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# Air quality directives

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The first EC Directive on ambient air quality was adopted by Council in 1980. Council Directive 80/779/EEC (EEC 1980) on Air Quality Limit[1] Values and Guide Values for Sulphur Dioxide and Suspended Particulates was adopted to protect human health and the environment against adverse effects from $SO_2$ and Suspended Particulates. (Minor modifications were amended by Council Directive 89/427/EEC (EEC 1989)).

The Directive lays down limit values for $SO_2$ and Suspended Particulates which are mandatory throughout the territory of Member States. The Directive also sets long term guide values. Member States are required to measure $SO_2$ and particulate matter, to ensure that the limit values are met, and to inform the Commission of any breaches of the limit values and to undertake any necessary abatement measures. The Directive was followed by Directives setting air quality limit values for lead and nitrogen dioxide (EEC 1982, EEC 1985). Table 1 shows the main air quality limit values in force in the European Union at the end of 1997.

[1] 'limit value' shall mean 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

Table 1. EC Air Quality Limit Values in force in 1997.

| Pollutant | Directive | Parameter | Limit Value, $\mu g/m^3$ |
|---|---|---|---|
| Sulphur dioxide | 80/779/EEC<br>89/427/EEC | 98 percentile of all daily mean values taken throughout the year. | 250 ( if particles < 150) |
| | | 98 percentile of all daily mean values taken throughout the year. | 350 (if particles >= 150) |
| Particulate matter (measured as Black Smoke) | 80/779/EEC | 98 percentile of all daily mean values taken throughout the year. | 250 |
| | | median of daily mean values throughout the year | 80 |
| Lead | 82/884/EEC | annual mean | 2 |
| Nitrogen dioxide | 85/203/EEC | 98 percentile of all daily mean values taken throughout the year. | 200 |

Their *primary aim* was to protect human health, though it was specifically recognised in the case of $SO_2$ and $NO_2$ that meeting the limit values would also reduce damage to the environment. The Directives require Member States to take steps to ensure that limit values are not exceeded after a certain date. Member States must measure concentrations, and report any breaches of the limit values to the European Commission.

- The Directives were based on the best scientific evidence available at that time, and in particular the work of the World Health Organisation (WHO, 1998), but there has been further research on the effects of air pollution on both human health and the environment, which should be taken into account. In addition, implementation of the existing Directives revealed a number of problems.

It was therefore decided that the European Union should bring air quality limit directives up to date. The goals are set out in the Fifth Programme of Action on Sustainable Development and the Environment. They are:

- Provision of effective protection of all citizens against recognised effects of air pollution.
- Establishment of permitted concentration levels of air pollutants which take into account the protection of the environment.

The first result is Directive 96/62/EC on Ambient Air Quality Assessment and Management, adopted by Council in September 1996 (the Air Quality Framework Directive) (EC 1996). The second is the Council Decision establishing a reciprocal exchange of information and data from networks and individual stations measuring ambient air pollution within the Member States (EC 1997). The Decision was revised in 2001 (EC 2001).

The main aims of the Directive are to:
- define and establish objectives for ambient air pollution in the Community designed to avoid, prevent and reduce harmful effects on human health and the environment as a whole;
- assess ambient air quality in Member States on the basis of common methods and criteria;
- obtain adequate information on ambient air quality and ensure that it is made available to the public inter alia by means of alert thresholds;
- maintain ambient air quality where it is good and improve it in other cases.

The Directive is a framework Directive provides a basic structure, which must be filled in pollutant by pollutant by means of daughter legislation. Figure 1 shows how this basic structure will operate.

The legislation requires the Member States to divide their territory into zones and must assess air quality annually in all of them. The Directive applies throughout the Member States.

*Daughter Directives* setting limit values will include the date by which the limit values must be attained. The margin of tolerance is a new concept in EC legislation on air quality. It is not a derogation of the limit value, but a trigger for action in the period before the limit value must be met. As Figure 1 shows, the *margin of tolerance*[2] is added to the limit value when the legislation setting the limit value comes into force. It is reduced each year to reach zero on the attainment date. The purpose of the margin of tolerance is to identify the zones with the worst air quality. Member States must prepare detailed action plans for these areas (Group 1 in Figure 1) showing how the limit value will be met on time.

