

**CASE STUDY 2**

**COMPARISON OF THE EU AND US  
AIR QUALITY STANDARDS & PLANNING REQUIREMENTS**

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<b>1. INTRODUCTORY OVERVIEW OF THE TWO AIR QUALITY MANAGEMENT SYSTEMS</b> .....	<b>1</b>
1.1. <i>THE EUROPEAN UNION</i> .....	<i>1</i>
1.2. <i>THE UNITED STATES</i> .....	<i>1</i>
<b>2. COMPARISON OF THE TWO SYSTEMS</b> .....	<b>2</b>
2.1. <i>WHAT TRIGGERS THE PLANNING REQUIREMENTS</i> .....	<i>2</i>
2.1.1. <i>The AQLVs versus the NAAQSs</i> .....	<i>2</i>
2.1.2. <i>Emission reduction targets</i> .....	<i>2</i>
2.2. <i>THE AQ PLANNING REQUIREMENTS</i> .....	<i>3</i>
2.2.1. <i>The process of designating geographical areas to be covered by the plans</i> .....	<i>3</i>
2.2.2. <i>Differentiation according to status of attainment, and the consequences</i> .....	<i>3</i>
2.2.3. <i>What needs to be in the plans</i> .....	<i>4</i>
2.2.4. <i>Guidance for inventories &amp; AQ modelling</i> .....	<i>5</i>
2.2.5. <i>Guidance on control strategies</i> .....	<i>6</i>
2.2.6. <i>Multistate / transboundary aspects</i> .....	<i>7</i>
2.3. <i>INSTITUTIONAL ACCOUNTABILITY IN THE PLANNING PROCESS</i> .....	<i>7</i>
2.3.1. <i>Regulatory oversight of the planning process</i> .....	<i>7</i>
2.3.2. <i>Measures to encourage compliance</i> .....	<i>8</i>
2.4. <i>ASSESSMENT OF THE EFFECTIVENESS</i> .....	<i>9</i>
2.4.1. <i>Environmental effectiveness</i> .....	<i>9</i>
2.4.2. <i>Attainment of targets</i> .....	<i>10</i>
<b>3. CONCLUSIONS &amp; RECOMMENDATIONS</b> .....	<b>12</b>

**Annex I: Tables Comparing the EU and US Air Quality Planning Requirements & the Air Quality Limit Values**

**Annex II: The EU Ambient Air Quality Standards & Requirements for Plans & Programmes**

**Annex III: The US National Ambient Air Quality Standards (NAAQS) and State Implementation Plans (SIPs)**



## **1. INTRODUCTORY OVERVIEW OF THE TWO AIR QUALITY MANAGEMENT SYSTEMS**

### **1.1. The European Union**

The European Union air quality management regime started in 1980 with Directive 80/779/EEC, which set air quality limit values (AQLVs) and guide values for SO<sub>2</sub> and suspended particulates (SP). Later Directives set limit values for lead, nitrogen dioxide, and ozone. This relatively late date in comparison to the US legislation in this area must be seen in the context of the evolution of the EU itself. The European Economic Community formed in 1956 did not begin to take specific actions with respect to environmental protection until the early 1970s,<sup>1</sup> and in fact did not get a constitutional basis for acts with respect to environmental protection until the 1987 Single Act. In the meantime, a number of Member States had already developed air quality regimes. Part of the challenge for the EU has therefore been to harmonize not only AQ standards, but also the national systems in place for assessing and monitoring AQ.

The 1996 Air Quality Framework Directive (AQFD) and its daughter Directives are aimed at establishing this harmonized structure for assessing and managing AQ throughout the EU. The role of the European Commission includes oversight of the implementation of the EU legislation, including enforcement action if a Member State has not complied with its obligations under the EC Treaty. It is also important to mention the European Environment Agency, which collects data on air quality from the Member States and other European countries through the CORINAIR programme and then publishes that information.

Within this structure, the EU Member States are given considerable scope to determine what actions they will take in order to meet their commitment to achieve the AQ standards within their territories. However, the Member States must at the same time implement the other EU-level measures that comprise the overall EU air quality management system. These include controls over stationary sources of polluting emissions to air, such as large combustion plants, industrial installations, and facilities using solvents. Other EU-level measures aim to reduce emissions from mobile sources, such as road traffic, and include technical requirements to limit air emissions from various types of motor vehicles as well as fuel quality standards. Finally, the NEC Directive establishes national emissions ceilings for SO<sub>2</sub>, NO<sub>x</sub>, VOCs and NH<sub>3</sub>.

### **1.2. The United States**

In the wake of air pollution's negative impacts on public health, ecosystems and the economy in the 1950s, the United States began its effort to understand the scientific complexity of air pollution problems and to develop an effective air quality management system. The first major efforts of the federal government began with the Air Pollution Control Act of 1955, which provided funds to local and state agencies for research and training. The Clean Air Act (CAA) of 1963 and the Air Quality Act of 1967 set Air Quality Criteria, Air Quality Control Regions (AQCRs), and the process for State Implementation Plans (SIPs). This framework was further developed and refined with the passage of the CAA Amendments in 1977 and 1990.

The CAA prescribes a complicated set of responsibilities and relationships among federal, states, tribal, and local agencies. The federal government coordinates efforts through the United States Environmental Protection Agency (USEPA) and sets national air quality standards and approaches to pollution mitigation so that it can provide a basic level of environmental protection to all individuals in the U.S. State and local governments then develop, implement, and enforce specific strategies and

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<sup>1</sup> Early legislation related to air quality concerns such as Directive 70/220/EEC on air pollution by emissions from motor vehicles was aimed primarily at harmonization of the then competing national standards in order to achieve the internal market.

control measures to achieve the national standards and goals. Although many aspects of the AQM system assume a collaborative relationship between the federal, state, and local agencies, the CAA empowers EPA to oversee the activities carried out by these agencies. In addition, the federal courts also have a role in AQM – final agency rules promulgated under the CAA are subject to judicial review and any citizen may file a civil action against EPA.

## 2. COMPARISON OF THE TWO SYSTEMS

### 2.1. What triggers the planning requirements

#### 2.1.1. *The AQLVs versus the NAAQSs*

In both the EU and the US, air quality limit values trigger planning requirements. In the **EU**, the AQFD and its daughter Directives establish air quality limit values (AQLVs) for specific pollutants and the timetables for meeting those LVs. AQLVs have been established to date for SO<sub>2</sub>, NO<sub>x</sub>, particulates (PM<sub>10</sub>), lead, carbon monoxide, benzene, and ozone, and a proposal to address poly-aromatic hydrocarbons, cadmium, arsenic, nickel and mercury is in the EU political process. For certain pollutants, temporary margins of tolerance are set and then reduced stepwise, so as to attain the limit value at the end of the determined period. The intensity of the monitoring that must be carried out under the AQFD depends on the degree to which the zone's AQ is in compliance with the AQLVs (see section 2.2.2 for more on this). Zones with a likelihood of an exceedence must be monitored more closely. Zones and agglomerations (zones with populations over 250,000) with pollutant levels over the AQLV plus the margin of tolerance (i.e., an exceedence) are reported to the Commission at the end of each calendar year, and AQ management plans or programmes must then be developed for those zones to show how they will come into attainment in the future.

**USA.** The US system is similarly linked to the NAAQS, which establish national air quality limit values to be met in every part of the US. The current six criteria pollutants are: carbon monoxide (CO), nitrogen dioxide (NO<sub>2</sub>), sulphur oxides (SO<sub>x</sub>), ozone (O<sub>3</sub>), particulate matter (PM<sub>2.5</sub> and PM<sub>10</sub>), and lead (Pb). On the basis of these NAAQSs and monitoring data, areas are designated as “attainment”, “nonattainment”, or “unclassifiable”, and on that basis become air quality control regions (AQCRs). Each AQCR (which can be areas within a state or areas straddling a number of states) is required to submit a State Implementation Plan (SIP). Two separate types of SIPs are developed: an attainment-maintenance SIP if the AQCR is designated as attainment and an attainment-demonstration SIP if designated as nonattainment.

See Annex I for a table providing a comparison of the air quality limit values of both jurisdictions.

#### 2.1.2. *Emission reduction targets*

**EU.** The EU Directive on national emissions ceilings (NECs) adopted in 2001 sets mandatory national emission reduction targets for SO<sub>2</sub>, NO<sub>x</sub>, VOCs and NH<sub>3</sub> (ammonia). One of the drivers for the NEC Directive has been the process within the context of the UN/ECE Convention on Long-Range Transboundary Air Pollution (CLRTAP) to define critical loads and to agree on the national emission reduction targets necessary to ensure that critical loads are not exceeded, at the lowest overall cost. The NEC Directive requires Member States to draw up programmes for the progressive reduction of the four pollutants, so as to comply with the NECS set down in Annex 1 of the Directive, by 2010 at the latest. The Directive covers emissions from all sources of the pollutants which arise as a result of human activities.

The 1988 Large Combustion Plant (LCP) Directive also set national emissions ceilings and reduction targets, but only for existing LCPs (plants licenced before 1987), and only for SO<sub>2</sub> and NO<sub>x</sub>. MS were obliged to draw up appropriate programmes for the progressive reduction of total annual emissions for existing plants so as to meet phased-in reduction targets for 1993, 1998 and 2003. The 2001 LCP Directive, adopted at the same time as the NEC Directive, retains this obligation. It also sets more stringent emission reduction goals for existing LCPs. MS are given the option of ensuring that all

individual existing LCPs meet the more stringent ELVs required from new plants, or are subject to a national emission reduction plan that would achieve the same overall reduction in emissions. The 1999 Solvents Directive also provides for national emissions reduction planning as an alternative to applying the ELVs required in the Directive.

**USA.** The closest US equivalent is the National SO<sub>2</sub> Target set in the Acid Rain Trading Programme. However, the US has a number of explicit and/or implied sub-national emission reduction targets in the various SIPs. For example, the NO<sub>x</sub> Trading Programme established by the Ozone Transport Commission (OTC) covering the mid-Atlantic and northeastern regions of the US fixes summertime only emission reduction targets for the energy generation facilities covered in the programme. In addition, through the NO<sub>x</sub> SIP Call, EPA established emissions limits for various sources of NO<sub>x</sub> in 19 states and the District of Columbia. See Case study 1 for more details on this, as well as on the trading programmes established under the NO<sub>x</sub> SIP call and the WRAP process.

A rule recently proposed by EPA, the Clean Air Interstate Rule, seeks to reduce interstate transport of fine particulate and ozone pollution to help states meet the new 8-hour ozone and fine particle NAAQS. This rule would establish emissions caps in two phases (2010 and 2015) for NO<sub>x</sub> and SO<sub>2</sub> in 28 states and the District of Columbia.

