading to air pollution. Air pollution can both be a local and an international problem, because it can be transported over long distances. EU legislation on air pollution addresses two sides of the same coin: pollutant emissions as well as air quality *(see chapter IV.1)*. Emission legislation tries to reduce the amount of pollution emitted into the atmosphere. Air quality legislation aims at guaranteeing that the air we breathe is safe for human health as well as for the environment as a whole.

The four topics presented in this chapter make up the cornerstones of European air legislation. The air quality Framework and Daughter Directives set minimum quality standards for clean air that apply throughout the Union. The Directive on national emission ceilings (NECs) is the most important law regulating the emissions of air pollutants. It covers four air pollutants of crucial importance for human health, ground-level ozone, acidification and eutrophication. The Directive defines important interim objectives in order to protect the environment and human health and also spells out long-term environmental and health objectives with regard to air pollution, the latter based on the carrying capacity of the ecosystems *(see chapter IV.3.2)*. The two other sections in this chapter focus on large combustion plants and car emissions, thus addressing two of the most important sectors causing air pollution in the EU.

While most of the current air legislation in the EU was formulated during the 90s, air pollution has been in the political debate for much longer. Over time, different aspects of the problem became

the focus of political attention. Strong environmental concerns brought air pollution onto the political agenda: the problem of acidification of Scandinavian lakes and rivers was discovered in the late 60s. This was followed by concerns over air pollution impacts on forests, including the acidification of forest soils in the 80s. Since the 90s, the debate has also focussed strongly on the health damage caused by air pollution, particularly with regard to urban air quality.

Clean air policy-making in the EU has been influenced by international negotiations on air pollution : under the 1979 Convention of Long-range Transboundary Air Pollution, and its various protocols, in particular the 1999 Gothenburg Protocol[20]. Important EU policy-goals relating to air pollution were laid down in the Fifth (1992) and Sixth (2002) Environment Action Programmes and the Community Strategy to Combat Acidification (1997) *(see chapter III)*.

Air pollution legislation in the European Union has so far been relatively effective. Over the past few decades it has reduced pollutant emissions and improved air quality substantially. However, combating air pollution is still a formidable challenge: we are far from reaching the EU's clean air objectives of not exceeding **critical loads** and levels and the effective protection of all people against recognised health risks from air pollution, which are the most important EU objectives with regard to air pollution *(see chapter IV.3.2)*.

DEFINITION

Critical loads specify the environmental carrying capacity for different ecosystems. They have been defined as: "The highest load that will not cause chemical changes leading to long-term harmful effects on the most sensitive ecological systems".

Source: Nilsson, J. (Ed) (1986): Critical loads for nitrogen and sulphur.

Ground-level ozone and particulate matter (PM) are still important issues of concern for human health and effects on ecosystems, particularly as more and better evidence about the negative health effects caused by these pollutants[21] becomes available. Currently the life-expectancy of EU-citizens is shortened on average by about 9 months due to man-made PM, according to the most recent calculations under the Clean Air for Europe programme (CAFE) (*Amann et al. 2004*)[22]. This is comparable to the impact of traffic accidents (*ibid p. iv*). In the year 2020, if all existing EU legislation concerning sources of air pollution is implemented, for large parts of the population life expectancy losses attributable to antropogenic PM are calculated to still exceed 6 months (and in countries like Belgium and the Netherlands it will still be about nine months) (*ibid, p.58*)[23]. Furthermore, the European Environment Agency (EEA) concludes that countries in Central and Eastern Europe still have problems with sulphur dioxide and nitrogen oxides (*EEA 2003*)[24].

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[20] For further information, see: **http://www.unece.org/env/lrtap/welcome.html** and **http://www.unece.org/env/lrtap/multi_h1.htm** (official Convention website). From ECO point of view, see: **http://www.acidrain.org/clrtap.htm**.

[21] For example: WHO (2003) Health Aspects of Air Pollution with Particulate Matter, Ozone and Nitrogen Dioxide, Report on a WHO Working Group, Bonn, Germany, 13-15 January 2003, Copenhagen, **http://www.euro.who.int/document/e79097.pdf** , WHO: Health Aspects of Air Pollution – answers to follow-up questions from CAFE, Report on a WHO working group meeting, Bonn, Germany 15-16 January 2004, Copenhagen, **http://www.euro.who.int/document/E82790.pdf**. For overview, see: **http://www.euro.who.int/eprise/main/WHO/Progs/AIQ/Activities/20020530_1**).

[22] Report available at: **http://www.iiasa.ac.at/rains/CAFE_files/Cafe-Lot1_FINAL(Oct).pdf**

[23] Please note: These figures are probably underestimations. This computer model only calculates mortality for population above 30 years, it does not calculate infant mortality and thus underestimates overall effect. Also, for technical reasons, these calculations only reproduce a part of the total observed mass of PM, thus health effects are likely to be underestimated.

[24] **http://reports.eea.eu.int/environmental_assessment_report_2003_10-sum/en/kiev_sum_en.pdf** .

Acidification is still a prevailing problem in European forests and fresh waters. If no further measures are taken, in the year 2020, 150,000 km² of forests will continue to receive unsustainable amounts of acid deposition from the atmosphere and thousands of Scandinavian lakes will still not be able to recover from past acidification (*Amann et al. 2004, p.vi*). Furthermore, improved understanding of the nitrogen cycle reveals serious threats for biodiversity from excess nitrogen deposition from the atmosphere throughout Europe (*ibid, p. iv*). Current computer modelling under the CAFE programme shows that if no additional abatement measures are taken, biodiversity will remain threatened at more than 650,000 km2 (45% of European ecosystems) due to excessive nitrogen deposition (*ibid, p. vi*.).

Therefore it is crucial that further efforts are made to reduce air pollution and to ensure that existing air pollution related Directives (as well the related IPPC Directive – *see chapter V.3.2*) are implemented and enforced everywhere in the EU. When introducing further policies to reduce air pollution, it is also important to keep in mind that there are linkages between air pollution and climate change. Energy efficiency, renewable energy and sustainable mobility policies offer win-win solutions that simultaneously help to combat both air pollution and climate problems.

IV.3.2 The overarching EU environmental and health objectives for clean air

Protection of the environment and the health of EU citizens are important elements of the EU Treaty. It obliges the European Community to preserve, protect and improve the quality of the environment and to strive for a high level of environmental and human health protection in its policies (EC Treaty).

In the field of air legislation, the two most important Directives in this context are the air quality Framework 1996/62/EC and national emission ceilings (NECs) 2001/81/EC Directives.

The air quality Directives define minimum standards for the protection of health and the environment that are to be met everywhere. The two main aims of the air quality Framework Directive are:

- To "define and establish objectives for ambient air quality in the Community designed to avoid, prevent or reduce harmful effects on human health and the environment as a whole".
- To "maintain air quality where it is good and to improve it in other cases".

The first objective is rather broad. It is further specified in the four subsequent "Daughter Directives" that were agreed by the EU in the following years. The Directive requires the Daughter Directives to set effects-based limit values, aimed at safeguarding human health and the environment. The second objective complements this by indicating where the Directive applies. It clearly states that air quality should not deteriorate anywhere in the EU.

The NEC Directive further complements ambient air quality standards by setting the long-term environmental quality and health objective "of not exceeding critical levels and loads and of effective protection of all people against recognised health risks from air pollution"[25].

[25] Directive 2001/81/EC, Art. 1.

Critical loads specify the environmental carrying capacity for different ecosystems. They have been defined as: "The highest load that will not cause chemical changes leading to long-term harmful effects on the most sensitive ecological systems" (*Nilsson 1986*). It can be said that in a strict sense a critical load, according to that definition, is one that produces no effect on the most sensitive[26]. receptor, even in the long term. Receptors may be individual species, types of soil, ecosystems, etc With regard to human health, it is evident that in order to effectively protect all people against recognised health risks of air pollution, particular attention needs to be paid to the protection of vulnerable groups such as children or elderly people. These long-term objectives provide the benchmark for the success and ambition of EU air policy measures.

IV.3.3 The air quality Directives: the Framework Directive on ambient air quality assessment and the four Daughter Directives

IV.3.3.1 INTRODUCTION

The Framework Directive on ambient air quality assessment and management (*96/62/EC*) from 1996 lays down, for the first time, common rules and principles for setting effects-based air quality limit values to be met everywhere in the EU. It lists 12 pollutants for which legislation, including limit values, measurement and assessment requirements, must be developed, and sets the timeframe for the development of the so-called "*Daughter Directives*". In the years 1999, 2000, 2002 and 2004 the EU subsequently adopted four Daughter Directives on ambient air quality, covering all the 12 pollutants.

The first Daughter Directive (*1999/30/EC*) sets limit values for sulphur dioxide, oxides of nitrogen, particulate matter, and lead in ambient air, and replaces the previous EU Directives adopted in the 80s. The limit values set in the Directive aim at protecting human health and are based mainly on the (1997) World Health Organisation's (WHO) guidelines. For sulphur dioxide (SO_2) and nitrogen dioxide (NO_2) additional environmental standards were introduced to be met outside built-up areas. The

DEFINITIONS

Limit value: a level fixed on the basis of scientific knowledge with the aim of avoiding, preventing or reducing harmful effects on human health and/or the environment as a whole, to be attained within a given period and not to be exceeded once attained.