[2] "margin of tolerance" shall mean the percentage of the limit value by which that value may be exceeded subject to the conditions laid down in this Directive;

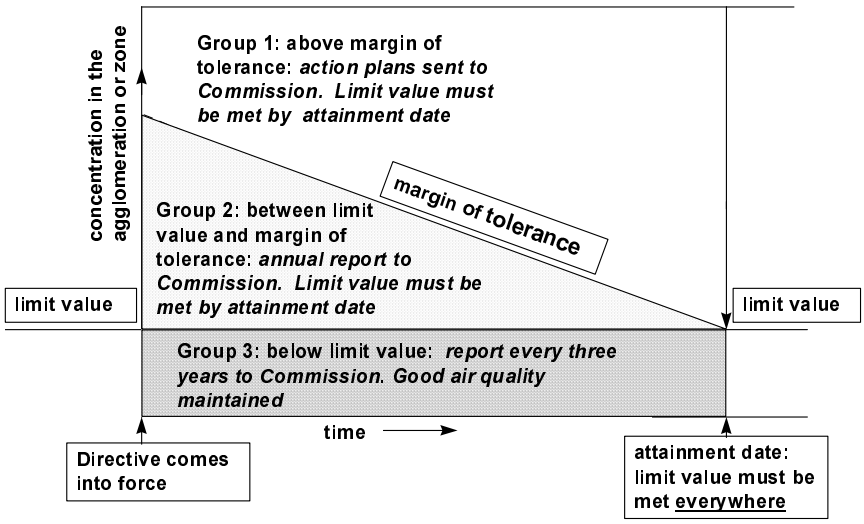


Figure 1. Schematic diagram of structure of the framework directive (EC, 2000b).

Zones where maximum pollution levels are between the limit value and the limit value plus margin of tolerance (Group 2 in Figure 1) are not required to forward detailed action plans to the Commission. But they must report concentrations annually to the Commission and must take any necessary steps to ensure that the limit value is met by the attainment date.

Annex I of the Air Quality Framework Directive lists the pollutants for which air quality objectives are to be set (Table 2).

Table 2 Pollutants listed in Annex I of Directive 96/62/EC.

| |
|---|
| ***Pollutants for which there is existing EC legislation*** |
| 1. Sulphur dioxide |
| 2. Nitrogen dioxide |
| 3. Lead |
| 4. Suspended particulate matter |
| 5. Fine particulate matter such as soot (including $PM_{10}$) |
| 6. Ozone |
| ***Other pollutants*** |
| 7. Benzene |
| 8. Carbon monoxide |
| 9. Cadmium |
| 10. Cadmium |
| 11. Arsenic |
| 12. Nickel |
| 13. Mercury |

The Air Quality Framework Directive envisages two types of air quality objective, i.e. limit values and alert (and information[3]) thresholds[4]. The air quality limit values in the first two daughter directives are listed in Table 3 and Table 4. It is defined as 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 one attained. In addition, alert thresholds are set for certain pollutants.

[3] "information threshold" shall mean a level beyond which there is a risk to human health from brief exposure for particularly sensitive sections of the population and for which immediate and appropriate information is necessary;

[4] "alert threshold" shall mean a level beyond which there is a risk to human health from brief exposure and at which immediate steps are to be taken by the Member States.