## 2.2. The AQ Planning Requirements

### 2.2.1. The process of designating geographical areas to be covered by the plans

**EU.** Under the EU AQFD, MS have full competence for defining the geographical areas within their territories (in addition to all agglomerations with 250,000 or more residents, which constitute a special type of zone that are covered *per se*) that will constitute zones for the purpose of AQ monitoring/assessment. If the zone exceeds AQLVs plus the margin of tolerance, an AQ management plan or programme must be drawn up. *Guidance on Assessment under the EU Air Quality Directives*, a document issued by the Commission to assist MS in this task, suggests linking zone boundaries to administrative areas within the country and to group adjacent administrative areas with similar AQ characteristics into one zone.

A 2002 Commission report reviewing the results of the preliminary assessments under the AQFD found that most, but not all, MS did follow administrative borders. It also found that the size of non-agglomeration zones varied dramatically both geographically (0.19 to 311,000 km<sup>2</sup>) and by population (3000 to 7.7 million inhabitants). There is no EU-level power of review to control how MS have defined zones and agglomerations.

**USA.** The CAA gives each State the primary responsibility for assuring air quality within the entire geographic area comprising the State. For purposes of administering the AQM system, the CAA adopted the air quality control regions (AQCRs) which were previously designated under the Air Quality Act of 1967. The 1990 CAA Amendments updated the boundaries of AQCRs based on the Metropolitan Statistical Area or the Consolidated Metropolitan Statistical Area (C/MSA). As a result, a number of major intrastate areas were grouped into one AQCR if such action deemed necessary or appropriate for administering the AQM system.

Within 1 year after promulgation of new or revised NAAQS, states are required to submit to USEPA a list of initial area designations for the AQCRs under their jurisdiction. Upon receiving a list of initial area designations and consulting with the state authorities, EPA announces final area designations within 2 years of promulgation of the NAAQS.

### 2.2.2. Differentiation according to status of attainment, and the consequences

**EU.** The AQFD requires the Member States to draw up lists of their zones and agglomerations:

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- Where concentrations of one or more pollutants exceed the LV plus margin of tolerance (*Art. 8(1)*).
- Where concentrations are above the LV but within the margin of tolerance (*Art. 8(2)*).
- Where all levels are below LVs (*Art. 9*).

If a zone or agglomeration is in exceedance of the LV plus the margin of tolerance (*Art. 8(1) zone*), the MS is required to draw up a plan or programme for attaining the LV within the time limit. Monitoring requirements are also more onerous. The MS must carry out measurements at fixed sites, either continuously or by random sampling with a large enough number to enable determination of the levels.

There is no requirement to draw up a plan or programme if a zone or agglomeration is in exceedance of the LVs but within the margin of tolerance (*Art. 8(2) zone*). Monitoring is still required, but the MS may use a combination of measurements and modelling techniques. Zones and agglomerations where the levels of pollutants are below the LVs (*Art. 9 zone*) do not need plans or programmes and it is possible to assess levels of pollutants solely by use of modelling or objective estimation techniques.

MS must report to the Commission each year the list of zones designated under the three categories above, as well as a list of occurrences of pollution levels exceeding the limit values, and each year the Commission publishes a list of the *Art. 8(1)* zones (i.e., where exceedances have occurred). This is therefore a fluid process, with no formal mechanism for designating a zone as in exceedance or for delisting a zone. A zone where exceedances no longer occur simply does not appear on the annual list.

Planning requirements under the NEC Directive do not vary according to the projected state of compliance by 2010 with the national ceiling.

**USA**. The US system classifies areas into three categories, as follows:

- *Nonattainment*. any area that does not meet (or that contributes to ambient air quality in a nearby area that does not meet) the primary or secondary NAAQS for the pollutant;
- *Attainment*. any area that meets the primary or secondary NAAQS for the pollutant and does not contribute to the violation of the standards in a nearby area;
- *Unclassifiable*: any area that cannot be classified on the basis of available information as meeting or not meeting the primary or secondary NAAQS for the pollutant.

In addition, the CAA classifies nonattainment areas according to the severity of the exceedance of the concentration levels. For example, O<sub>3</sub> nonattainment areas are classified as either marginal, moderate, serious, severe-15, severe-17, or extreme. Similarly, CO nonattainment areas are classified as moderate or serious; and PM<sub>10</sub> areas as serious and moderate. The SIP for a particular area must comply with more stringent planning and control requirements the more severe the classification of the nonattainment.

In addition to a mechanism for identifying and designating nonattainment areas, the CAA also specifies a process by which a nonattainment area can be redesignated as an attainment area.

### 2.2.3. *What needs to be in the plans*

**EU**. The AQFD's Annex IV specifies what must be in the programmes for improvement of ambient air quality for the *Art. 8(1)* zones, including information on

- where the excess pollution occurs, the type of zone and the population exposed to the pollution,
- the main emission sources responsible for the pollution,
- the total quantity of emissions from those sources and any pollution imported from other regions,
- analysis of factors responsible for the exceedance and possible measures for improving the AQ,

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- details of any measures for AQ improvement (both those which existed prior to the AQFD and those adopted to reduce pollution after the AQFD), including timetables for implementation and estimates of expected improvements in AQ,
- details of any measures or projects planned for the long term.

The NEC Directive gives few details concerning what MS must include in their national programmes for the progressive reduction of emissions. The programmes are to be drawn up with the aim of complying with the NECs laid down in the Directive's Annex I by 2010 at the latest, and are to include

- information on adopted and envisaged policies and measures;
- quantified estimates of the effect of the policies and measures on emissions of the pollutants in 2010;
- any anticipated significant changes in the geographical distribution of national emissions.

At the end of each year, MS are also to report their national emission inventories and their emission projections for 2010 to the Commission and the European Environment Agency. The emission projections are to include information to enable a quantitative understanding of the key socioeconomic assumptions used in their preparation.

National emission reduction plans prepared under the 2001 Large Combustion Plant Directive (as an alternative to ensuring that all existing plants meet the more stringent requirements for new plants) must "comprise objectives and related targets, measures and timetables for reaching these objectives and targets, and a monitoring mechanism".

**USA.** The key components of an attainment-demonstration SIP are as follows:

- An emissions inventory.
- An analysis involving air quality model simulations, observational data and related evidence to determine the amount and types of emission reductions needed to demonstrate attainment by the deadline.
- A description of the emissions control strategies and enforcement measures to be adopted to achieve the required reductions.

There are explicit requirements for emission control strategies and enforcement measures for each criteria pollutant.

SIP requirements both for planning and control measures vary, depending on the severity of the non-attainment. For example, serious and above ozone nonattainment areas must use a photochemical grid model and provide for an enhanced vehicle inspection and maintenance (I/M) program, while marginal and above areas are required to include a "regular" I/M program.

### 2.2.4. Guidance for inventories & AQ modelling

**EU.** The AQFD requires the plan or programme for AQ improvement to list the main emission sources responsible for the pollution, along with the total quantity of emissions from these sources, including information on pollution imported from other regions. No formal guidance is provided for this, e.g., for estimation of the contribution from various sources or the projected impact of any new EU-level measures such as emission controls.

The 2001 NEC Directive requires preparation and annual updating of national emission inventories (and emission projections for 2010) for the four pollutants for which national ceilings are set. The emission inventories and projections are to be established using the methodologies specified in the *EMEP/CORINAIR Emission Inventory Guidebook* (3d edition, October 2003 update), prepared by the UNECE/EMEP Task Force on Emissions Inventories and Projections.

## Assessment of the Effectiveness of European Air Quality Policies and Measures

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The AQFD daughter Directive on ozone in ambient air establishes one of the few formal links between the AQFD regime and the Directives aimed at controlling emissions to air. It requires MS to draw up plans and programmes for zones in which levels of ozone are higher than the target values, taking into account the provisions of the NEC Directive. MS are also to prepare and implement cost-effective measures to achieve long-term objectives for ozone concentrations in ambient air, building upon measures taken to achieve the NEC Directive provisions and other relevant existing and future EC legislation. However, no formal guidance has been provided to date concerning how to take the NEC Directive provisions into account in developing plans and programmes for zones that are not in attainment of the target values set for ozone.

**USA.** Under the US system, SIPs are required to list all sources of the pollutant or its precursor; the rate of emission at these sources for all areas; and other emissions data as deemed necessary for SIP development (i.e. the criteria pollutants with regional transport). EPA provides a general procedure for developing emissions inventory of four sources: point, area, mobile, and biogenic. These inventories are generally developed using a combination of direct measurements and emission models.

Once an emissions inventory is complete, state agencies analyze the amount of emission reductions needed to achieve attainment of the NAAQS using air quality models. These models simulate one or more of the historical events that contributed to the areas exceedance and to demonstrate that appropriate emission controls will prevent future violation during similar events. In addition to the historical events, future projections incorporate a variety of factors that affect emissions, such as vehicle kilometres travelled and the effectiveness of emission control technology.

### *2.2.5. Guidance on control strategies*

**EU.** The EU gives considerable latitude to the MS to determine how they will meet the AQLVs set in the daughter Directives, and there is little formal guidance on general AQ management and emission control strategies at EU level. The Commission does make efforts to facilitate information-sharing among the MS, e.g., through the committee comprising MS representatives established under the AQFD Committee, and to draw attention to best practices in this area.

Similarly, it is up to each MS to determine how and where it will meet its national emissions ceiling (NEC) within its national territory. Though the NECs were set on the basis of AQ modelling information that determined critical loads for sensitive ecosystems across Europe, each NEC covers the total emissions throughout that MS territory. There is no requirement to link emission reductions to the region within a given MS where the emission reduction is most needed to protect specific ecosystems.

On the other hand, in 2003, the Commission issued a Recommendation on the guidelines to assist a Member State in the preparation of a national emission reduction plan under the 2001 Large Combustion Plant Directive. Moreover, considerable guidance has been provided with respect to the 1996 Directive on integrated pollution prevention and control (IPPC). An extensive EU-wide exercise has been carried out to determine best available techniques (BAT) for the categories of installations covered by the Directive and to provide reference documents (BATREF) to guide MS authorities in setting permit conditions for the installations in those categories within their territories. The IPPC Directive also requires MS authorities issuing integrated permits to take account of environmental quality standards, such as AQLVs, and to set more stringent conditions than those achievable by the use of the best available techniques (BAT) if necessary to comply with the quality standard.

**USA.** In the US system, after conducting an emission inventory and determining the amount of emission reductions needed, state agencies develop strategies for emission control and enforcement to demonstrate attainment status by the required date. The emission-control strategy is typically developed in stages by identifying applicable federal, local (mandatory or additional), and multistate



regional measures. USEPA provides guidelines and models for federal measures that are expected to achieve emission reductions in the nonattainment area and for local-mandatory measures.<sup>2</sup>

### *2.2.6. Multistate / transboundary aspects*

**EU.** The AQFD stipulates that when the level of a pollutant exceeds or is likely to exceed the limit value plus the margin of tolerance as a result of significant pollution originating in another MS, the MS concerned shall consult with one another with a view to finding a solution. The Commission may be present at such consultations. The first and second AQFD daughter Directives give no mention to transboundary aspects.