Target value: a level, fixed with the aim of avoiding more long-term harmful effects on human health and/or the environment as a whole, to be attained where possible over a given period.

Alert threshold: a level beyond which there is a risk to human health from brief exposure and at which immediate steps shall be taken (...).

Source: Framework Directive (96/62/EC).

[26] For further information, see: Critical loads Environmental factsheet published by the Swedish NGO Secretariat on Acid Rain. Updated May 1998, http://www.acidrain.org/cl_fact.htm#Critical_loads

Directive further defines detailed measurement requirements, i.e. where to measure air quality (urban background, close to traffic, close to industry, etc.), how many monitoring stations per city, and which measurement technique should be used. Last but not least, a separate article defines the Member States' obligations regarding the dissemination of information to the public.

The second Daughter Directive (*2000/69/EC*) sets limit values for benzene and carbon monoxide (CO) for the first time in the EU. This is particularly important as it represents the introduction of an air quality standard for a carcinogenic pollutant – benzene – where no safe threshold can be defined. After the full implementation of this Directive it is estimated that emissions of benzene will drop 70% by 2010 and those of carbon monoxide by one-third by 2005.

The third Daughter Directive relating to ozone (*2002/3/EC*)[27] sets non-binding target values for ozone in ambient air to be attained "where possible" by 2010 as well as long-term objectives equivalent to the World Health Organisation's guideline values[28]. These targets correspond to the objectives set in Directive 2001/81/EC on national emission ceilings *(see chapter IV.3.4)*. The Directive also sets alert thresholds and requires Member States to take short-term action if these alert thresholds are exceeded and includes requirements to inform citizens about the actual pollution load.

The fourth Daughter Directive (*2004/107/EC*) also sets non-mandatory target values for arsenic, cadmium, nickel and polycyclic aromatic hydrocarbons (PAHs) as well as specifying monitoring requirements for mercury.

All Directives require the development of pollution reduction plans by Member State authorities. When a certain concentration of pollutants is exceeded (specified in detail in the different Directives), plans and programmes have to be made, listing the different policy actions (e.g. low emission zones, promotion of walking and cycling etc.) the authority plans to take for achieving the standard. These plans and programmes have to be reported to the Commission and to be made available to the public, in order to allow citizens to trace progress towards meeting the standards.

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[27] This Directive replaces and older Ozone Directive (92/72/EC), which was repealed by that date.

[28] The possibility to set target instead of limit values in the case of ozone is already mentioned in the Framework Directive (Art. 4.1) taking "*account of the specific formation mechanisms of this pollutant*". In the opinion of the EEB, this shouldn't, however, reduce the efforts to implement policies to reduce ozone pollution.

Table 1: Limit (LV) and target values (TV) in the air quality Directives.

POLLUTANT	ENTRY INTO FORCE	1 H. AVERAGE (HUMAN HEALTH)	24 H. AVERAGE (HUMAN HEALTH)	ANNUAL AVERAGE (HUMAN HEALTH)	8 H. MEAN VALUE (HUMAN HEALTH)	VEGETATION AND ECOSYSTEM
Sulphur Dioxide ($Sé_2$)	2005 (LV)	350µg/m3	125 µg/m3			20µg/m3 per year
Nitrogen Dioxide (NO_2)	2010 (LV)	200 µg/m3		40 µg/m3		30µg/m3 per year
PM_{10}	2005 (LV) 2010 (LV) [a]		50 µg/m3 [b] 50 µg/m3 [c]	40 µg/m3 20 µg/m3		
Lead (Pb)	2005 (LV)			0.5 µg/m3		
Benzene (C_6H_6)	2010 (LV)			5 µg/m3		
Carbon Monoxide (CO)	2005 (LV)				10 µg/m3	
Ozone (O_3)	2010 (iV)	180/240 µg/m3 [d]			120 µg/m3 [e]	AOT_{40} [f] = 18 000 µg/m3 hours
PAH	2012 (TV)				1 ng/ m^3	
Cadmium (Cd)	2012 (TV)				5 ng/ m^3	
Arsenic (As)	2012 (TV)				6 ng/ m^3	
Nickel (Ni)	2012 (TV)				20 ng/ m^3	
Mercury (Hg)	no LV or TV	-	-	-	-	-

(a) Indicative limit values to be reviewed in the light of further information on human health and environmental effects, technical feasibility and experience in the application of Stage 1 limit values in the Member States.

(b) Not to be exceeded more than 35 times a calendar year.

(c) Not to be exceeded more than 7 times a calendar year.

(d) At 180 (information threshold) the population should be informed, and at 240 (alert threshold) short-term action should be taken.

(e) Not to be exceeded more that 25 times per year.

(f) AOT_{40} = Accumulated exposure over the threshold 40 ppb.

IV.3.3.2 ASSESSMENT

IV.3.3.2.1 Strong points

Legally Binding Standards: The limit values in Directive 1999/30/EC and Directive 2000/69/EC are legally binding air quality standards. These are strong policy drivers for air quality management and policies for clean air. Citizens have the right to go to court if their authorities have not achieved the standards or not implemented appropriate measures to achieve them. This is a strong tool for environmental organisations which, together with affected citizens, can raise court cases about enforcing the air quality limit values (this has already been done in the UK and the Netherlands, and is likely to happen in Germany as well).

Simple: Limit values are relatively simple and easy to communicate. This makes it easy for environmental groups to use them in communicating with the general public. In Germany for example, EEB member organisation Bund für Umwelt und Naturschutz Deutschland (BUND) refers to the limit values when campaigning for better inner city transport policies and particulate filters for diesel cars.

More data: The Directives generate a wealth of air quality data. In the different Daughter Directives, measurement requirements (citing criteria, number of stations) have subsequently been laid down in more detail. This data will enable a better understanding of air quality problems throughout the EU and will thus help to identify gaps in the policy responses at local, national and EU levels. It will also facilitate better target policies and measures and could possibly be used to benchmark between Member States (However also *see the point on comparability under chapter IV.3.3.2.2*).

Public information: Public information clauses in the air quality Directives are quite good. Besides obligations to inform the general public, the second, third and fourth Daughter Directives include the explicit obligation to inform environmental and consumer organisations. Attention and pressure from citizens and environmental organisations are particularly important for the implementation of the ozone and heavy metal Directives, which set target values instead of limit values. Strong concerns from the general public can serve as an additional policy driver to ensure that countries and regions do everything they can to comply with the target values.

Systematic approach: Air quality plans and programmes can lead to a systematic approach to tackling the problem of air pollution. The implementation of the first Daughter Directive indicates that the obligation to make plans and programmes and to comply with limit values stimulates some regions and cities to deal with the problem of air pollution in a more systematic and integrated way. This helps to raise the issue of air pollution on the agenda of local and regional policy makers and encourages different sections within administrations to work together on air quality management.

Important related positive effects: If air pollution is tackled through integrated traffic management and sustainable mobility policies there will be other positive side-effects such as less noise and congestion, and better quality of life in cities. Findings from the Dutch National Institute for Public Health and the Environment identify transport-related air quality and noise problems as main factors contributing to the diseases caused by environmental problems in the EU (*National*

Institute for Public Health and the Environment 2004). Reducing both noise and pollution would yield considerable health benefits. Additionally, many measures reducing air pollution also reduce atmospheric levels of CO_2 , the main greenhouse gas. This is a case for encouraging , for example, more stringent energy efficiency requirements in the industry and housing sectors as well as for measures promoting renewable energy.

IV.3.3.2.2 Weak points

Target values: Not all air quality Directives contain legally binding limit values. Directive 2002/3/EC on ozone, as well as Directive (*2004/107/EC*) on heavy metals and PAHs contain only non-mandatory target values. Particularly with regard to the latter, the EEB had demanded the setting of limit values, because of the carcinogenic properties of these pollutants. Cadmium and mercury are identified as priority hazardous substances in the Water Framework Directive *(see chapter IV.5).* Therefore the objective should be to phase out all anthropogenic emissions of these carcinogens. Unfortunately the air quality Directive does not make this link – it does not refer to the Water Framework Directive nor does it set limit values or ambitious long-term objectives. The target values require Member States to attain these levels, "where possible" *(2002/3/EC, Art. 2.9)*. However, if they do not reach them, political and juridical action might be limited. Furthermore, without a clear EU level playing field Member States and their authorities are vulnerable to economic pressure groups. Specifically in the case of the Directive on heavy metals and PAHs, target values are explicitly excluded from being used as relevant environmental quality standards in the permitting procedures of industrial installations under the IPPC Directive *(see chapter V.3.2)*.

Local versus national: Air quality Directives focus primarily on local pollution hotspots, but the substances addressed are not only of local origin, but also transported over long distances. Local authorities charged with implementing the Directives often claim that local policies and measures are not sufficient to bring down pollutant concentrations to the required levels. Often, additional measures at national or EU-level are needed to achieve air quality standards. However, there is not necessarily co-ordination between national and local air quality policies. National policy objectives particularly in the field of transport, often run counter to local air quality objectives. Therefore, when additional EU measures are negotiated in the Council, Member States – because of short-term national interests - often block or water down legislative proposals that would help them achieve air quality standards (for example the currently negotiated revision of Directive 1999/32/EC on the sulphur content of ship fuel).