Table 3 The limit values for $SO_2$ , NO and $NO_2$, particulate matter and lead in the first daughter directive (EC 1999).

| | Averaging period | Limit value | Date by which limit value is to be met |
|---|---|---|---|
| ***Sulphur dioxide*** | | | |
| 1. Hourly limit value for the protection of human health | 1 hour | 350 µg/m$^3$ not to be exceeded more than 24 times per calendar year | 1 January 2005 |
| 2. Daily limit value for the protection of human health | 24 hours | 125 µg/m$^3$ not to be exceeded more than 3 times per calendar year | 1 January 2005 |
| 3. Limit value for the protection of ecosystems, to apply away from the immediate vicinity of sources | calendar year and winter (1 October to 31 March) | 20 µg/m$^3$ | two years from entry into force of the Directive |
| ***Oxides of nitrogen*** | | | |
| 1. Hourly limit value for the protection of human health | 1 hour | 200 µg/m$^3$ $NO_2$ not to be exceeded more than 18 times per calendar year | 1 January 2010 |
| 2. Annual limit value for the protection of human health | calendar year | 40 µg/m$^3$ $NO_2$ | 1 January 2010 |
| 3. Annual limit value for the protection of vegetation | calendar year | 30 µg/m$^3$ NO + $NO_2$ | two years from entry into force of the Directive |
| ***Particulate matter*** | | | |
| *Stage 1* | | | |
| 1. 24-hour limit value for the protection of human health | 24 hours | 50 µg/m$^3$ $PM_{10}$ not to be exceeded more than 35 times per year[1)] | 1 January 2005 |
| 2. Annual limit value for the protection of human health | calendar year | 40 µg/m$^3$ $PM_{10}$ | 1 January 2005 |
| *Stage 2* | | | |
| 1. 24-hour limit value for the protection of human health | 24 hours | 50 µg/m$^3$ $PM_{10}$ not to be exceeded more than 7 times per year | 1 January 2010 |
| 2. Annual limit value for the protection of human health | calendar year | 20 µg/m$^3$ $PM_{10}$ | 1 January 2010 |
| ***Lead*** | | | |
| Limit value for the protection of human health | calendar year | 0.5 µg/m$^3$ | 1 January 2005 |

Table 4. The limit values for benzene and CO in the second daughter directive (EC, 2000a).

| | Averaging period | Limit value | Date by which limit value is to be met |
|---|---|---|---|
| ***Benzene*** | | | |
| Limit value for the protection of human health | Calendar year | 5 μg/m$^3$ | 2010 |
| ***Carbon monoxide*** | | | |
| Limit value for the protection of human health | Maximum daily 8-hour mean | 10 mg/m$^3$ | |

No non effect level has been defined for ozone, the heavy metals and PAH's. The directives set therefore target values for these pollutants, Table 5 and Table 6.

Table 5. Target value and long term objectives for ozone in the fourth daughter directive (EC, 2002).

| ***Target values for ozone*** | | |
|---|---|---|
| | Parameter | Target value for 2010 |
| Target value for the protection of human health | Maximum daily 8-hour mean | 120 μg/m$^3$ not to be exceeded on more than 25 days per calendar year averaged over three years |
| ***Long-term objectives for ozone*** | | |
| | Parameter | Long-term objective |
| 1. Long-term objective for the protection of human health | Maximum daily 8-hour mean within a calendar year | 120 μg/m$^3$ |
| 2. Long-term objective for the protection of vegetation | AOT40, calculated from 1 h values from May to July | 6 000 μg/m$^3$·h |

Table 6. Target values[5] for arsenic, cadmium, nickel and benzo(a)pyrene ((EC, 2004)

| Pollutant | Target value (1) |
|---|---|
| Arsenic | 6 ng/m$^3$ |
| Cadmium | 5 ng/m$^3$ |
| Nickel | 20 ng/m$^3$ |
| Benzo(a)pyrene | 1 ng/m$^3$ |
| (1) For the total content in the $PM_{10}$ fraction averaged over a calendar year. | |

Alert and information thresholds has been set for $SO_2$ , $NO_2$ and ozone

Table 7. Alert thresholds for $SO_2$ and $NO_2$.

| Pollutant | Alert threshold |
|---|---|
| Sulphur dioxide | 500 μg/m$^3$ |
| Nitrogen dioxide | 400 μg/m$^3$ |

Table 8. Information and alert thresholds for ozone

| Purpose | Averaging period | Threshold |
|---|---|---|
| Information | 1 hour | 180 μg/m$^3$ |
| Alert | 1 hour | 240 μg/m$^3$ |

Air quality assessment includes measurement, the compilation of emission inventories and air quality modelling. The first Commission proposal for a daughter Directive refers to these two levels as the *upper and lower assessment thresholds*. Table 9 summarises its requirements.