However, the third daughter Directive on ozone in ambient air explicitly mentions the transboundary nature of ozone pollution and dedicates an article to the issue, requiring – where ozone concentrations exceeding target values are due largely to precursor emissions in other MS – that the MS concerned cooperate in drawing up joint plans and programmes in order to attain the target values. The Commission is to assist in those efforts, and in particular to consider whether further action at Community level along the lines of the NEC Directive is needed to reduce precursor emissions responsible for such transboundary air pollution. The Ozone Daughter Directive also requires that neighbouring zones in different MS either prepare and implement joint short-term action plans, or receive appropriate information about each other's action plans.

Though the EU system does not require regional plans and programmes specifically, it should be noted that transboundary pollution problems have driven much of the EU AQ management regime. In particular, both the Large Combustion Plant Directive and the NEC Directive resulted directly from multistate negotiations on how to deal with the transboundary transport of acidifying, eutrophying and photochemical air pollutants. However, this is a European-wide commitment. There is no formal mechanism in place such as the river basin management requirement under the Water Framework Directive for facilitating cross-border cooperation on shared air quality management problems in a particular region.

**USA.** Under the US system, 1990 CAA Amendments required implementation of multistate air pollution mitigation strategies through the creation of regional planning organizations (RPOs). By issuance of EPA and voluntary adoption by states, rules and regulations of RPOs can be mandated and hence counted towards developing attainment-demonstration strategy.<sup>3</sup> In addition, section 126 of the CAA allowed any state or political subdivision to petition EPA for finding that emissions from major stationary sources in upwind States contribute significantly to nonattainment (or interfere with maintenance) of a NAAQS in a petitioning State. If EPA makes such a finding, it can impose additional regulatory measures for the emitting State (i.e. NO<sub>x</sub> SIP Call for ozone NAAQS).<sup>4</sup>

## **2.3. Institutional Accountability in the Planning Process**

### *2.3.1. Regulatory oversight of the planning process*

**EU.** The AQFD grants the Commission a number of important oversight roles with respect to AQ management plans & programmes. These include:

- Receipt of notifications from MS concerning designation of zones, and if non-attainment
- Receipt and review of plans and programmes

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<sup>2</sup> The CCA specifies mandatory local measures to be included in the SIP, depending on the type and severity of the criteria pollutant (i.e. enhanced inspection and maintenance program for severe ozone nonattainment areas).

<sup>3</sup> As a result, Ozone Transport Commission (OTC) in the eastern half of the United States and the ad hoc Ozone Transport Assessment Group (OTAG) were established to implement further reduction of NO<sub>x</sub> emission (see Case Study #1 Ozone section). In the west, the Grand Canyon Visibility Transport Commission (GCVTC) and Western Regional Air Partnership (WRAP) were established (see Case Study #4 Particulate Matter).

<sup>4</sup> See Case Study #1: Regional Air Pollution – Ozone section for detail.

## Assessment of the Effectiveness of European Air Quality Policies and Measures

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- Regularly check implementation of the plans or programmes by examining trends on air pollution and progress toward meeting the limit values
- Report to the European Parliament and Council on implementation and progress towards achieving AQ targets
- Participation in transboundary consultations among Member States affected by pollution originating in another MS

The 2001 Large Combustion Plant Directive gives the Commission more explicit powers with respect to any national emission reduction plans drawn up for existing plants, including the role of evaluating whether or not the plant meets the requirements set forth in the Directive and, if the Commission considers that the plan does not meet requirements, informing the MS thereof. The MS then has three months to communicate the steps taken to meet the requirements.

The 2001 NEC Directive requires MS to report their national emission inventories and emission projections to the Commission and the EEA each year, and to inform the Commission of the national emission reduction programmes drawn up under the Directive. On the basis of this information, the Commission is to report to the European Parliament and the Council on progress on implementation, including the extent to which the interim environmental objectives are likely to be met by 2010. “If appropriate”, the reports are to be accompanied by proposals for (a) modifications of the national ceilings, (b) possible further emission reductions with the aim of meeting the long-term objectives of the Directive, (c) measures to ensure compliance with the ceilings.

**USA.** In the US, SIPs are submitted to EPA for review to check if the plan meets its requirements. If EPA approves the plan, the SIP becomes enforceable as a matter of federal and state law and therefore subject to lawsuits for failure to comply. EPA can disapprove a SIP if it does not meet the procedural and substantive requirements, and require a resubmission with revisions. A SIP is also subject to change in order to reflect new federal or state requirements, new information, or change in status of NAAQS attainment. Likewise, SIP revisions must be reviewed and approved by EPA before it is enforceable. If a state fails to generate a SIP, then EPA has the power to control the air quality management programs for that state or area. In extreme cases where the state has an inadequate SIP or fails to implement its SIP, EPA can replace a SIP with a federal implementation plan (FIP).

### *2.3.2. Measures to encourage compliance*

**EU.** The European Commission does not have many tools to compel compliance with the requirements set forth in air quality legislation, if a MS does not attain the AQLVs or any required reductions. The range of means for bringing pressure for compliance is limited, but includes

- “Name and shame” efforts
- An infringement proceeding under Article 226 EC Treaty
- A sanction (fine) under Article 228 EC Treaty, if the MS has been declared in infringement by the ECJ and failure to take corrective action has led to a second infringement proceeding
- Article 10(4) of the AQFD, which provides for the Commission to examine the need to develop harmonised Community measures for the most relevant economic sectors and products contributing to acidification, eutrophication and formation of ground-level ozone.

More generally, EU financial assistance to MS under the Cohesion Policy is in theory available only to finance efforts totally in compliance with EU requirements. If a zone is in exceedence of an AQLV, this in theory should block use of any EU funds for regional development efforts that could lead to increased emissions, such as expansion of roads or construction of new industrial facilities. This study could not find any examples of proposed projects that were refused EU funding on the grounds that they would not enable compliance with EU environmental quality requirements.

**USA.** In the US several measures are provided to encourage compliance. These measures include:

## Assessment of the Effectiveness of European Air Quality Policies and Measures

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- *Bump-up provision.* The USEPA can reclassify an ozone nonattainment area ranked below ‘severe’ that fails to achieve attainment by the specified deadline to the next higher classification or the classification applicable to the area’s design value at the time of failure to attain. Once reclassified, the AQCR is required to develop and promulgate a new SIP in accordance with more stringent pollution control measures that are mandatory of the new classification.
- *Sanctions.* The 1990 CAA Amendments authorized EPA to impose sanctions when a nonattainment area fails to submit an adequate plan (or revised plan) or to demonstrate attainment by the deadline. There are two types of sanctions: “2-to-1” emission offsets and the withholding of federal highway funds. The 2-to-1 emission offset sanction requires newly constructed or expanded major stationary sources to reduce emissions from other facilities twice the amount they project to emit at the new development. Under the federal highway fund sanction, funds for transportation projects within the nonattainment area are withheld, with the exception of projects designed to improve safety, transit, and air quality.
- *Conformity determination.* Close integration of air quality and transportation planning authorities is required to make their plans conform to each other. These regulations mainly affect the procedure by which metropolitan planning organizations (MPOs) develop Transportation Improvement Program (TIP), which identifies major highway and transit projects that the area will undertake.
- *Penalty fee.* Local governments of the severe and extreme ozone nonattainment areas are allowed to collect a penalty fee from major stationary sources in case of failure to timely attainment.

### 2.4. Assessment of the effectiveness

The systems for addressing air quality in both regions play an important role in laying the foundation for the emissions control measures instituted to address the emissions of concern. The extent to which the systems, as opposed to control measures, have led to the emissions reductions achieved is matter of conjecture and possible future analysis. Therefore, it is important to also consider the measures implemented in these two regions. Below we present some summary information on the effectiveness in the two regions. For more detailed discussion and information see case studies 1, 3, and 4.

#### 2.4.1. Environmental effectiveness

Both regions have achieved significant progress in reducing emissions and the impacts associated with those emissions (see case studies 1 and 4). In some cases, further progress is needed. In both regions, these efforts have been undertaken in one form or another for several decades. However, most effort has been focused in recent years so it is most interesting to compare the levels of reductions in the two most recent decades. The table below compares the level of emissions reductions per GDP achieved in the respective regions. It is important to keep in mind that each region has a variety of underlying factors, such as economic drivers, starting point of emissions levels, and mix of the economy. Therefore it is impossible to control for all factors when considering these values.

*Table 1: Comparison of Changes in Emissions per GDP in the EU-15 and US (kt/MEUR)*

	EU-15			US		
	1980	2001	% chg	1980	2001	% chg
<b>NO<sub>x</sub></b>	3433	827	-75.9%	7156	1627	-77.3%
<b>SO<sub>2</sub></b>	6745	494	-92.7%	6851	1150	-83.2%
<b>VOC</b>	4210	823	-80.5%	8220	1756	-78.6%

However, it is interesting to note that the EU-15 achieved a greater percentage reduction in emissions of SO<sub>2</sub> and VOC per GDP in this period, whereas the US achieved a greater percentage reduction in emissions of NO<sub>x</sub>.

## Assessment of the Effectiveness of European Air Quality Policies and Measures

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### 2.4.2. Attainment of targets

Another means to compare the progress of the various regions is to consider the number of areas, as designated by the regions, which do not meet the limit values, as established in those regions. Since each region calculates and determines compliance and non-compliance with these values differently, it is impossible to compare these regions on an equal basis. Therefore, the table below essentially attempts to consider the extent to which the given regions have met their air quality objectives.

Only preliminary information is available to date on the status of attainment/nonattainment in the various Member States. A 2002 Commission report<sup>5</sup> summarizing the findings of some of the preliminary air quality assessments carried out in the EU Member States and Norway with respect to SO<sub>2</sub>, NO<sub>2</sub>/NO<sub>x</sub>, PM<sub>10</sub> and lead includes some data on the occurrence of exceedences of various air quality thresholds, including the number of countries with zones where exceedences were reported that were over the limit value (LV) and the margin of tolerance (MOT) set in the First Daughter Directive.

	No. of countries reporting on >LV+MOT	No. of countries with no zones >LV+MOT	No. of countries with some zones >LV+MOT	No. of countries with most zones >LV +MOT
SO <sub>2</sub>	8	6	2	0
NO <sub>2</sub> /NO <sub>x</sub>	9	3	5	1
PM <sub>10</sub>	7	2	2	3
Lead	9	8	1	0

The countries that reported no zones in exceedence of the limit values and margin of tolerance could be considered equivalent to zones in attainment. The table above considers a zone to have threshold exceedence if an exceedence occurs anywhere in the zone, irrespective of whether the entire zone or only a small spot is in exceedence. This is similar for the US where an exceedence in a given portion of the area enables classification as nonattainment for the standard.

Sometime in 2004, the Commission's Review Report on data from 2001 submitted by the Member States in their first reports on zones and threshold exceedences for these parameters will be released and this should provide more up to date information on whether MS are on track to attain the AQLVs set in the first AQFD daughter Directive.