HOTSPOT AND BACKGROUND STATIONS

PM monitoring stations are located in three different categories of places: hotspots, urban background and rural background. Hotspot monitoring stations measure ambient air quality near busy roads or other highly polluted places, whereas urban and rural background stations give the concentration for the air quality in a city or region as a whole.

Comparability: Data generated by the Directives is not always comparable. Countries have some leeway in deciding where exactly to put pollution monitors, so in some countries hotspot measurement stations would be closer to the road centre than in others[29]. Countries that have prob-

[29] This is the case for instance with regard to the siting criteria for traffic-oriented PM10 samplers, which currently define a minimum distance from the kerbside, but no maximum distance (1999/30/EC).

lems in meeting the limit values in these hotspots may argue that other countries which appear not to have such problems only do so because when they take measurements they do not measure closely enough to the kerbside. Countries also have some freedom on deciding how to set up their mix of stations, i.e. the ratio between hotspot and background stations varies from country to country[30]. Furthermore, the two most commonly used types of measurement equipment used in the EU to monitor PM do not produce equivalent results. To provide comparable data, the countries that use non-standard measurement methods need to demonstrate to the Commission that the results of their measurement methods are equivalent to the standard method defined in the first Daughter Directive. If they are not, they need to apply a correction factor to the results they obtained. An expert working group on implementation has produced substantive guidance on how this equivalency can be demonstrated mathematically, but so far the guidance has not been used by Member States or correction factors are still missing for some monitoring stations. All these factors mean that EU-wide PM data is not fully comparable. This is impractical for establishing EU-wide trends and forecasts, which are politically relevant particularly if Member States are or are likely to be out of compliance with the limit values.

Ecosystem protection: Siting criteria for ecosystem monitoring stations are too lax. The current criteria defining where ecosystem monitoring stations need to be installed mean that it is not possible for example to apply ecosystem limit values at Natura2000 sites that are close to a road or relatively close to an agglomeration[31]. This means such areas would only be covered by the less stringent limit values for human health and thus could be exposed to levels of air pollution that are damaging to ecosystems and plants. This is in clear contradiction to the goals of EU nature conservation and biodiversity policies. In locations where specific EU legislation for ecosystem protection exists, ambient air quality legislation should complement this. The siting criteria in the Directive should be amended, making it possible to apply the stricter ecosystem limit values in these areas.

IV.3.3.3 IMPLEMENTATION:

IV.3.3.3.1 Will the objectives be achieved?

It is difficult to assess whether the limit values of EU air quality legislation will be achieved or not, as some of these limit values will enter into force in 2005 or 2010 respectively (i.e. after the time of writing of this article). Most of the following assessment will be focussed on the first Daughter Directive, as this is where most implementation experience has already been gathered.

With regard to PM_{10}, a wealth of monitoring data has been analysed by the CAFE expert working group on particulate matter. In summer 2004, this working group produced the Second

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[30] PM monitoring stations are located in three different categories of place: hotspots, urban background and rural background. Hotspot monitoring stations measure ambient air quality near busy roads or other highly polluted places, whereas urban and rural background stations give the concentration for the air quality in a city or region as a whole.

[31] Sampling points for analysing air quality for ecoystems or vegetation should be sited more than 20 km form agglomerations or more than 5 km from other built-up areas including motorways, see: 1999/30/EC, Annex VI.

Position Paper on Particulate Matter, which will inform the Commission in preparation for the planned revision of the first Daughter Directive. It concluded that: "without additional policies and measures, there will be widespread non-attainment" of the PM limit values in the EU[32].

In hotspots, PM limit value exceedances can be quite substantial[33]. The highest concentrations - about twice the actual 24 hour limit value - were found at traffic hotspots and near industrial installations[34]. The high concentrations near industrial installations illustrate again, how air quality protection is linked to the IPPC Directive, as PM limit values have to be respected, when site-specific permits are issued. Permits for industrial installations are one way of achieving the proscribed level of air quality *(see chapter V.3.2)*. Diffuse PM emissions are also important in the context of heavy metals which are regulated under the fourth air quality Daughter Directive, as some of the particulate mass can consist of heavy metal compounds.

In many countries PM_{10} levels frequently exceeded even the urban background measurement sites, and some countries also have very high rural background concentrations of PM. Rural background levels for example in the Netherlands are higher than levels at traffic hotspot stations in countries such as Finland, Norway or the United Kingdom[35]. This illustrates that current PM concentration is highly differentiated across Europe. Given these substantial exceedances in many locations, it is indeed unlikely that the limit values will be met in all places in the year 2005. This is particularly worrying, as several studies have clearly demonstrated the many health hazards caused by particulate matter[36].

Regarding ground-level ozone, the third Daughter Directive on ozone 2002/3/EC has only been in force since 9 September 2003. Based on ozone monitoring data, a significant reduction in ozone concentrations has yet to be achieved. The EEA concludes: "Under current legislation and with the rate of turnover of the vehicle fleet, further reductions will gradually occur towards 2010, and further reductions may be necessary to achieve the target values of the new ozone Directive"[37].

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[32] **http://europa.eu.int/comm/environment/air/cafe/pdf/working_groups/2nd_position_paper_pm.pdf** , p. 12.

[33] Out of the number of stations exceeding the limit values plus margin of tolerance in 2001, several monitoring stations reported peak levels exceeding 100 µg/m3, which is more than twice the 24h limit value for PM10. CAFE Working Group on Particulate Matter (2004): p. 60.

[34] See: CAFE Working Group on Particulate Matter (2004): p. 60. Typical examples of industrial installations with diffuse dust emissions are steel mills, non-ferrous metal smelters, open mining, cookeries, cement production, large uncovered stock piles or loading and unloading of dusty goods, see ibid. p. 72.

[35] CAFE Working Group on Particulate Matter (2004): p. 67. When referring to any of these results it is important to keep in mind that there are comparability problems of PM10 levels in Europe *(see weak points in this chapter)*.

[36] Medina, Sylvia, Elena Blodo, Michael Saklad (2004): Health Impact Assessment of Air Pollution in 26 European Cities and Communication Strategy – Latest Findings of the Apheis Programme, **http://www.umweltdaten.de/whocc/Newsletter34.pdf**, WHO (2003) **http://www.euro.who.int/document/e79097.pdf** .

[37] EEA (2003): Air pollution by ozone in Europe in summer 2003. Overview of exceedances of EC ozone threshold values during the summer season April–August 2003 and comparisons with previous years, Report to the European Commission by the European Environment Agency, European Topic Centre on Air and Climate Change based on data provided in the framework of Council Directive 92/72/EEC on air pollution by ozone by 15 September 2003, Executive Summary **http://reports.eea.eu.int/topic_report_2003_3/en/tab_content_RLR**

In the summer of 2003 exceptionally long-lasting and spatially extensive episodes of high ozone concentrations occurred, mainly in the first half of August. EEA states that these episodes appear to be associated with the extraordinarily high temperatures over wide areas of Europe. This demonstrates an important link between high ozone concentrations and climate change: if climate change were to result in warmer summers in Europe, ozone levels would increase, even if current emission levels of air pollution were to remain the same[38]. In order words, climate change would aggravate the problem of ground-level ozone, causing additional health and environmental impacts *(see chapter IV.2 on Nature Protection and Biodiversity)*.

IV.3.3.3.2 Have plans and programmes been made?

In summer 2004, the European Commission sent first warnings to nine out of the EU-15 Member States for failure to submit plans and programmes reducing NO_2 and PM. These formal notices were sent to Austria, France, Germany, Ireland, Italy, Luxembourg, Portugal, Spain and the UK[39]. None of these countries had submitted plans and programmes to the Commission by December 2003, even though there were quite significant exceedances of the limit values in the first Daughter Directive all over Europe.

Italy has the most zones reporting exceedances of the PM_{10} and NO_2 limit values **plus margin of tolerance**. No pollution-reduction plan or programme had been notified to the Commission by July 2004. This is particularly striking, as Italy is among those countries that – according to the PM position paper – have the highest exceedances for hotspots as well as urban background concentrations.

MARGIN OF TOLERANCE
Percentage by which the limit value may be exceeded in the years before it enters into force. The aim of this margin is to indicate, in which areas Member States need to implement policies to achieve the limit values. If the margin of tolerance is exceeded, plans and programmes must be made with the aim of meeting the limit value.

In France, lengthy implementation procedures seem to have contributed to the late start in making plans and programmes. Analysis by French EEB member France Nature Environment (FNE) also shows that out of 26 agglomerations that need to make air quality management plans, at the time of writing, only one has actually implemented an air quality management plan. 19 agglomerations are still beginning to design their plan, which means that the plans will not enter into force before the end of 2004 or beginning of 2005 respectively (*Roesch and Cambou 2004*)[40]. This is obviously too late, if they are intended achieve limit values in 2005.

IV.3.3.3.3 What is the quality of the plans and programmes?

It is difficult to assess the quality of the many plans and programmes that have been made and are still being made in the context of the first Daughter Directive. According to a recent

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[38] EEA (2003): p. V and VI.