[5] "target value" means a concentration in the ambient air fixed with the aim of minimising harmful effects on human health and the environment

Table 9. Assessment requirements under Directive 96/62/EC.

| Area | Assessment regime, from the most demanding (top) to the lowest (bottom) requirements |
|---|---|
| 1. Where levels are above the upper assessment threshold | Based on high quality measurements - may be supplemented by modelling |
| 2. Where levels are between the upper and lower assessment thresholds | Combination of high quality measurement (but less intensive than in case 1) and modelling allowed |
| 3. Where levels are below the lower assessment threshold | At least one high quality measuring site per agglomeration, combined with modelling, objective estimation, indicative measurements |
| a. In agglomerations for pollutants for which an alert threshold has been set | At least one high quality measuring site per agglomeration, combined with modelling, objective estimation, indicative measurements |
| b. In all other cases | Modelling, objective estimation, indicative measurements |

The aim is:

- to ensure that the most intensive assessment is carried out in those agglomerations and other zones within which there is the highest risk of a limit value being exceeded;
- to ensure that the least intensive requirements apply only where pollution levels are sufficiently low that there is virtually no risk of an exceedance. It should be noted however that if an alert threshold has been set for a pollutant measurements must be made within agglomerations no matter how low the level of pollution.

Daughter legislation on each pollutant will fill in the framework by including:

- criteria and techniques for measurement, including the location of sampling points, the minimum number of sampling points and reference measurement and sampling techniques;
- criteria for the use of other techniques for assessing ambient air quality, particularly modelling;
- defining the upper and lower assessment thresholds.

The Member States have the responsibility to decide what the best means to tackle local problems are.

**Thematic Strategy on Air Pollution**

Despite significant improvements, serious air pollution impacts persist. The Community's Sixth Environmental Action Programme (6th EAP) therefore called for the development of a "Thematic Strategy on Air Pollution" with the objective to attain "levels of air quality that do not give rise to significant negative impacts on, and risks to human health and the environment". Under the Clean Air for Europe programme (CAFE), the Commission has examined whether current legislation is sufficient to achieve the 6th EAP objectives by 2020 (EC, 2005a). This analysis looked at future emissions and impacts on health and the environment and has used the best available scientific and health information. It showed that significant negative impacts will persist even with effective implementation of current legislation. The main problems are particles, $NO_x$, ozone and ammonia.

The Thematic Strategy establishes interim objectives for air pollution in the EU and proposes appropriate measures for achieving them. It recommends that current legislation be modernised, be better focused on the most serious pollutants and that more is done to integrate environmental concerns into other policies and programmes.

Part of the strategy will be implemented through a revision of the current ambient air quality legislation, i.a. based on new research (WHO, 2000 and 2005). The revision comprises two main elements (EC, 2005b):

- streamlining of existing provisions and merging the four daughter directives and the exchange of information decision into a single directive;
- the introduction of new air quality standards for fine particulate matter ($PM_{2.5}$) in air and the $PM_{10}$ limit value for annual average in stage 2 will be replaced by the limit value in stage 1.

The standards for $PM_{2.5}$ include a concentration cap[6] on 25 $\mu g/m^3$ to be met by 2010 at al locations in the Member States. In addition a 20 % decrease at urban background sites between 2010 and 2020 in relation to the level in 2008-2010.

[6] Concentration cap shall mean a level fixed on the basis of scientific knowledge, with the aim of preventing unduly high risks for human health, to be attained within a given period and not to be exceeded once attained;

The national emission ceilings directive (NECD) will also be revised to ensure reduced emissions of nitrogen oxides, sulphur dioxide, volatile organic compounds, ammonia and primary particulate matter consistent with the interim objectives proposed for 2020.

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