On the other hand, preliminary information is available on projected levels of attainment of emission reduction targets under the NEC Directive. According to the projections of emissions submitted to the Commission to date (representing 10 of the EU-15), most MS will achieve their NECs for SO<sub>2</sub>. However, only the UK and Finland are projected to achieve their NECs for NO<sub>x</sub>, and only Denmark, Italy, Sweden and France are expected to achieve their NECs for VOCs.

For the US, data is available on the status of nonattainment areas as classified by the USEPA. The table below shows the trends in the total number of nonattainment areas according to pollutant. Significant progress has been made in reducing nonattainment areas for CO—only 10 areas out of the original 43 areas remain in nonattainment. For NO<sub>2</sub> and Pb, zero and 3 areas remain in nonattainment, respectively. For ozone, the greatest progress has been made in reducing the number of nonattainment areas for the least serious areas—marginal and moderate. Less progress has been made in the areas with worse ozone problems—serious, severe-15, severe-17, and extreme.

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<sup>5</sup> *Overview of Methods and Results of the Preliminary Assessment of Air Quality in Europe under Directives 96/62/EC and 1999/30/EC* (European Commission, DG Environment, May 23<sup>rd</sup> 2002).

## Assessment of the Effectiveness of European Air Quality Policies and Measures

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Table 2-4. Classifications and Number of Nonattainment Areas in 1992 Remaining in Nonattainment as of May 17, 2004 (NRC, 2004; EPA 2004a)

Pollutant	Classification	1992	2004	change
CO	Serious	7	6	-1
	Moderate	4	1	-3
	Moderate	32	3	-29
NO <sub>2</sub>	-	1	0	-1
Pb	-	13	3	-10
O <sub>3</sub>	Extreme	2	2	0
	Severe-17 <sup>a</sup>	5	5	0
	Severe-15 <sup>b</sup>	7	7	0
	Serious	13	10	-3
	Moderate	29	6	-26
	Marginal	43	19	-25
	Other <sup>c</sup>	2	1	-1
PM <sub>10</sub> <sup>d</sup>	Serious	8	8	0
	Moderate	78	51	-27
SO <sub>2</sub>	Primary	48	15	-33
	Primary, Secondary	6	6	0
<b>Total</b>		<b>310</b>	<b>146</b>	<b>-164</b>

<sup>a</sup> "Severe-17" nonattainment areas have 17 years to attain standards.

<sup>b</sup> "Severe-15" nonattainment areas have 15 years to attain standards.

<sup>c</sup> This category includes areas that violate the O<sub>3</sub> standard and have a design value of less than 0.121 ppm. That occurs when the exceedance is higher than the O<sub>3</sub> standard exceedance rate of 1.0 per year, even though the estimated design value is less than the standard.

<sup>d</sup> See *Code of Federal Regulations* (40 CFR Part 81) and *Federal Register* for lists and boundaries (<http://www.epa.gov/oar/oaqps/greenbk/pfnrpt1.html>). For areas designated as in nonattainment for PM<sub>10</sub>, § 188 of the CAA outlines the process for classification and establishes that area's attainment date. All PM<sub>10</sub> nonattainment areas are initially classified as moderate by operation of law, but can be reclassified as serious, if EPA determines the area cannot "practically" attain the PM<sub>10</sub> NAAQS by the attainment date, or after the passage of the attainment date, if EPA determines the area has failed to attain the standards.

### 2.4.3. Compliance with the planning requirements

Since the programs detailed here are largely aimed at the development of plans to meet various air quality goals, it is also useful to assess the level of compliance with those planning requirements. In the EU, most national emission reductions plans under the NEC Directive were submitted late, and none of the plans had complete information. The MS submitted their first reports on threshold exceedences under the first AQFD daughter Directive in 2001, which triggered the planning requirement. No information is available yet as to the status of compliance with the AQFD planning requirements for those zones where exceedences were reported.

In the US, one measure of compliance with the planning requirement is to consider the number of occasions where an area has been subject to the sanctions outlined in the CAA. As of March 13, 2004, EPA has had to impose one or more of the sanctions mandated in the 1990 CAA Amendments in 28 instances. An additional 39 areas are currently under the clock facing sanctions in the near future unless they correct the relevant deficiency or deficiencies (FHWA, 2004a). In cases where the sanctions were imposed, areas quickly addressed the deficiency to have them removed within relatively short periods. In almost all cases where highway sanctions were imposed, areas did not actually lose highway funds because there were no proposed projects during the brief periods when the sanctions were in effect.<sup>6</sup>

<sup>6</sup> Highway sanctions remained in effect in only one case (East Helena, MT).

### 3. CONCLUSIONS

While the air quality planning process does not necessarily determine the specific emissions control measures introduced, it can potentially lay an important foundation for those measures. It has not been possible to fully assess the success or failure of these planning processes in either the EU or the US, since it is difficult to separate out the emissions control measures that have been implemented as a result of these planning requirements from those that would have been implemented in any case. Instead, we wish to highlight some of the findings from our comparison of the EU and the US systems that might be instructive for future development of both regions' air quality management systems.

- In both the EU and the US, air quality limit values trigger planning requirements. The EU system also features planning requirements for achieving overall emissions reductions at national level, e.g., for all sources of emissions under the NEC Directive. There is no US equivalent to this requirement, other than the State Implementation Plan process, which requires setting a type of emissions ceiling in order to achieve air quality targets. The only system in the US that is partially comparable is the US Acid Rain Trading program which establishes a national SO<sub>2</sub> ceiling. In this system, no planning requirement is needed since it is unnecessary to outline the specific measures that a facility will undertake because the amount of emissions allowed is firmly fixed based upon the number of emissions allowances issued.
- While both regions have established emissions reduction targets for specific pollutants, the mechanisms differ. For example, the EU-15 has established national emissions ceilings for a number of pollutants that cover all sources, while the US has not explicitly established national emissions ceilings that cover emissions for all sectors. However, the US SIP process establishes implicit emissions limits for all sources in order to meet the NAAQS. The US process has also established emission reduction targets for specific types of emitting facilities (e.g., electricity generating facilities).
- In the EU the MS are free to determine how they delineate AQ management zones and there is no EU-level review of this process. In the US, the States put forward proposals for AQ management regions but these are reviewed at central level and modifications are sometimes required in order to address regional air quality problems more effectively.
- Under the EU AQFD, plans are required only if a zone is in exceedance and therefore the planning requirements could be perceived as a type of sanction. In the US, the planning requirement covers all areas, irrespective of the level of attainment. Even those areas in attainment must be covered by plans to show how the attainment status will be maintained.
- Where regional AQ problems can be found in cross-border regions, the EU AQ Framework Directive requires MS to consult with one another but, outside of the NEC Directive, which applies to all MS, there is no mechanism to ensure that specific MS work together to solve a particular regional problem. The US system has stronger mechanisms to compel cross-border co-operation. The federal government can compel regional planning organizations or regional emissions control programs to be formed to develop coordinated efforts, e.g., to address ozone formation and regional haze.
- The EU system does not provide for much differentiation among areas according to the severity of their air quality problems, while this occurs for most pollutants in the US. Though the AQFD does provide some differentiation between zones in exceedance by reference to the "margin of tolerance", the US uses a system, especially for ozone, that provides much more differentiation according to the severity of the air quality problem, e.g., moderate and serious. Such a system could prove useful within the EU to help focus efforts on areas according to their air quality problems.

## **Assessment of the Effectiveness of European Air Quality Policies and Measures**

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- While the types of information required to be in the air quality plans are similar in the two regions, the US system places more stringent planning requirements on areas according to the severity of their air quality problems. For example, the US requires non-attainment areas for ozone to carry out more stringent planning and control measures according to the degree of this classification. In addition, the SIP planning process has more explicit links between air quality objectives and controls over specific types of emission sources.
- Both regions have mechanisms to address regional transport of emissions, e.g., the national emissions ceilings set for the EU MS, progress towards which is monitored closely by the Commission. However, only the US system has in place explicit legal mechanisms for states to request that the USEPA address transport emissions from another region.
- Both regions have in place mechanisms to encourage or enforce proper development of plans and programmes by states, and to enforce AQ standards. However, the US powers of enforcement are stronger. The US Clean Air Act gives the federal government specific powers over the states if they fail to meet the NAAQSs, whereas the EU system relies more on peer pressure and persuasion, e.g., through review of status of implementation, reporting of findings and the prospect of additional measures. If a MS does not achieve the AQ standards, the Commission may bring a case before the European Court of Justice, but this is a general power of enforcement over the MS that applies to all areas of EU law, and is not specifically linked to AQ or other environmental goals. In any case, it appears that the US system of compliance has been used to a greater extent.
- The EU system has few explicit links between its air quality planning requirements and controls over emissions from specific sources, whereas the US system provides detailed guidance and/or models on air quality analysis, development of emissions inventories, and to some extent expected emissions reductions to enable the SIPs to account for emissions reductions expected from federal-level controls.
- In the US the debate is now shifting to a realisation that more federal actions are needed to reduce source emissions, in order to effectively address regional transport issues and to alleviate competitiveness concerns on the part of some States. In the EU context, it may well be that there is a similar need for more centralised regulatory actions in order to support local and regional air quality planning efforts.





## Assessment of the Effectiveness of European Air Quality Policies and Measures

*A project for DG Environment carried out by Milieu Ltd, the Danish National Environmental Research Institute, and the Center for Clean Air Policy*