[39] Commission press release (2004) Outdoor air quality: Commission asks nine Member States to reduce pollution, reference: IP/04/872 Date: 08/07/2004.

[40] Available at , **http://www.fne.asso.fr/PA/air/doc/GuidePPA.pdf** . For further info: **http://www.fne.asso.fr/PA/air/dos/sp_air_A9.htm#ppa**

Commission workshop on plans and programmes[41] a frequent problem seems to be the lack of quantification of air quality impacts. Air quality impacts of certain measures are rarely modelled. Given this lack of quantification, the prioritisation of measures becomes difficult. Moreover, several cities and regions in the New Member States report the planned construction of ring-roads to solve inner-city air quality problems[42]. Obviously, this is a counterproductive way of managing urban transport policy and cannot be supported from an environmental point of view.

According to German EEB member (BUND) most plans and programmes drawn up by German cities are disappointing, because they are often quite noncommittal. Measures are not co-ordinated into an overall policy with concrete measures to reduce traffic at large. Effective measures like low emission zones with restricted access for high-emission vehicles (for example for diesel cars without particulate filters) have not yet been planned by any German city. However, as far as technical measures are concerned, some cities retrofit or intend to retrofit their bus fleets with particulate matter traps. All buses in Frankfurt and Lübeck use particulate filters, as do most of the buses in Berlin and Munich use them as well[43]. FNE shares the German analysis with regard to Dunkerque, the only French city to have already implemented an air quality management plan.. The measures specified in the plan are too general and there is a lack of targeted and quantified measures (*Roesch and Cambou 2004, p. 60*).

In the UK, there are around 130 local authorities required to make air quality management plans, and their quality varies. As there are so many plans and programmes, it is difficult for environmental citizens' organisations to assess the overall quality. An assessment for the UK Department of the Environment mentions the quantification of policy impacts as one of the first problems that come to attention in a comparative analysis of plans and programmes. It shows that in some cases it is extremely difficult to estimate the effect of certain measures on pollutant concentrations, because – again – some local authorities did not include quantified data regarding the emission sources. Cost-effectiveness assessment on a local scale has also proved difficult (*DEFRA 2004*)[44].

IV.3.3.3.4 How will the Directives be enforced by the Commission?

At the time of writing, it is not clear how the Commission will respond to the likelihood that many Member States will fail to comply with limit values. However, in response to the widespread lack of action plans so far and the indications that in the plans, effective measures aimed at reducing transport growth in city centres are often lacking, the EEB is calling for a strict enforcement of the

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[41] Implementing Air Quality Legislation in the enlarged EU: Workshop on Plans and Programmes of Air Quality and National Emission Ceiling Directives, 1-2 September 2004, Brussels, **http://europa.eu.int/comm/environment/air/cafe/general/workshop_on_plans_programmes.htm**.

[42] Prague reported a "speed-up the construction of new elements of communication system (inner and outer circuit)" as well as prioritising their street construction "according to its significance for air protection". The Silesia region in Poland as well as the Moravian-Silesian Region in the Czech republic presented "bypass building" and "continuation of road investment" as means to comply with the PM10 limit values. See: **http://europa.eu.int/comm/environment/air/cafe/general/workshop_plans_presentations.htm**

[43] Interview with Martin Schlegel (29.11.2004), transport campaigner BUND.

[44] Available at http://www.defra.gov.uk/environment/airquality/laqm/eval/pdf/actionplan-report.pdf , p. 19 ff.

Directive. A high level of scrutiny from the Commission is needed with regard to the question of whether plans and programmes have been made in time and if the Directive has been properly implemented in EU Member States. Furthermore, the Commission should evaluate the effectiveness of policies and measures undertaken in action plans. In particular, it should investigate if and how local air quality management is complemented by supporting policies at national level or if it is in fact counteracted by national policy priorities particularly in the field of transport policy.

So far it is clear that air quality Directives have not achieved their double objective of avoiding, preventing or reducing harmful effects on human health and the environment as a whole while at the same time maintaining ambient air quality where it is good and improving it in other cases. This is mainly due to insufficient implementation and enforcement: plans and programmes have to contain effective measures to reduce air pollution and this needs to be supported by a coherent national policy. Given the dramatic health impact of PM specifically, but also continuing problems with high ground-level ozone concentrations, more action to reduce PM and ground-level ozone is urgently needed.

IV.3.3.3.5 Room for ECO action (Environmental Citizens' Organisation)

ECO action on these Directives can take place at local, national and at EU levels. At EU level, ECOs can participate in the Clean Air For Europe (CAFE) process, where current EU clean air policy is evaluated and an integrated strategy for the future of clean air policy is formulated. At the time of writing, it appears as if the Commission is likely to revise the first Daughter Directive and to introduce new limit values for smaller dust particles ($PM_{2.5}$), which are so far not regulated by air quality Directives. ECOs should pay close attention to this revision process to ensure that the revised directive is environmentally ambitious.

At national level, focus on implementation of the existing Directives will become increasingly important. While the onus of controlling Member States' compliance with EU Directives rests with the Commission, it remains limited and its effectiveness depends largely on ECOs making the Commission aware of specific problems. As air quality legislation has good provisions for informing the public, environmental organisations, citizens' groups as well as public health organisations can use these to assess local air quality. They can act as a watchdog, demanding that these standards are respected everywhere in the EU, particularly at traffic hotspots and in areas near industrial installations. Furthermore, the plans and programmes that need to be drawn up to reduce pollution offer a unique opportunity for ECOs to promote a sustainable urban transport policy that reduces traffic, traffic congestion and pollution. Local environmental groups can critically follow the development of these action plans and insist that the measures selected in them are sound from a longer-term sustainability perspective and that they are actually put into practice. This is important to ensure that these Directives are implemented in a meaningful way, leading to improved environmental and health conditions and a better quality of life in cities.

IV.3.4 National emission ceilings for certain atmospheric pollutants[45]

The Directive 2001/81/EC on national emission ceilings (NECs) covers four air pollutants, namely sulphur dioxide (SO_2), nitrogen oxides (NOx), volatile organic compounds (VOCs), and ammonia (NH_3). It sets long-term environmental and health objectives with regard to air pollution in the European Union as well as interim environmental objectives to be achieved by 2010 *(see chapter IV.3.4.1)*[46]. These objectives are strong political commitments defining the environmental quality objectives in the field of air pollution.

Air quality legislation and emission legislation are complementary. Air quality Directives set the minimum standards to be achieved in ambient air everywhere in the union (*see chapter IV.3.3*). Emission legislation tries to provide the tools to attain the reductions necessary to meet those standards as well as to achieve long-term environmental quality objectives. This is a key Directive, both for defining long-term and interim environmental objectives as well as for defining country-by-country emission ceilings, which is the most important legally binding tool for meeting these objectives. Emission ceilings are also crucial for attaining the EU air quality standards for a number of pollutants, including SO_2, NO_2, fine particles (PM_{10}), and ozone.

IV.3.4.1 INTERIM OBJECTIVES AND EMISSION CEILINGS

The interim environmental objectives specified in this Directive are:

- **Acidification.** The areas where critical loads are exceeded to be reduced by at least 50% in all areas compared with the 1990 situation.
- **Health-related ozone exposure.** Ground-level ozone above the critical level for health to be reduced by two-thirds in all areas compared with the 1990 situation.. In addition, ground-level ozone load should not exceed a given absolute limit anywhere.
- **Vegetation-related ozone exposure.** Ground-level ozone above the critical level for vegetation to be reduced by one-third in all areas compared with the 1990 situation.. In addition, ground-level ozone load should not exceed a given absolute limit anywhere.

These interim objectives should be met by 2010. The Directive further specifies country-by-country emission ceilings to be attained by 2010. The purpose of the emission ceilings is *"to meet broadly"* interim environmental objectives, given in Article 5 of the Directive. Member States must limit their annual national emissions so that these do not exceed ceilings laid down in Annex 1 of the Directive (*see Table 2 at the end of chapter IV.3.4.6*), and they must ensure that these emission ceilings are not exceeded in any year after 2010.

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[45] This section of the text is largely reproduced from Environmental Factsheet No. 16, June 2004 by The Swedish NGO Secretariat on Acid Rain, see: **http://www.acidrain.org/pages/publications/factsheet/factsheet16.pdf**.

[46] To "move towards the long-term objectives of not exceeding critical levels and loads and of effective protection of all people against recognised health risks from air pollution", *2001/81/EC, Art. 1*. The long-term objective should be achieved "preferably by 2020", *Art 10.5 (b)*.

After the adoption of the NEC Directive, national emission ceilings for 2010 have also been agreed with the new Member States. These NECs are established in the accession treaties between the EU and each acceding country, and presented in Table 4 at the end of chapter IV.3.4.6.

IV.3.4.2 PROGRAMMES AND REPORTING

The Directive prescribes that by October 2002 at the latest, Member States were to have drawn up programmes for the progressive reduction of national emissions of the four pollutants and to have reported them to the Commission. These reports shall provide information on measures and action taken at national level to attain emission ceilings. National programmes are to be updated and revised by 1 October 2006 and Member States are obliged to make this information available to the public[47]. Member States must also make annual reports of their national emission inventories, and their emission projections for 2010, to the Commission. Methodologies for emission inventories and projections are specified in the Directive.