	US	EU
Geographical Areas Covered	Each State has primary responsibility for assuring air quality within its entire geographic area. AQ is managed on the basis of air quality control regions (AQCRs), usually counties. USEPA may redesignate any interstate or major intrastate areas into one AQCR if necessary or appropriate for AQM.	(1) Under the AQFD, each Member State is responsible for ensuring air quality within its territory, and for designating agglomerations and zones on the basis of AQ management considerations. (2) The NECD also places responsibility on each Member State to reduce emissions within its territory.
What triggers the planning requirement	States must submit SIPs covering each of the NAAQS for the AQCRs within their areas. The SIP is either an attainment-maintenance SIP (if the AQCR is designated as in attainment) or an attainment-demonstration SIP (if the AQCR is designated as nonattainment).	(1) The AQFD requires plans only for those zones and agglomerations with pollutant levels higher than the AQLVs, and not if a zone is in attainment. (2) The NECD requires MS to draw up national-level programmes for progressive reduction of pollutants as required to achieve ceilings by 2010.
Consequences related to status of attainment	Requirements for control measures & deadlines for achieving attainment are differentiated according to the severity (degree) of non-attainment.	No differentiation in terms of requirements for control measures or attainment deadlines on basis of severity of non-attainment
Who makes the plan	Agency(s) differ from state to state due to various geographic spans of AQCRs. A SIP can be prepared by the state authority or a local or regional government.	(1) MS designate at the appropriate levels the competent authorities and bodies responsible for implementing the AQFD requirements.
What is required to be in the plans	SIPs are required to include a list of local, state, regional and federal air quality control measures in accordance with the pollutant-specific requirements provided by the Clean Air Act (CAA).	(1) The AQFD requires plans to list main emission sources, total emissions from these sources (tonnes/year), pollution imported from other regions, description of measures; estimated improvement of AQ & time to attain the objectives.
Transboundary aspects	Downwind states can petition EPA to have upwind contribution recognized & force upwind state to take action (NO <sub>x</sub> SIP call resulted in upwind states being given caps for LCP emissions)	(1) Member States required to consult each other when level of pollution due to significant pollution originating in another Member State. (2) NECs set at levels aimed at reducing regional pollutant transport problems.
Regulatory oversight during the review process of the plan	Once SIPs are developed, they are submitted to EPA to check if the plan meets requirements. If EPA approves the SIP, it becomes enforceable as a matter of federal & state law (& subject to lawsuits if failure to comply).	AQFD requires MS to report to Commission on the plans & programmes prepared in order to attain the target value, & to inform the Commission every 3 years on the progress of any such plan or programme.
Consequences of inadequate plans	EPA can disapprove a SIP if it does not meet the procedural and substantive requirements & require a resubmission with revisions. If a state fails to generate a SIP, EPA has the power to control the AQM programs for that state. In extreme cases, EPA can replace an inadequate SIP with a federal implementation plan (FIP).	(1) AQFD does not specify. In general, if a MS is not in compliance with EU law, the Commission can decide to initiate an infringement action (see below).
Consequences of non-compliance and/or nonattainment	If AQCRs fail to demonstrate attainment by deadline, the following measures can be applied: (1) sanctions: (a) 2-to-1 emission offset sanctions before allowing any new or expanded major stationary sources; (b) withholding of federal funding for highway projects, except for projects to improve safety, transit, & AQ; (c) federal funding, authorization, or approval of any project or program that does not conform with the SIPs withheld; (2) "bump-up" provision: reclassification of a failed ozone nonattainment area to a higher classification, triggering more stringent requirements; and (3) penalty fee (severe & extreme ozone nonattainment areas only): each major source in area required to pay \$5,000 per ton of VOC or NO <sub>x</sub> emitted in excess of 80% of the stationary source's permitted level of emissions until attainment is demonstrated.	(1) The Commission publishes an annual list of the zones & agglomerations in exceedance of AQLVs. (2) The Commission is obliged to submit reports in 2004 & 2008 to the Council & European Parliament on progress towards meeting the NECs. The reports, if appropriate, are to be accompanied by proposals for modifications to the NECs, possible further emission reductions, and/or measures to ensure compliance with the ceilings.  If a MS does not comply with the AQLVs or the NEC, the Commission may pursue an infringement action, including an action before the European Court of Justice, under its general power of enforcement over the MS.

## Assessment of the Effectiveness of European Air Quality Policies and Measures

A project for DG Environment carried out by Milieu Ltd, the Danish National Environmental Research Institute, and the Center for Clean Air Policy

### Annex II: Table comparing EU and USA Air Quality Limit Values

Pollutant	EU – AQFD Daughter Directives $\mu\text{gm}^3$	USA $\mu\text{gm}^3$
<b>1. SO<sub>2</sub></b>		
1 hour mean	350 - not to be exceeded more than 24 times per calendar year (as of 1.1.2005)	--
3 hour mean	--	1310 – not to be exceeded more than once per year
24 hour mean	125 - not to be exceeded more than 3 times per calendar year	365 - not to be exceeded more than once per year
Annual mean	20 - annual and winter mean for protection of ecosystem	79
<b>2. NO<sub>x</sub></b>		
1 hour mean	200 - not to be exceeded more than 8 times per calendar year (as of 1.1.2010)	--
Daily average of 1 hour	--	--
Annual mean	40	100
<b>3. PM 2.5</b>		
24 hour average	--	65 $\mu\text{gm}^3$ - the 3-year average of the 98th percentile of 24-hour concentrations at each population-oriented monitor within an area
Annual average	--	15 $\mu\text{gm}^3$ - the 3-year average of the annual arithmetic mean PM2.5 concentrations from single or multiple community-oriented monitors
<b>4. PM 10</b>		
Hourly	--	--
24 hr mean	50 - not to be exceeded more than 35 times a calendar year (as of 1.1.2005)	150 $\mu\text{gm}^3$ - not to be exceeded more than once per year
Annual mean	40	50 $\mu\text{gm}^3$ - expected annual arithmetic mean PM10 concentration at each monitor within an area
<b>5. Lead</b>		
Annual	0,5 (as of 1.1.2005 or 1.1.2010 in immediate vicinity of specific sources situated on sites contaminated by decades of industrial activities)	--
Quarterly average	--	1.5 $\mu\text{gm}^3$

## Assessment of the Effectiveness of European Air Quality Policies and Measures

*A project for DG Environment carried out by Milieu Ltd, the Danish National Environmental Research Institute, and the Center for Clean Air Policy*

Pollutant	EU – AQFD Daughter Directives $\mu\text{g}\text{m}^3$	USA $\mu\text{g}\text{m}^3$
<b>6. Ozone</b>		
8 hour mean	120 – not to be exceeded on more than 25 days per calendar year averaged over three years (as of 1.1.2010)	160 - 3-year average of 4th-highest daily maximum 8-hour average ozone concentrations measured at each monitor within an area over each year
1 hour mean	--	240 - (a) Standard attained when expected number of days per calendar year with maximum hourly average concentrations above 0.12 ppm is $\leq 1$ ; (b) 1-hour standard applicable to all areas notwithstanding the promulgation of 8-hour ozone standards (in 2003, EPA proposed several options for when the 1-hour standard would no longer apply to an area.
<b>7. Benzene</b>		
Annual	5 (as of 1.1.2010)	--
Yearly	--	--
<b>8. Carbon monoxide</b>		
8 hour mean	10000 (as of 1.1.2005)	10000 - not to be exceeded more than once per year
1 hour mean	--	40000 - not to be exceeded more than once per year
Daily average of 1 hour	--	--
<b>9. Poly-aromatic hydrocarbons</b>		
	Proposed assessment threshold : $\mu\text{g}\text{m}^3$	--
<b>10. Cadmium</b>		
For the total content in the PM 10 fraction average over a calendar year	Proposed assessment threshold : $\mu\text{g}\text{m}^3$	--
	5	--
<b>11. Arsenic</b>		
For the total content in the PM 10 fraction average over a calendar year	Proposed assessment threshold : $\mu\text{g}\text{m}^3$	--
	6	--
<b>12. Nickel</b>		
For the total content in the PM 10 fraction average over a calendar year	Proposed assessment threshold : $\mu\text{g}\text{m}^3$	--
	20	--
<b>13. Mercury</b>		
For the total content in the PM 10 fraction average over a calendar year	Proposed assessment threshold : $\mu\text{g}\text{m}^3$	--
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**CASE STUDY 2: ANNEX II**

**EU AMBIENT AIR QUALITY STANDARDS &  
REQUIREMENTS FOR PLANS & PROGRAMMES**

*4 October 2004*

<b>1.</b>	<b><u>PLANNING IN THE EU AIR QUALITY MANAGEMENT SYSTEM</u></b> .....	<b>1</b>
1.1.	<i>Introductory Overview</i> .....	1
1.2.	<i>Air Quality Limit Values (AQLVs)</i> .....	1
1.3.	<i>Air Quality Planning Requirements in Community Law</i> .....	3
1.3.1.	<i>Planning to achieve air quality limit values</i> .....	3
1.3.2.	<i>Planning to address urgent air quality exceedences</i> .....	5
1.3.3.	<i>Planning to reduce emissions from sources contributing to transboundary pollution</i> .....	5
1.4.	<i>Main Components of Air Quality Management Planning</i> .....	7
1.4.1.	<i>Designation of air quality management zones</i> .....	7
1.4.2.	<i>Transboundary cooperation</i> .....	8
1.5.	<i>MAIN COMPONENTS OF EMISSION REDUCTION PLANNING</i> .....	10
1.5.1.	<i>Emissions inventories</i> .....	10
1.5.2.	<i>Development of control strategies</i> .....	10
<b>2.</b>	<b><u>INSTITUTIONAL ACCOUNTABILITY IN THE PLANNING PROCESS</u></b> .....	<b>10</b>
2.1.	<i>EU-LEVEL POWERS TO CONTROL CONTENTS OF PLANS &amp; PROGRAMMES</i> .....	10
2.2.	<i>MEASURES TO ENCOURAGE COMPLIANCE</i> .....	11
2.2.1.	<i>“Name and shame” efforts</i> .....	11
2.2.2.	<i>Infringement proceeding under Article 226 of the Treaty</i> .....	11
2.2.3.	<i>Sanctions under Article 228 of the Treaty</i> .....	13
2.2.4.	<i>Financial incentives under the Cohesion Policy</i> .....	13
<b>3.</b>	<b><u>ASSESSMENT OF THE EFFECTIVENESS</u></b> .....	<b>15</b>
3.1.	<i>ENVIRONMENTAL EFFECTIVENESS</i> .....	15
3.2.	<i>COMPLIANCE AND ENFORCEMENT</i> .....	15



## **1. PLANNING IN THE EU AIR QUALITY MANAGEMENT SYSTEM**

### **1.1. Introductory Overview**

The European Union air quality management regime started in 1980 with Directive 80/779/EEC, which set air quality limit values (AQLVs) and guide values for SO<sub>2</sub> and suspended particulates (SP). Later Directives set limit values for lead, nitrogen dioxide, and ozone. This relatively late date in comparison to the US legislation in this area must be seen in the context of the evolution of the EU itself. The European Economic Community formed in 1956 did not begin to take specific actions with respect to environmental protection until the early 1970s,<sup>7</sup> and in fact did not get a constitutional basis for acts with respect to environmental protection until the 1987 Single Act. In the meantime, a number of Member States had already developed air quality regimes. Part of the challenge for the EU has therefore been to harmonize not only AQ standards, but also the national systems in place for assessing and monitoring AQ.

The 1996 Air Quality Framework Directive (AQFD) and its daughter Directives are aimed at establishing this harmonized structure for assessing and managing AQ throughout the EU. The role of the European Commission includes oversight of the implementation of the EU legislation, including enforcement action if a Member State has not complied with its obligations under the EC Treaty. It is also important to mention the European Environment Agency, which collects data on air quality from the Member States and other European countries through the CORINAIR programme and then publishes that information, and the relationship between the EU regime and the European-wide effort to combat acidification and other regional AQ problems in the context of the UN ECE Convention on Long-range Transboundary Air Pollution and its Protocols and the EMEP.

Within the EU structure, the Member States are given considerable scope to determine what actions they will take in order to meet their commitment to achieve the AQ standards within their territories. However, the Member States must at the same time implement the other EU-level measures that comprise the overall EU air quality management system. These include controls over stationary sources of polluting emissions to air, such as large combustion plants, industrial installations, and facilities using solvents. Other EU-level measures aim to reduce emissions from mobile sources, such as road traffic, and include technical requirements (product standards) to limit air emissions from various types of motor vehicles as well as fuel quality standards.

This case study looks in particular at the planning and programming requirements found in the various Directives relevant to air quality.

### **1.2. Air Quality Limit Values (AQLVs)**

The air quality limit values (AQLVs) set down in European Community legislation are important in the context of AQ management planning in that they trigger the requirement to develop an air quality management plan or programme, as well as provide the AQ objective or target that the plan is aimed at achieving. They also play a role in determining the intensity of the AQ monitoring that must be carried out in a particular zone.

The first EU-level AQLVs were set in 1980 for SO<sub>2</sub> and suspended particulates (SP),<sup>8</sup> and intended primarily for protection of human health as well as to contribute to the protection of the environment.

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<sup>7</sup> Early legislation related to air quality concerns such as Directive 70/220/EEC on air pollution by emissions from motor vehicles was aimed primarily at harmonization of the then competing national standards in order to achieve the internal market.

<sup>8</sup> Directive 80/779/EEC

## Assessment of the Effectiveness of European Air Quality Policies and Measures

*A project for DG Environment carried out by Milieu Ltd, the Danish National Environmental Research Institute, and the Center for Clean Air Policy*

Later legislation set AQLVs for lead<sup>9</sup>, nitrogen dioxide<sup>10</sup>, and ozone<sup>11</sup>. Member States were required to ensure that concentrations of these pollutants in ambient air did not exceed the AQLVs by specific attainment deadlines, i.e., by April 1993 for SO<sub>2</sub> and SP, December 1989 for lead, and January 1994 for NO<sub>x</sub>. The Directives were also aimed to bring about a harmonization of assessment methods<sup>12</sup>.

In the mid-1990s, in the context of the Fifth Environmental Action Programme, the EU launched a major reform of its AQ legislation aimed at providing more effective protection of people against health risks from air pollution and at better protection of the environment, including the objective of ensuring that critical loads and levels for acidification in the Community were not to be exceeded. This effort began with the adoption of the 1996 Air Quality Framework Directive (AQFD),<sup>13</sup> which establishes a common strategy for

- (1) defining ambient AQ objectives to protect human health and the environment;
- (2) assessing ambient AQ on the basis of uniform methods and criteria;
- (3) making information on AQ available to the public, including by means of alert thresholds<sup>14</sup>; and
- (4) “maintain[ing] where it is good and improve[ing] it in other cases”.

Annex I of the AQFD stipulated thirteen pollutants for which limit values (and, as appropriate, alert thresholds) were to be established.

The actual setting of limit values and alert thresholds for specific pollutants is done via the so-called Daughter Directives. The limit values represent long-term objectives equivalent to the World Health Organisation’s new guideline values.<sup>15</sup> Because these new values are considerably lower than the previous AQLVs, and therefore require major pollution reduction efforts in order to achieve attainment, temporary margins of tolerance are set for certain pollutants. These margins of tolerance are then reduced stepwise, so as to provide interim targets until the AQLV is attained at the end of the determined period.

Besides setting numerical AQLVs and alert thresholds (in the case of ozone, target values) for each of the identified pollutants, the Daughter Directives harmonise monitoring strategies, measuring methods, calibration and quality assessment methods to arrive at comparable measurements throughout the EU and to provide for good public information.

The first Daughter Directive (1999/30/EC) sets limit values for NO<sub>x</sub> for the protection of vegetation (to be met by 2001), and for the protection of health for SO<sub>2</sub> and PM<sub>10</sub> (to be met by 2005), as well as for NO<sub>2</sub> and Pb (to be met by 2010). The second Daughter Directive (2000/69/EC) establishes limit values for concentrations in ambient air of carbon monoxide (to be met by 2005) and for benzene (to be met by 2010, unless an extension is granted). Aspiration target values for ozone are set in the third

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<sup>9</sup> Directive 82/884/EEC on a limit value for lead in the air (OJ L 378, [date], p. 15).

<sup>10</sup> Directive 85/203/EEC on air quality standards for nitrogen dioxide (OJ L 87, [date], p. 1). Under this Directive, MS could set stricter limit values in zones in order to prevent or limit a foreseeable increase in NO<sub>2</sub> for urban or industrial development, as well as limit values that were lower than the guide values in areas considered to need special environmental protection.

<sup>11</sup> Directive 92/72/EEC on air pollution by ozone (OJ L 297, [date], p. 1).

<sup>12</sup> For example, Directive 80/779 (SO<sub>2</sub> and SP) specified reference methods of sampling and analysis, while allowing Member States to choose an alternative method of sampling and analysis to comply with other limit values. The limit values and assessment methods it set down have remained in effect but will be replaced once the management regime of the 1996 AQFD and the Daughter Directives is fully in place, i.e., 2005 for SO<sub>2</sub> and PM<sub>10</sub>, and 2010 for NO<sub>x</sub> and lead.

<sup>13</sup> Directive 96/62/EC on ambient air quality assessment and management, OJ L 296, 21.11.96, p. 55.

<sup>14</sup> “Alert threshold” is defined as 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 MS.

<sup>15</sup> *Air Quality Guidelines for Europe* (second edition), WHO Regional Publications, European Series, No. 91 (2002), <http://www.euro.who.int/document/e71922.pdf>.



Daughter Directive (2002/3/EC), to be attained where possible by 2010, and in accordance with Directive 2001/81/EC on national emission ceilings. The remaining pollutants, *i.e.*, poly-aromatic hydrocarbons, cadmium, arsenic, nickel and mercury are covered by a Commission proposal for a Directive that is currently in the legislative process<sup>16</sup>.

### 1.3. Air Quality Planning Requirements in Community Law

Air quality plans have featured in EU AQ legislation since Directive 80/779, which required Member States to ensure that concentrations of SO<sub>2</sub> and particulates did not exceed the AQLVs set for those pollutants and, for those zones where there was a likelihood of exceedences, to notify the Commission thereof and forward at the same time plans for the progressive improvement of the AQ in those zones.

In addition to their role in the EU AQ management regime, plans or programmes are also required in a number of other Directives in the waste management, water quality, nature protection and other environmental sectors. While the concept of plan or programme has not been defined in Community environmental law, in general, plans in EU environmental legislation are more like management plans, while programmes tend to be aimed at reaching a specific political objective within a specific time period.<sup>17</sup>

Three types of plans or programmes can be found in EU air quality legislation: (1) plans to achieve specific air quality objectives; (2) short-term plans to address urgent air quality exceedences; and (3) plans to reduce emissions from sources. Each type is discussed further below:

#### 1.3.1. Planning to achieve air quality limit values

Directive 80/779/EEC required MS to forward to the Commission plans for the progressive improvement of AQ in those zones where there was likelihood that concentrations of SO<sub>2</sub> and SP would exceed the limit values.<sup>18</sup> The plans, to be “drawn up on the basis of relevant information on the nature, origin and evolution of the pollution”, were to describe the measures to be taken and the procedures to be implemented, so as to bring the concentrations of SO<sub>2</sub> and SP within the limit values.

Similarly, the companion Directives setting AQLVs for lead and for NO<sub>2</sub> required MS to draw up AQ improvement plans for places where the limit values could be exceeded, setting measures and procedures to bring the concentrations of those pollutants in those places to or below the established limit value by the determined dates. The plans were to identify the main sources of pollution, assess possibilities for emission reduction, and to describe, in particular, the measures to be taken and the procedures to be implemented by the MS concerned.

In contrast to these early requirements for AQ management plans, which left considerable latitude to each MS to determine what to include, the 1996 Air Quality Framework Directive lays down more detailed requirements. Member States have to draw up a list of zones and agglomerations where the levels of one or more pollutants are higher than the limit value plus the margin of tolerance. Plans or programmes then have to be prepared and implemented for those zones, in order to attain the AQLV within the time limit. The plans have to be made available to the public and have to incorporate at least the information of Annex IV, as listed in the following box.

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<sup>16</sup> The Commission submitted proposals for limit values and alert thresholds for these pollutants on 16 July 2003 and on 20 April 2004 the Parliament completed the first reading.

<sup>17</sup> One commentator concluded that use of the terms plans and programmes in Community instruments was not consistent and had become more confusing in recent legislation. L. Krämer, *Casebook on EU Environmental Law* (Oxford & Portland Oregon: Hart Publishing, 2002), p. 366.

<sup>18</sup> MS were also to endeavor to move towards achieving the stricter guide values (GVs) for sulphur dioxide and suspended particulate) set in Annex II of the Directive.

## Assessment of the Effectiveness of European Air Quality Policies and Measures

*A project for DG Environment carried out by Milieu Ltd, the Danish National Environmental Research Institute, and the Center for Clean Air Policy*

<b>Information to be included in the local, regional or national programmes for improvement in the ambient air quality (Annex IV of the AQFD)</b>	
1. Localisation of excess pollution	<ul style="list-style-type: none"> <li>- Region</li> <li>- City (map)</li> <li>- Measuring station (map, geographical coordinates)</li> </ul>
2. General information	<ul style="list-style-type: none"> <li>- Type of zone (city, industrial or rural area)</li> <li>- Estimate of the polluted area (KM<sup>2</sup>) &amp; of the population exposed to the pollution</li> <li>- Useful climatic data</li> <li>- Relevant data on topography</li> <li>- Sufficient information on the type of targets requiring protection in the zone</li> </ul>
3. Responsible authorities	<ul style="list-style-type: none"> <li>- Names &amp; addresses of persons responsible for the development &amp; implementation of improvement plans</li> </ul>
4. Nature & assessment of pollution	<ul style="list-style-type: none"> <li>- Concentrations observed over previous years</li> <li>- Concentrations measured since the beginning of the project</li> <li>- Techniques used for the assessment</li> </ul>
5. Origin of pollution	<ul style="list-style-type: none"> <li>- List of the main emission sources responsible for pollution (map)</li> <li>- Total quantity of emissions from these sources (tonnes/year)</li> <li>- Information on pollution imported from other regions</li> </ul>
6. Analysis of the situation	<ul style="list-style-type: none"> <li>- Details of those factors responsible for the excess (transport, including cross-border transport, formation)</li> <li>- Details of possible measures for improvement of AQ</li> </ul>
7. Details of those measures or projects for improvement which existed prior to end 1996	<ul style="list-style-type: none"> <li>- Local, regional, national international measures</li> <li>- Observed effects of these measures</li> </ul>
8. Details of those measures or projects adopted after end 1996 with a view to reducing pollution	<ul style="list-style-type: none"> <li>- Listing &amp; description of all the measures set out in the project</li> <li>- Timetable for implementation</li> <li>- Estimate of improvement of AQ planned &amp; expected time required to attain the objectives</li> </ul>
9. Details of the measures or projects planned or being researched for the long term	-
10. List of the publications, documents, work, etc. to supplement requested information	-

The plans are to be integrated plans for those zones and agglomerations where the level of more than one pollutant is higher than the limit values. The Commission is to regularly check the implementation of the plans or programmes by examining the trends on air pollution, and the progress toward meeting the limit values.