IV.3.4.3 REVIEW AND REVISION

Based on, among other elements, the information from Member States, the Commission was to report to the European Parliament and the Council in 2004 on progress made in the implementation of the national emission ceilings, on the extent to which interim environmental objectives are likely to be met by 2010, and on the extent to which long-term objectives could be met by 2020. It will have to report again in 2008.

The Directive's review was to be completed in 2004, including an evaluation of the indicative emission ceilings for the Community as a whole *(see next paragraph)*, and consideration of further cost-effective actions that might be taken in order to reduce emissions with the aim of attaining interim environmental objectives by 2010. The review report has not yet been delivered yet, but was to be part of the Thematic Strategy on air pollution to be published in July 2005. Furthermore, the Commission has launched a contract to evaluate national plans of the Member States, to provide technical input to the revision.[48]

The Commission intends to prepare and adopt by mid-2006 a legislative proposal to revise the national emission ceilings. This revision will build upon the work performed in the context of the Clean Air for Europe Programme and the Thematic Strategy on air pollution. The Commission may also propose *"further emission reductions with the aim of meeting, preferably by 2020, the long-term objectives"*.

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[47] The programmes are available under: **http://europa.eu.int/comm/environment/air/nationalprogr_dir200181.htm** .

[48] The final reports are available at the Commission's website at: **http://europa.eu.int/comm/environment/air/necr.htm**

IV.3.4.4 ASSESSMENT OF THE NEC DIRECTIVE

IV.3.4.4.1 Systematic overestimation of costs

In essence the methodology used when developing the Directive is intended to attain agreed objectives for improving environmental and health protection. It should also bring about an equal relative environmental improvement everywhere in the EU, while at the same time ensuring extraordinary improvements in the worst affected areas.

A computer model for integrated assessment was used to carry out a so-called joint optimisation to find the most cost-effective way, for the EU as a whole, of achieving the environmental aims expressed in the NEC Directive. This enabled the Commission to propose differentiated national emission ceilings, which largely reflects the polluter-pays principle and should maximize the environmental benefits of emission reductions[49].

A drawback of this methodology is that it tends to overestimate the costs for emission reductions. The reason is partly that only technical emission abatement measures have been considered, no account having been taken of structural measures such as switching fuels from coal to gas, increasing energy efficiency, greater use of alternative energy sources, and changes in the transportation and agricultural sectors. Emissions could be reduced at much lower cost through some of these structural changes rather than by relying solely on technical end-of-pipe solutions.

Furthermore, a highly doubtful energy scenario has been used in the computer modelling. This is largely based on information submitted by the individual Member States, and would imply an *increase* in the EU emissions of carbon dioxide by about 8 per cent by 2010. Such an increase is in absolute disregard of the commitments made by the EU and its member countries under the Kyoto protocol, involving a reduction of 8 per cent in EU emissions of greenhouse gases (of which carbon dioxide is the most important). A computer model run simulating a low-CO_2 scenario that would roughly accord with the Kyoto agreement brought the extra cost down by more than 40 per cent.

IV.3.4.4.2 Benefits to health and the environment

The area of ecosystems where the depositions of acidifying air pollutants exceed critical loads will be diminished as a result of the Directive. There will also be reductions in the exposure to damaging levels of ozone, both for people and vegetation. By lowering the emissions of SO_2 and NOx, the Directive will help reduce exposure to health-damaging fine particles (PM_{10} and $PM_{2.5}$), as these two pollutants act as precursors to secondarily formed sulphate and nitrate particles. Thus the Directive will contribute to achieving air quality limit and target values for SO_2, NO_2, PM_{10} and ozone. Although no interim targets have been set for eutrophication, improvements can nevertheless be expected as result of lower emissions of NOx and ammonia. However, in all cases significant further reductions in emissions are needed in order to attain the long-term objectives for protecting health and the environment.

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[49] A similar approach is now also being used in the Clean Air for Europe Programme (CAFE) generating the background data for the upcoming Thematic Strategy for Clean Air, which will outline the EU's priorities in air pollution policy until the year 2020.

The Commission also made an analysis of the quantifiable financial gains to be made from reducing emissions.. Account was taken chiefly of the effects on human health (morbidity and mortality), on farm crops and modern buildings and materials. Calculations showed the gains to be significant, and that the economically quantifiable benefits significantly outweighed the estimated costs. It should however be noted that a number of gains were not included, such as direct health effects of NO_2 and VOCs, less acidification of soil and water, less eutrophication, reduced effects on biological diversity, less long-term effect on forest productivity, and reduced damage to historical monuments.

IV.3.4.4.3 Level of ambition too low

A weakness of the Directive is that the country-by-country emission ceilings are not strong enough. Current NECs in the Directive will fail to reach even agreed interim environmental objectives for 2010 and will certainly not attain long-term objectives by 2020. This is because during the negotiations of the Directive, a political compromise between the Council and the Parliament was reached, which resulted in less demanding emission ceilings.

Initially the ceilings proposed by the Commission were relatively strict. These ceilings were largely also supported by the Parliament, but were firmly rejected by the Council. Another result of this compromise was that in the current Directive there is no strong legal link between the emission ceilings and interim objectives. The emission ceilings are only required to "meet broadly" interim objectives by 2010. In order to illustrate the gap between country-by-country emission ceilings and what needs to be achieved to meet interim environmental objectives, the Directive also contains so-called indicative emission ceilings (*set out in Annex II*). These are set for the EU as a whole (i.e. not for each Member State), and reflect the estimated emission reductions needed EU-wide to meet interim targets (*see Table 3 chapter IV.3.4.6*). In any case it is obvious that the attainment of long-term objectives will require significant further reductions in emissions of all four pollutants.

IV.3.4.5 FUTURE DEVELOPMENTS

The Directive was scheduled for review and revision by 2004. The revision would have been an opportunity both to strengthen the NECs for 2010, for setting new NECs for later target years (e.g. 2015 and/or 2020), and for deciding on a date for the attainment of the long-term environmental objectives.

As mentioned earlier, the first review and revision will be delayed by over a year, the reason being that the analysis and evaluation was to be co-ordinated with the ongoing Clean Air For Europe (CAFE) programme, initiated by the Commission in 2001[50]. The CAFE programme will result in a Thematic Strategy on air pollution due to be presented by the Commission by July 2005. The strategy is to be accompanied by proposals for revised and/or new Directives relating to air pollution. The review of the NEC-Directive will be one part of the Thematic Strategy, but legislative proposal revising the NEC-Directive and setting new national emission ceilings will be postponed until mid-2006. Current developments under CAFE indicate that the NEC-Directive may be extended to include national emission ceilings for fine particles (PM_{10} or $PM_{2.5}$, or both).

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[50] For further information, see: **http://europa.eu.int/comm/environment/air/cafe/index.htm**

IV.3.4.6 ROOM FOR ECO ACTION (ENVIRONMENTAL CITIZENS' ORGANISATION)

As significant further reductions in emissions of all four pollutants are needed to attain the long-term objectives and the ambient air quality standards described in chapter IV.3.3, it is important that ECOs keep monitoring the implementation of this Directive as well as acting to influence new related policy developments. One possible way of influencing EU policy development in this context is for ECOs to become more engaged and involved in the CAFE programme. This could take place both at the national level (Member States provide input data to the analysis, as well as national views and opinions) and at the EU-level (by participating in CAFE working groups, evaluate ongoing work and provide opinions).

As regards the Member States' reporting of national programmes, only a minority of Member States had actually prepared and reported such programmes in accordance with the Directive obligations. Here, national organisations could play an important role by exerting national pressure on their governments. If prepared in accordance with the obligations, these programmes could provide useful information not only on future emission levels, but also on national forecasts regarding future activity levels in the sectors of energy, transport, industry, and agriculture. Moreover, if Member States produce and disseminate this type of information properly, the likelihood of compliance with other air quality legislation, such as the EU air quality standards, could be better evaluated.

Table 2: National emission ceilings for SO_2, NOx, VOCs and NH_3, to be attained by 2010 for EU15 Member States (kilotonnes).

COUNTRY	SO2	NOX	VOCS	NH3
Austria	39	103	159	66
Belgium	99	176	139	74
Denmark	55	127	85	69
Finland	110	170	130	31
France	375	810	1050	780
Germany	520	1051	995	550
Greece	523	344	261	73
Ireland	42	65	55	116
Italy	475	990	1159	419
Luxembourg	4	11	9	7
Netherlands	50	260	185	128
Portugal	160	250	180	90
Spain	746	847	662	353
Sweden	67	148	241	57
UK	585	1167	1200	297
EU15	***3850***	***6519***	***6510***	***3110***

Table 3: Indicative EU-wide emission ceilings for SO_2, NOx and VOCs (kilotonnes).

	SO2	NOX	VOCS
EU15	3634	5923	5581

Table 4: National emission ceilings for SO_2, NOx, VOCs and NH_3, to be attained by 2010 for the new Member States[i] and accession candidate[ii] countries (kilotonnes).

COUNTRY	SO2	NOX	VOCS	NH3
Bulgaria	*856*	*266*	*185*	*108*
Czech Republic	265	286	220	80
Cyprus	39	23	14	9
Estonia	100	60	49	29
Hungary	500	198	137	90
Latria	101	61	136	44
Lithuania	145	110	92	84
Malta	9	8	12	3
Poland	1397	879	800	468
Romania	*918*	*437*	*523*	*210*
Slovakia	110	130	140	39
Slovenia	27	45	40	20

[i] The NECs for the new Member States are not given in the NEC Directive (2001/81/EC), but in the accession treaty for each country.

[ii] The NECs for the two accession candidate countries Bulgaria and Romania have not yet been established. Therefore, the figures given in this table for these two countries are taken from the 1999 Gothenburg Protocol.

IV.3.5 Road vehicles

IV.3.5.1 WHY EMISSION LEGISLATION FOR ROAD VEHICLES?

In 2001, road traffic in the EU15 was responsible for nearly half of all emissions of nitrogen oxides (NOx) and one third of those of volatile organic compounds (VOCs). It also contributed significantly to the emissions of fine particulates (PM) and of the greenhouse gas, carbon dioxide (CO_2). Reducing vehicle emissions is therefore a crucial component of any strategy to combat pollution from PM and ozone, as well as climate change.

Emission requirements for light road vehicles have existed in the EU since the early 70s, while the first emission standards for heavy vehicles came at the end of the 80s. As a result of this legislation, over the years the air pollution rate per vehicle has decreased considerably. A new car or truck today may emit some 80-90 per cent less air pollutants, as compared to a vehicle produced in the 70s.

It is however important to note that while technological improvements have lead to significant improvements in the emission rates from new road vehicles, transport volumes in the EU have grown steadily, at about the same rate as the economy or above. Over some ten years since the early 90s, passenger transport has grown by almost 20% and freight transport by about 30% (*EEA 2004*). Furthermore, progress made with diesel cars was much slower than with petrol cars, where the introduction of the catalytic converter as exhaust gas treatment brought about the main improvements. Diesel engines have only been treated by an internal optimisation of the engine. This helps explain why, during the same time period, emissions of regulated air pollutants from the transport sector were reduced only by 24 to 35% (international aviation and marine shipping not included) (*EEA 2004*). In spite of these reductions in air pollutant emissions from road transport, serious air quality problems still exist, especially in urban areas.

Consequently, significant further emission reductions from motor vehicles are necessary for the EU to reach its environmental and health objectives as outlined in the two previous subchapters. Technical standards, which apply to all new vehicles in the EU, offer the possibility of achieving across-the-board emission cuts and can help to bring down background concentrations of PM and ground-level ozone. They are thus important measures that can help local authorities to achieve the air quality limit values *(see chapter IV.3.3.3)*. Emission limits for vehicles have to be EU-wide, as internal market regulations require joint Community standards so that vehicles, like any other product, can circulate freely in the internal market of the European Union.

IV.3.5.2 SOME ASPECTS OF REGULATING VEHICLE EMISSIONS

The specific properties of different types of engine and fuel result in different emissions of the various pollutants (carbon monoxide, nitrogen oxides, particulate matter, hydrocarbons an carbon dioxide). Diesel-driven vehicles for example emit much more PM and NOx, but less CO_2 than petrol-driven ones. Moreover, the quality of the fuel plays an important role in determining pollutant emissions and also influences the functioning of some exhaust gas treatment equipment (*see also chapter V.4.7*). Lead in gasoline, for example poisons catalytic converters, which was one reason behind the introduction of lead-free petrol in the EU[51].

To test if vehicles comply with emission limit values, standard testing procedures are used -so-called test-cycles. They aim at creating repeatable emission measurement conditions and, at the same time, simulate real driving conditions. Typically any new engine model has to be emission certified before it is released onto the market.

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[51] For a good and more detailed explanation of the different aspects of regulating vehicle emissions, also see: Taschner, Karola Dr. (1998): Auto-Oil I and II, in: EEB (1998): EEB Industry Handbook, Brussels, **http://www.eeb.org/publication/INDUSTRYHANDBOOK.pdf**.

The reliability and credibility of the test procedures are important to ensure that all new vehicles comply with the legally binding emission limit values, but also to ensure that the vehicles maintain low emission rates in real-life driving conditions. The different test-cycles for cars and heavy-duty vehicles have come under critique, as they do not adequately reflect real-life driving conditions. This means that in reality the emissions of the existing car fleet are likely to be higher than calculated when the emission standards were set. ECOs have therefore argued that the current test-cycles should be reviewed and revised. Different test-cycles are used in the EU, North America and Asia, and emission standards from different regions may not always be directly comparable.

Furthermore, it is also important to ensure that vehicles maintain low emission rates, even after several years of use. Therefore durability requirements as well as in-use testing durability testing, road worthiness tests and on-board diagnostic systems are also important.

IV.3.5.3 CURRENT LEGISLATION

Emission standards for cars and light-duty vehicles are referred to as EURO 1-5 standards (the Commission is currently working on a proposal for EURO 5). The most important Directive in this field is Directive 70/220/EC, which has been amended a number of times[52]. Amendments include:

- Euro 1 standards (also known as EC 93): Directives 91/441/EEC (passenger cars only) or 93/59/EEC (passenger cars and light trucks)
- Euro 2 standards (*EC 96*): Directives 94/12/EC or 96/69/EC
- Euro 3/4 standards (*2000/2005*): Directive 98/69/EC as well as further amendments in 2002/80/EC

Table 5. EU emission standards for passenger cars, including UBA (Federal Environment Agency, Germany) proposal for 2008[53].

PASSENGER CARS	PM (MG/KM)		NOX (G/KM)		HC (G/KM)		HC+NOX (G/KM)	
	diesel	petrol	diesel	petrol	diesel	petrol	diesel	Petrol
Euro 1 (1992-93)	140	-	-	-	-	-	0.97	0.97
Euro 2 (1996)	80/100[i]	-	-	-	-	-	0.7/0.9[i]	0.5
Euro 3 (2000)	50	-	0.50	0.15	-	0.20	0.56	-
Euro 4 (2005)	25	25	0.25	0.08	-	0.10	0.30	-
Euro 5 – UBA Proposal (2008)	*2.5*	*2.5*	*0.08*	*0.08*	*0.05*	*0.05*	-	-

[i] Indirect Injection (IDI) and Direct Injection (DI) engines respectively. *Source: ACID NEWS No.3, September 2004*

[52] For a list of all amendments, see: **http://europa.eu.int/comm/enterprise/automotive/Directives/vehicles/dir70_220_cee.html** .

[53] These standards currently regulate four groups of compounds: nitrogen oxides (NOx), hydrocarbons (HC), carbon monoxide (CO) and particulate matter (PM). Of these, carbon monoxide is less significant from the point of view of health and the environment.

The EURO 3 and EURO 4 standards were elaborated in the context of the Auto-Oil programme, in which information on the abatement potential and costs of vehicle technology and corresponding fuels were analysed. The data input for this programme was provided by the European Motor Industry Federations(ACEA) and the mineral oil industry (EUROPIA), as well as by a consultant[54].

EURO standards have also been set for heavy-duty vehicles. These are referred to with roman numbers, EURO I – V. The most important Directive is the Heavy Duty Diesel emissions Directive 88/77/EEC, which has subsequently been amended several times[55].

Table 6. EU emission standards for heavy vehicles and UBA (Federal Environment Agency, Germany) proposals (no EU legal obligation) for 2008 and 2010.

HEAVY DUTY VEHICLES	NOX (G/KWH)	(HC) G/KWH	PM (MG//KWH)
EURO I ('92 – '93)	9.0	1.23	400
EURO II ('95 – '96)	7.0	1.1	150
EURO III (2000)	5.0[i]	0.66[ii]	100/160[iii]
EURO IV (2005)	3.5[i]	0.46[ii]	20/30[iii]
EURO V (2008)	2.0[i]	0.46[ii]	20/30[iii]
EURO V UBA PROPOSAL (2008)	1.0[i]	0.46[ii]	2/3[iii]
EURO VI (UBA PROPOSAL 2010)	0.05[i]	0.46[ii]	2/3[iii]

[i] Both ESC and ETC test cycle. [ii] ESC test cycle only. [iii] ESC and ETC test cycle respectively.

It is expected that many engine manufacturers will have to fit heavy duty diesel vehicles with both particulate filters and NOx reduction technology to meet EURO IV requirements. However, some manufacturers are now able to meet the limit values without further exhaust gas treatment.

IV.3.5.4 PLANNED LEGISLATION[56]

A review of current emission standards for road vehicles in the EU began in autumn 2003. This work is being carried out by a subgroup of the Commission's Motor Vehicle Emissions Group (MVEG), with the participation of the member countries and various stakeholders.

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[54] Environmentalists, consumer organisations, motoring and other citizen's organisations have raised concerns about the Auto-Oil process being intransparent, see: Taschner, Karola Dr. (1998): Auto-Oil I and II, in: EEB (1998): EEB Industry Handbook, Brussels, **http://www.eeb.org/publication/1998/INDUSTRYHANDBOOK.pdf**, p. 52-62. On costs of technology in the Auto–Oil programme see also: Stockholm Environment Institute (1999), Costs and strategies presented by industry during the negotiation of environmental regulations, Stockholm Environment Institute, Stockholm, Sweden, **http://www.york.ac.uk/inst/sei/pubs/ministry.pdf**, p. 19-23. On Auto-Oil in general, see: **http://europa.eu.int/comm/environment/air/autooil.htm**.