The first Daughter Directive requires Member States to “take the measures necessary” to ensure that concentrations of SO<sub>2</sub>, NO<sub>2</sub> and NO<sub>x</sub>, PM<sub>10</sub> and lead do not exceed the limit values as of the deadlines specified. Member States have to implement the Article 8(3) action plans where the exceedences of the limit values are due to man-made emissions (rather than natural sources). These programmes must be made directly available to the public, and must also be sent to the Commission. The requirements in the second Daughter Directive setting AQLVs for carbon monoxide and benzene are similar.

The third Daughter Directive on ozone in ambient air also requires Member States to prepare and implement plans or programmes for any zones and agglomerations where ozone levels are higher than the target values. The Member State is required to attain the target value by 2010, “save where not achievable through proportionate measures.” The plans or programmes must be in accordance with the provisions of Directive 2001/81/EC (on national emissions ceilings). In those zones where there are

## Assessment of the Effectiveness of European Air Quality Policies and Measures

*A project for DG Environment carried out by Milieu Ltd, the Danish National Environmental Research Institute, and the Center for Clean Air Policy*

exceedences of other pollutants in the ambient air, the Member States have to prepare and implement integrated plans or programmes that cover all the pollutants concerned. The programmes need to be reported to the Commission and to be made available to the public so as to allow citizens to trace progress towards meeting the ozone standards. The Directive includes also improved and more detailed requirements to monitor and assess ozone concentrations and to inform citizens about the actual pollution load.

### *1.3.2. Planning to address urgent air quality exceedences*

The AQFD and the Ozone Daughter Directive also require short-term action plans to be developed for those zones where there is a risk of the alert thresholds being exceeded. Plans are to be prepared as a blueprint well in advance of an alert case, so that they are available and can be implemented rapidly in a case of an exceedence of an alert threshold, e.g., by controlling activities (motor-vehicle traffic) that contribute to the air pollution.

The short-term action plans under the Ozone Daughter Directive are to indicate specific measures to be taken in the short term, taking into account particular local circumstances, if there is a significant potential for reducing the risk or the duration or severity of any exceedence of the alert threshold. Member States are exempt from having to draw up these short-term action plans if there is no significant potential for reducing the risk, duration or severity of any exceedence in the relevant zones.

### *1.3.3. Planning to reduce emissions from sources contributing to transboundary pollution*

A third type of plan related to achieving air quality goals is that aimed at reducing emissions from specific sources, particularly the large sources that are significant contributors to transboundary air pollution. These emission reduction plans stem from the European-wide effort to combat acidification and other regional pollution problems in the context of the 1979 UNECE Convention on Long-range Transboundary Air Pollution (CLRTAP). Though no planning requirements are in the CLRTAP itself, such requirements have been set in subsequent protocols. For example, the first Sulphur Protocol<sup>19</sup> requires Parties to develop without undue delay national programmes, policies and strategies for reducing sulphur emissions or their transboundary fluxes by at least 30 % by 1993.

The first national emission reduction programme requirement under EU law can be found in the 1988 Large Combustion Plant Directive, adopted in the effort to achieve this 30% sulphur emission reduction target. The 1988 LCP Directive set in place separate regimes for new plants and for existing plants (basically, those constructed before 1987). All new LCPs had to comply with the emission limit values for SO<sub>2</sub>, NO<sub>x</sub> and dust set in the Directive, while existing plants were to be covered by national emission reduction programmes. The programmes were to provide for the progressive reduction of total annual emissions from these existing plants, with the aim of complying with the national emission ceilings and corresponding percentage reductions for SO<sub>2</sub> and NO<sub>x</sub> set in the Directive's annexes.

The next stage in the European-side effort to address acidification under the CLRTAP led to a differentiation of emission reduction obligations for individual countries, based on an effects-based ("critical load") approach. The resulting regional agreement, the so-called second Sulphur Protocol<sup>20</sup>, set national emission ceilings to be reduced further over time, and required each Party to adopt national strategies, policies and programmes to reduce annual sulphur emissions to the specified levels.

The critical loads approach was taken to the next level by the 1999 Gothenburg Protocol<sup>21</sup>, which sets emission ceilings for 2010 for SO<sub>2</sub>, NO<sub>x</sub>, volatile organic compounds (VOCs) and ammonia (NH<sub>3</sub>). The ceilings were negotiated on the basis of scientific assessments of pollution effects and abatement

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<sup>19</sup> 1985 Helsinki Protocol on the Reduction of Sulphur Emissions or their Transboundary Fluxes by at least 30 per cent (entered into force in 1987).

<sup>20</sup> 1994 Oslo Protocol on Further Reduction of Sulphur Emissions (entered into force in 1998).

<sup>21</sup> 1999 Gothenburg Protocol to Abate Acidification, Eutrophication and Ground-level Ozone (not yet in force).

## Assessment of the Effectiveness of European Air Quality Policies and Measures

*A project for DG Environment carried out by Milieu Ltd, the Danish National Environmental Research Institute, and the Center for Clean Air Policy*

options. The Protocol also sets limit values for specific emission sources (e.g. combustion plant, electricity production, dry cleaning, cars and lorries) and requires best available techniques to be used to keep emissions down.

In 2001, the EU adopted two interlinked acts to achieve these more stringent targets, both of which provide for national emission reduction plans: Directive 2001/81/EC on national emission ceilings for certain atmospheric pollutants (the NEC Directive), and Directive 2001/80/EC on the limitation of emissions of certain pollutants into the air from large combustion plants (the 2001 LCP Directive).

The NEC Directive sets national emissions ceilings for SO<sub>2</sub>, NO<sub>x</sub>, VOCs and NH<sub>3</sub> for each MS<sup>22</sup>, and obliges MS to draw up national emission reduction programmes, with the aim of achieving compliance with the ceilings by 2010. The Directive covers emissions from all sources of the pollutants which arise as a result of human activities. MS are to decide which measures to take in order to comply. The programmes are to be drawn up by October 2002 and updated and revised as necessary by October 2006. The national programmes are to include information on the policies and measures adopted and envisaged, as well as quantified estimates of the effect of these policies and measures, i.e., the amount by which emissions will be reduced as a result.

The 2001 LCP Directive is similar to the 1988 LCP Directive in providing two options for MS to choose for reducing emissions from “existing plants” (those licensed before 1987), one of which is the option of developing a national emission reduction plan (NERP) covering all existing plants that will reduce total annual emissions of SO<sub>2</sub>, NO<sub>x</sub> and dust to the same level that would be achieved if the existing plants in operation in the year 2000 complied with the more stringent emission limit values (ELVs) set in the 2001 Directive for new plants put into operation after November 2003<sup>23</sup>. Since existing plants were previously not subject to any ELVs, this new requirement has posed a considerable challenge to the MS. The NERP for existing plants must comply with the ceilings for SO<sub>2</sub> and NO<sub>x</sub> set in the Directive’s Annexes I and II.

The 2001 LCP Directive sets a number of conditions for the national emission reduction plan (NERP):

- The closure of a plant included in the NERP may not result in an increase in the total annual emissions from the remaining plants covered by the plan;
- The plan shall comprise objectives and related targets, measures and timetables for reaching these objectives and targets, and a monitoring mechanism;
- NERPs are to be communicated to the Commission by November 2003;
- The Commission will evaluate whether the plan meets the requirements set and inform the MS if this is not the case, after which the MS has three months to upgrade the plan.

To assist MS in drawing up NERPs for existing plans, the Commission has developed a Guidance Document<sup>24</sup> outlining various approaches that can be adopted for reducing emissions from large plants.

The 1999 Solvents Directive<sup>25</sup> also provides for national emissions reduction planning. MS have the option to either require existing activities and industrial installations to meet the ELVs set in the Directive’s annexes or to implement national plans for reducing VOCs emissions so as to achieve an

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<sup>22</sup> The national emissions ceilings agreed by the EU Member States and set forth in the NEC Directive are more ambitious than those agreed in the Gothenburg Protocol.

<sup>23</sup> Existing (pre-1987) plants may be exempted from compliance with ELVs and from inclusion in the national emission reduction plan, if they opt for the Article 4(4) limited life derogation, i.e., not to operate the plant for more than 20,000 operational hours starting from 1 January 2008 and ending no later than 31 December 2015.

<sup>24</sup> See [http://europa.eu.int/comm/environment/air/pdf/0210\\_finalsummary.pdf](http://europa.eu.int/comm/environment/air/pdf/0210_finalsummary.pdf) for a summary.

<sup>25</sup> Council Directive 1999/13/EC on the limitation of emissions of volatile organic compounds due to the use of organic solvents in certain activities and installations.

## Assessment of the Effectiveness of European Air Quality Policies and Measures

*A project for DG Environment carried out by Milieu Ltd, the Danish National Environmental Research Institute, and the Center for Clean Air Policy*

equivalent reduction in overall emissions compared to what would have been achieved by applying the ELVs. If a MS opts to establish a national plan, it must include:

- identification of the activity or activities to which the plan applies;
- number of installations affected by the plan, their total emissions and the total emission of each activity;
- the reduction in emissions to be achieved by those activities corresponding to that which would have been achieved by applying the specified ELVs;
- a full description of the range of instruments through which the requirements will be achieved, evidence that these instruments will be enforceable and details of the means by which compliance with the plan will be demonstrated;
- list of the measures taken or to be taken;
- binding interim reduction targets against which progress towards the aim can be measured.

The NERPs for VOCs must be submitted to the Commission for approval. Each MS using this option must designate a national authority to be responsible for the collection and evaluation of information and the implementation of the NERP. The MS must also take into account any guidance published by the Commission in issuing permits and in formulating binding rules in this area.

For the most part, the plans and programmes related to air quality objectives have no direct link to the plans and programmes required for meeting specific emissions reduction targets for stationary sources. The one explicit link is between the NEC Directive and the Ozone Daughter Directive. With respect to those zones and agglomerations which do not meet the target values set in the Ozone Daughter Directive, Member States are required to prepare and implement a plan or programme in order to attain the target value by 2010 (except where that target value cannot be achieved through proportionate measures). This plan or programme is to be in accordance with the provisions of the NEC Directive and the corresponding national emission reduction programme for *inter alia* the ozone precursors, NO<sub>x</sub>, VOC and ammonia.

### 1.4. Main Components of Air Quality Management Planning

#### 1.4.1. Designation of air quality management zones

Because of the structure of the European Union, the basic unit for air quality management is the national territory of each Member State. The EU air quality legislation is in the form of Directives, and this form allows each Member State to decide how to transpose and implement the requirements in the way considered best for its particular legal, institutional and administrative system. Each MS thus has considerable freedom to determine for itself how to define these zones within the parameters set forth in the specific directives, and how it will organize air quality management within its borders.

Under the AQFD, for example, MS have full competence for defining the geographical areas within their territories (in addition to all agglomerations with 250,000 or more residents which constitute a special type of zone that are covered *per se*) that will constitute zones for the purpose of AQ monitoring/assessment.