[55] For a list of all amendments, see: **http://europa.eu.int/comm/enterprise/automotive/Directives/vehicles/dir88_77_cee.html**.

[56] This section of the text is largely reproduced from Environmental Factsheet No. 17, September 2004 by The Swedish NGO Secretariat on Acid Rain, see: **http://www.acidrain.org/factsheet17.pdf**

On the basis of this work the Commission will present a Directive containing new standards. The proposed Directives for light and heavy vehicles are expected to be issued in spring and autumn 2005, respectively. The development of new technology in recent years, combined with new findings regarding harmful health effects, especially of PM, makes it likely that the Commission will propose significant strengthening of emission limit values, primarily for diesel vehicles.

In 2003, the German Federal Environment Agency (UBA) published a proposal for new emission standards for motor vehicles (*German Environment Agency 2003*)[57].

For passenger cars the UBA proposal include the following (*see Table 5, above*):

- Emission requirements should be fuel neutral, i.e. the same for all fuels.
- Emission limit values for PM should be strengthened by a factor of ten. This is likely to require the application of particulate filters, which can remove 90 per cent or more of particulates in the entire size range (*The Danish Ecological Council 2004*)[58]. The current Euro 4 standards for diesel cars can be met without such filters, at least by small cars. If petrol vehicles are also covered by the proposed new PM requirement it may mean that direct injection engines will have to be fitted with particulate filters.
- The NOx requirement for diesel cars should be strengthened by a factor of three, down to the same level as for petrol vehicles.
- The summation value for NOx + HC for diesel cars should be replaced with an HC limit value regardless of engine type.

The UBA proposal for heavy duty vehicles means (see Table 6, above):

- Fuel-neutral requirements.
- Agreed, but as yet, indicative PM standards for 2008 are lowered by a factor of ten, which is likely to require the application of particulate filters.
- Agreed, but as yet indicative, NOx requirements for 2008 are halved, and then halved again in 2010.

In its report, the UBA discusses whether emissions of particulates should also be counted by number, or whether simply regulating the weight would suffice.. The authors conclude that confining the limit to weight could lead to the engine makers concentrating primarily on eliminating the largest and heaviest particles, which have relatively little effect on health. They would therefore like to supplement the current weight-based standards with limits on the maximum number of particles within the size range that is inimical to health.

The extra cost for a diesel car to meet UBA EURO 5 standard proposals - compared with EURO 4 - is estimated to run to 200–400 euros. It would cost practically nothing, on the other hand, for a

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[57] The report of the German Environment Agency can be downloaded from **http://www.umweltdaten.de/uba-info-presse/hintergrund/FutureDiesel_e.pdf**.

[58] On health effect of diesel particles and particulate filters, see the Danish Ecological Council at: **http://www.ecocouncil.dk/download/dieselpjece_eng.pdf**.

heavy vehicle to move from EURO V to EURO VI, since it would be enough in that case to improve the emission control equipment that is already needed to meet EURO V requirements.

The need to reach a relatively quick agreement on exhaust emission requirements is important not only to allow industry the time to prepare for the production of cleaner vehicles, but also to give member countries an opportunity to introduce tax incentives to favour vehicles that comply with the requirements early -such as diesel cars fitted with particulate filters.

IV.3.5.5 OUTLOOK – ROOM FOR ECO ACTION (ENVIRONMENTAL CITIZENS' ORGANISATION)

The EEB, together with the European Federation for Transport & Environment (T&E), has been calling on EU Member States and the Commission to support UBA proposals for strengthened emission standards as well as demanding that the introduction date be brought forward to 2008[59]. At the time of writing, technology that would easily meet the proposed emission limit values is already commercially available so there is no reason to delay widespread introduction until 2010.

Environmental citizens' organisations in several countries have been campaigning for the introduction of particulate filters for diesel vehicles as well as for national fiscal measures favouring earlier introduction of cars equipped with such filters. It is important that nationals continue to demand that their governments support ambitious new limit values both for PM and NOx.

With regard to urban air quality, the concept of "environmental zones" will probably gain more importance in the future. In the context of air quality plans and programmes *(see chapter IV.3.3.3)*, local authorities can create low-emission zones in urban areas. In these zones, it is possible to restrict the access of highly polluting vehicles. ECOs can call for the establishment of more low-emission zones in urban areas, with restricted access for diesel vehicles not equipped with particulate filters. This would put pressure on car manufacturers to provide incentives to retrofit existing vehicles.

IV.3.6 Large Combustion Plants

IV.3.6.1 WHY A DIRECTIVE FOR LARGE COMBUSTION PLANTS (LCPS)?

The Large Combustion Plant (LCP) Directive (*2001/80/EC*) applies to combustion plants with a thermal capacity greater than or equal to 50 megawatts (MW)[60]. The LCP-sector is dominated by power plants, but also includes other industrial combustion plants in sectors such as iron and

[59] See ECO letter to the Environment Council in October 04: **http://www.t-e.nu/docs/Positionpapers/2004/2004-10-11_ngo_input_envi_council.pdf**.

[60] The 50 MW thermal is related to energy input, not output, i.e. it is based on the amount of fuel the plants burn, not on the amount of (useful) energy they produce. Furthermore, the emission limit values in the Directive are set as milligrams of pollutant per cubic metre of air (mg/m^3), which again has no relation to the amount of useful energy produced. ECOs have long been calling for changing this to unit (e.g. grams) of pollutant per gigajoule (g/GJ) of useful energy produced, as this would help to promote energy efficiency.

steel production and petroleum refineries. It is important to regulate emissions from these plants because they are the EU's largest source of SO_2 emissions, as well as contributing significantly to NOx and particulate matter emissions. According to the European Pollutant Emissions Register (EPER) these combustion installations contributed to 69 % of all sulphur emissions, 64 % of nitrogen oxide emissions and 41 % of particulate matter emissions in all sectors covered by EPER in 2001 (*for EU 15)*[61].

Substantial reductions in emissions from LCPs are necessary in order for the EU to meet its international and internal environmental aims, as laid down in the 1999 Gothenburg Protocol to the Convention on Long-range Transboundary Air Pollution, the EU's Fifth and Sixth Environmental Action Programmes. According to a recent study analysing the largest point sources of air pollutant emissions in Europe, in 2001 the 100 largest point sources of SO_2-emissions were still emitting 7.1 million tonnes of SO_2 a year, corresponding to 43 per cent of the total of 16.7 million tonnes from all sources on land in Europe (*Barrett 2004*)[62].

IV.3.6.2 REQUIREMENTS AND EMISSION STANDARDS

The first EU Directive on Large Combustion Plants entered into force in 1988 (*88/609/EEC*). It set emission limit values for plants built after 1987 (so-called new plants) as well as country-by-country ceilings for step-wise national reductions in SO_2- and NOx-emissions from plants built before that date (so-called existing plants). However, the emission reductions required by this Directive were not ambitious and did not at all reflect what technology could deliver at that time. In October 2001, it was replaced by the second LCP Directive (*2001/80/EC*), setting stricter standards for some categories of plant and including more plants within the scope of the Directive.

The Directive sets emission limit values for sulphur dioxide, nitrogen oxides and dust. These limit values are minimum standards, which mean that Member States are free to adopt emission limit values and compliance deadlines which are stricter than those of the Directive, as well as including other pollutants and laying down additional requirements. The Directive sets emission limit values for three categories of plants:

1) plants licensed before July 1987 (so-called existing installations)
2) plants licensed between July 1987 and November 2003 (so-called "old" new installations)
3) plants licensed after November 2002 (so-called "new" new installations)

The limit values vary according to the age and capacity of the plants, as well as the type of fuel they burn (see Tables 7 and 8).

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[61] See: European Pollutant Emissions Register: **http://www.eper.cec.eu.int**. EPER holds emissions data on around 10,000 large and medium-sized industrial plants, which are listed in Annex I of the IPPC Directive and which exceed specified emission thresholds. This means the percentage figures given here reflect the share of LCP emissions from all installations covered by EPER, not from all sources in the EU.

[62] Available at **http://www.acidrain.org/apc17.pdf**.

Table 7: Emission limit values for SO_2 and NOx from plants licensed after November 2002 (mg/m^3)

	SO2			Nox		
Plant size (MW_{th})	*50-100*	*100-300*	*>300*	*50-100*	*100-300*	*>300*
Solid fuels [i]	850	200	200	400	200	200
Liquid fuels	850	400-200 [iii]	200	400	200	200
Biomass	200	200	200	400	300	200
Natural gas [ii]	35	35	35	150	150	100

[i] NB. Where the emission limit values for SO_2 cannot be met due to the characteristics of the fuel, installations smaller than 300 MW_{th} must either limit their emission levels to 300 mg SO_2/m^3, or achieve a desulphurisation rate of at least 92%. Larger plants must achieve a desulphurisation rate of at least 95% and limit emission levels to 400 mg SO_2/m^3

[ii] Specifically for gas turbines using natural gas, the limit value in most cases being 50 mg NOx/m^3.

[iii] Linear decrease

Source: Acid News no. 3/2001

Table 8: Emission limit values to be applied from 1 January, 2008 for SO_2 and NOx from existing plants (licensed before November 2002). Plant size in MW_{th} and emission limits in mg/m^3.

	SO2			Nox	
Plant size	***50-100***	***100-500***	***>500***	***50-500***	***>500***
Solid fuels	2000 [i]	2000-400 [i,ii]	400[1]	600	500 [iii]
Plant size	***50-300***	***300-500***	***>500***	***50-500***	***>500***
Liquid fuels	1700	1700-400 [ii]	400	450	400
Plant size	***>50***	***50-500***	***>500***		
Natural gas	35	300	200		

[i] NB: Where the emission limits for SO_2 cannot be met due to the characteristics of the fuel, various rates of desulphurisation should be achieved (from 60 to 94%) - with the highest rate applicable for plants greater than 500 MW_{th}.

[ii] Linear decrease

[iii] From 1 January 2016 the emission limit value will be 200 mgNOx/m^3.

Source: Acid News no. 3/2001

This LCP Directive has important links with the IPPC Directive. The LCP Directive sets mandatory emission limit values for air pollutants, that have to be respected in the permitting procedure. The IPPC Directive also takes account of other environmental impacts of large combustion plants and enables permitting authorities to set additional obligations for individual plants *(see chapter V.3.2 on IPPC)*.

IV.3.6.3 ASSESSMENT

IV.3.6.3.1 Directive applies to existing plans

The most important innovation of the new LCP Directive is that it sets emission limit values for *existing* plants, which was not the case in the 88/609/EC Directive, in which plants built before 1988 were exempt from such limit values. Under the new Directive, existing plants are subject to emission limit values as from 2008.

It was largely thanks to the efforts of the European Parliament as well as active lobbying by ECOs that the terms of the Directive now also include emission standards for pre-1987 plants. Additional analysis undertaken for the Commission in 2001 clearly showed that if no action were taken, existing (pre-1987) large combustion plants would remain important sources of SO_2- and NOx-emissions in the year 2010 (*Cofala and Amann 2001*)[63]. It was estimated that by applying the same emission limit values to the pre-1987 plants as those in Directive 88/609/EC for post-1987 plants, SO_2 emissions from these sources in the EU15 would be reduced by almost 70 per cent and NOx emissions by about nine per cent. In accession countries SO_2-emissions from existing LCPs would be 86 per cent lower and NOx emissions would be cut by eight per cent[64].

In addition to prescribing measures for pre-1987 plants, the new LCP-Directive also sets tighter emission requirements for new plants, i.e. those licensed after November 2002. In this context it should be noted that the emission limit values also for these post-2002 plants are not very strict, especially regarding the NOx limit values (*see chapter IV.3.6.5*).

IV.3.6.3.2 Country-wide "bubbles"

A weak point of the Directive is that it opens up the possibility for Member States to combine their emissions from existing LCPs in country-wide bubbles. This means that instead of applying emission limit values to each individual plant, Member States are allowed to reach the equal overall reductions from existing plants via a so-called national plan for the country as a whole. National plans have to ensure that the overall total emission reductions achieved are the same as what would have been achieved by applying ELVs to individual plants.. This procedure thus allows highly polluting plants to exceed the emission limit values, provided this is compensated by additional emission reductions in other plants within the national bubble – which obviously may result in negative impacts on local air quality. Currently, eight Member States have submitted national plans under the LCP directive: the Czech Republic, Finland, France, Greece, Ireland, Netherlands, Slovenia, UK. However, Slovenia subsequently withdrew its plan and opted for the ELV approach.[65]

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[63] Available at **http://europa.eu.int/comm/environment/pollutants/combustion_report.pdf**

[64] Ibid.

[65] Entec UK Ltd (2005): Preparation of the review relating to the Large Combustion Plant Directive -- a report for the European Commission, DG Environment; Draft Final Report; April 2005; Entec UK Ltd

IV.3.6.3.3 Exemptions and derogations

Another weakness of the Directive is the possibility of avoiding emission limit values altogether for plants which will not be in operation for more than 20,000 hours between January 2008 and 2015. This means that the oldest and most inefficient plants – which are also usually the most polluting ones – are allowed to remain in operation until 2015 without restrictions on their emissions , provided they do not exceed the total amount of operating hours.

Furthermore, the Directive provides "relaxed" emission limit values for LCPs operating only during so-called peak-loads. Such relaxed limit values are allowed for peak-load plants that will be in operation for less than 2000 hours annually until 2015, and for less than 1500 hours annually as from 2016. As 2000 hours equals nearly three months of operation, this means in practice that old, inefficient and highly polluting plants are allowed to continue to operate at seasonal load, while still emitting up to four times as much pollutants as other LCPs.

IV.3.6.4 REVIEW

According to the Directive, the Commission was to have submitted a review report to the European Parliament by the end of 2004, which could be followed up with a proposal for revision. In the review it was to investigate possibilities for further emission reductions, analysing among other things the need for further measures, costs and advantages of further emission reductions in the power plant sector compared to other sectors, and the technical and economical feasibility of further emission reductions. It was to have included "as appropriate" a proposal of possible end dates or lower emission limit values for one of the derogations relating to the NOx limit values. Furthermore, the Commission is required to analyse the national plans provided by the Member States *(2001/80/EC, Art. 4.7)* However the Commission has not yet published a review report.

At the time of writing the Commission has appointed external consultants to support the review of the Directive, by providing additional data on large combustion plant emissions, abatement measures and costs, and addressing the points mentioned above. The final consultant report has not yet been published.[66] The Commission is likely to base its review report on the consultants' findings as well as on the results of the cost-effectiveness analysis conducted in the context of the Clean Air For Europe programme *(see chapter IV.3.1)*.

IV.3.6.5 OUTLOOK AND ROOM FOR ECO ACTION (ENVIRONMENTAL CITIZENS' ORGANISATION)

The Directive will result in further emission reductions from the LCP sector, especially regarding SO_2-emissions from old (pre-1987) plants, but these reductions will in most cases take place only after January 2008, the deadline set for these plants in the Directive. Expected NOx reductions from old plants are likely to be less significant, since strict NOx-standards for pre-1987 and pre-2002 plants will only apply from 2016 onwards.

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[66] An interim report can be found under: **http://europa.eu.int/comm/environment/air/future_stationary.htm**.

However, the key problem with the Directive is that several derogations and late deadlines have meant that some old, inefficient and highly polluting plants will be allowed to remain in operation more or less unabated for many years.. A recent study, analysing the emissions from large point sources in Europe, found that around 90 per cent of the emissions of SO_2 from large coal-fired plants come from those that were commissioned before 1987 (Barrett 2004). These plants should be replaced or upgraded urgently not only because they cause air pollution, but also in order to combat climate change, as they are not only very polluting, but in many cases also very inefficient.

Another problem with the emission limit values set in this Directive is that they are technology-conserving, rather than technology-forcing. Emission limit values are set at levels that could be met with technologies that were commercially available by the time the Directive was drafted in the second half of the 1990s. Moreover, some of these limit values, i.e. those for NOx, will not come into force until 2016 - fifteen years after the Directive was agreed. By comparison, emission limit values for road vehicles were set at levels that were considered achievable within a few years from when the Directives were agreed. They have also been reviewed and successively tightened.

From an environmental point of view, there is a clear need to further strengthen the emission limit values for all three air pollutants, NOx, SO_2 and dust. The application of currently available abatement techniques can deliver emission reductions well below the limit values of the LCP Directive. Recent analysis has found that in some countries (e.g. Germany, Netherlands, Austria, Denmark and Sweden) there are already a number of existing plants which easily meet the emission limit values set in the LCP Directive for new post-2002 installations. There can therefore be no doubt that it is possible to achieve emission levels with conventional technology that are considerably lower than the current standards (*Barrett 2004, p.43*). The forthcoming review and possible revision of the LCP Directive provides an opportunity to strengthen emission limit values, remove the unnecessary derogations, and set stricter deadlines for implementation.

Demanding a change in the units used for measuring emission limit values, from pollution/m^3 to pollution/GJ useful energy still remains a priority. Currently, the emission limit values in the Directive are set as milligrams of pollutant per cubic metre of air (mg/m^3). ECOs have long been calling for changing this to grammes per gigajoule (g/GJ) of useful energy produced, as this would help to promote energy efficiency *(see footnote 60)*. At the national level, ECOs should pay special attention to the local air quality near large combustion plants. This is particularly important in Member States where national plans are being applied.

By 2007 at the latest all LCPs will need a permit according to the IPPC Directive (*see chapter V.3.2*). Such permits must consider Best Available Techniques as outlined in the EU guidance[67]. As authorities deal with the task of writing these permits ECOs should use this opportunity to have an input into the process, using it to insist on stringent emission limit values beyond the ones set by the LCP Directive.

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[67] See for the guidance the European IPPC Bureau website at **http://eippcb.jrc.es/pages/FActivities.htm**.

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