The AQFD requires Member States to divide their territory into zones and agglomerations for the purpose of carrying out preliminary assessments of air quality, with a view to determining how to achieve the AQLVs to be set through the Daughter Directives. Thus the definition of zones is related to the findings of these preliminary assessments and to the MS's future efforts to achieve the AQLVs. On the basis of the preliminary assessments and the AQLVs set in the Daughter Directives, the MS are to draw up lists of those zones and agglomerations

- Where concentrations of one or more pollutants exceed the LV plus margin of tolerance (*Art. 8(1)*).

## Assessment of the Effectiveness of European Air Quality Policies and Measures

*A project for DG Environment carried out by Milieu Ltd, the Danish National Environmental Research Institute, and the Center for Clean Air Policy*

- Where concentrations are above the LV but within the margin of tolerance (*Art. 8(2)*).
- Where all levels are below LVs (*Art. 9*).

If a zone or agglomeration is in exceedence of the LV plus the margin of tolerance (*Art. 8(1) zone*), the MS is required to draw up a plan or programme for attaining the LV within the time limit. Monitoring requirements are also more onerous. The MS must carry out measurements at fixed sites, either continuously or by random sampling with a large enough number to enable determination of the levels.

There is no requirement to draw up a plan or programme if a zone or agglomeration is in exceedence of the LVs but within the margin of tolerance (*Art. 8(2) zone*). Monitoring is still required, but the MS may use a combination of measurements and modelling techniques. Zones and agglomerations where the levels of pollutants are below the LVs (*Art. 9 zone*) do not need plans or programmes and it is possible to assess levels of pollutants solely by use of modelling or objective estimation techniques.

MS must report to the Commission each year the list of zones designated under the three categories above, as well as a list of occurrences of pollution levels exceeding the limit values, and each year the Commission publishes a list of the *Art. 8(1)* zones (i.e., where exceedences have occurred). This is therefore a fluid process, with no formal mechanism for designating a zone as in exceedence or for delisting a zone. A zone where exceedences no longer occur simply does not appear on the annual list.

*Guidance on Assessment under the EU Air Quality Directives*, a document issued by the Commission to assist MS in this task, suggested linking zone boundaries to administrative areas within the country and to group adjacent administrative areas with similar AQ characteristics into one zone. A 2002 Commission report reviewing the results of the preliminary assessments under the AQFD found that most, but not all, MS did follow administrative borders. It also found that the size of non-agglomeration zones varied dramatically both geographically (0.19 to 311,000 km<sup>2</sup>) and by population (3000 to 7.7 million inhabitants).

There is no EU-level power of review concerning how MS have defined zones and agglomerations. Moreover, the lack of agreement on how to define air quality management zones has thus led to a lack of consistency with respect to geographical areas and populations covered among the different MS, and even to differences in the numbers of zones designated for different pollutants within a particular MS.

### *1.4.2. Transboundary cooperation*

The often transboundary nature of air pollution is recognized in EU law in two respects. Firstly, Member States are not expected to achieve satisfactory air quality with respect to pollutants originating from outside their territory. Secondly, Member States are required to take into account the effects of their own emissions on other countries even when those emissions have no significant adverse effects within their own frontiers. Member States having a common border are expected to consult each other, when necessary, regarding air quality.

For example, Directives 80/779/EEC and 85/203/EEC required a Member State to consult its neighboring Member States before setting a limit value or adopting measures in a border region. Where the limit values were or might have been exceeded following significant pollution which originated or could have originated in another Member State, the Member States concerned had to hold consultations with a view to remedying the situation and the Commission could attend such consultations as well.

Similarly, the 1996 AQFD requires, when the level of a pollutant exceeds the limit value plus the margin of tolerance or, as the case may be, the alert threshold following significant pollution originating in another Member State, the Member States concerned shall consult with one another with a view to finding a solution. The Commission may also be present at such consultations.

## Assessment of the Effectiveness of European Air Quality Policies and Measures

*A project for DG Environment carried out by Milieu Ltd, the Danish National Environmental Research Institute, and the Center for Clean Air Policy*

The Ozone Daughter Directive sets out the most elaborated requirements to date concerning action to be taken in case air pollution crosses national borders. It requires the drawing up of joint plans and programmes in order to attain the target values or long-term objectives, save where not achievable through proportionate measures. The Commission is to assist in those efforts. In its review and reporting on the application of the Ozone Daughter Directive, and taking into account the requirements of the NEC Directive, the Commission is to consider whether further action should be taken at Community level in order to reduce precursor emissions responsible for such transboundary ozone pollution.

Moreover, Member States are to prepare and implement joint short-term action plans covering neighbouring zones in different Member States, if appropriate (i.e., if there is a significant potential for reducing that risk or for reducing the duration or severity of any exceedence of the alert threshold). Member States must ensure that neighbouring zones in different Member States, which have developed short-term action plans, receive all appropriate information. Where exceedences of the information threshold or alert threshold occur in zones close to national borders, information should be provided as soon as possible to the competent authorities in the neighbouring Member States concerned in order to facilitate the provision of information to the public in those States.

Though the EU system does not specifically require cross-border plans and programmes, it should be noted that transboundary pollution problems have driven much of the EU AQ management regime. In particular, both the Large Combustion Plant Directive and the NEC Directive resulted directly from multistate negotiations on how to deal with the transboundary transport of acidifying, eutrophying and photochemical air pollutants.

The EU air quality management regime therefore features a general obligation of consultation between MS in order to address transboundary pollution problems, but does not provide an approach or system for setting up joint programmes to manage cross-border environmental problems.

Similar difficulties in addressing cross-border problems can be found in other areas of EU environmental law. For example, the Water Framework Directive<sup>26</sup> (WFD) requires MS to prepare a river basin management plan for each river basin district (RBD) lying entirely within their territory. In the case of international river basins, MS must co-ordinate such plans among each other with the aim of producing a single international river basin management plan. Where third countries are involved, MS must “endeavour to produce a single river basin management plan”. If such an international river basin management plan is not produced, MS are obliged to produce river basin management plans covering at least those parts of the international river basin district falling within their territory to achieve the objectives of this Directive. A river basin management plan must cover specific elements listed in Annex VII of the Directive.

However, the WFD does not set additional requirements for administration structures for international RBDs. It is up to each individual country to decide which authority shall be responsible for management of international RBD/RBDs. It is in line with the WFD if one country decides to designate a separate authority for each individual international RBD, while another country sharing the same RBDs decides to designate one competent authority for all of them. Though the international dimensions are more explicit in the WFD than in the EU AQ acts, and MS are seemingly required to move towards closer cross border cooperation in managing shared river basins, the strict legal requirements to actually achieve joint management remain weak even in this sector.

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<sup>26</sup> Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for Community action in the field of water policy.

## 1.5. Main Components of Emission Reduction Planning

### 1.5.1. Emissions inventories

The NEC Directive requires Member States to draw up, and regularly update, national emission inventories and SO<sub>2</sub>, NO<sub>x</sub>, VOC and NH<sub>3</sub> emission projections for 2010, and present them to the European Commission and the European Environment Agency each year. Emission inventories and projections must be established using the methodologies specified in Annex III (using the methodologies agreed in the joint EMEP/CORINAIR guidebook<sup>27</sup> in preparing these inventories and projections) and have to be publicly available.

### 1.5.2. Development of control strategies

The EU gives considerable latitude to the MS to determine how they will meet the AQLVs set in the daughter Directives, and there is little formal guidance on general AQ management and emission control strategies at EU level. The Commission does make efforts to facilitate information-sharing among the MS, e.g., through the committee comprising MS representatives established under the AQFD Committee, and to draw attention to best practices in this area.

The role of the EU Directives setting requirements for industrial installations should be noted here. The 1996 Directive on integrated pollution prevention and control (IPPC) has triggered an extensive EU-wide exercise to determine best available techniques (BAT) for the categories of installations covered by the Directive and to provide reference documents (BATREF) to guide MS authorities in setting permit conditions for the installations in those categories within their territories. The IPPC Directive also requires MS authorities issuing integrated permits to take account of environmental quality standards, such as AQLVs, and to set more stringent conditions than those achievable by the use of the best available techniques (BAT) if necessary to comply with the quality standard. Also, in 2003, the Commission issued a Recommendation on the guidelines to assist a Member State in the preparation of a national emission reduction plan under the 2001 Large Combustion Plant Directive.

## 2. INSTITUTIONAL ACCOUNTABILITY IN THE PLANNING PROCESS

### 2.1. EU-level powers to control contents of plans & programmes

In considering at the EU air quality management system, it is important to remember that the EU is a regional organisation comprising sovereign Member States, each with its own policies and laws in place. Each Member State (MS) has responsibility for implementing EU law within its borders. Because the EU can act only when the Council of Ministers (comprising the MS governments) and the European Parliament (directly elected) adopts a measure, the MS have considerable influence in deciding which requirements they will be subject to. Where the EU has not legislated, Member States can maintain their own measures based on national priorities, provided they are not in conflict with Community law on, e.g., the internal market.

Within this structure, the powers of the European Commission are relatively limited, but nonetheless important. Only the Commission can propose new legislation. Moreover, the Commission is charged with being the guardian of the Treaty, i.e., for ensuring that the measures adopted by the institutions are applied, including implementation by the Member States. This includes the power to proceed against a Member State that has failed to implement or is in infringement of an obligation.

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<sup>27</sup> Emission Inventory Guidebook, September 2003.



The EU air quality management regime, through the AQFD and other legislation, has granted the Commission various significant roles:

- To develop guidance documents
- To receive notifications from MS concerning designation of zones
- To receive notifications from MS if zones are not in attainment of AQLVs and to publish lists of those zones
- To receive and review plans and programmes
- To report to the European Parliament and Council on implementation and progress towards achieving AQ targets
- To consider whether further action should be taken at Community level, e.g., to reduce precursor emissions responsible for transboundary ozone pollution
- To participate in transboundary consultations among MS affected by pollution originating in another MS

The 2001 Large Combustion Plant Directive gives the Commission more explicit powers with respect to any national emission reduction plans drawn up for existing plants, including the role of evaluating whether or not the plant meets the requirements set forth in the Directive and, if the Commission considers that the plan does not meet requirements, informing the MS thereof. The MS then has three months to communicate how the plan has been improved to meet the requirements.

### 2.2. Measures to Encourage Compliance

The European Commission does not have many tools to compel Member States to comply with the requirements set forth in air quality legislation. If a Member State does not attain the required reductions or does not comply with the requirements and obligations of the AQ Directives, the Commission has a range of limited means for bringing pressure for compliance. These include

- “Name and shame” efforts
- An infringement proceeding under Article 226 EC Treaty
- A sanction (fine) under Article 228 EC Treaty, if the MS has been declared in infringement by the ECJ and failure to take corrective action has led to a second infringement proceeding
- Article 10.4 of the AQFD, which provides for the Commission to examine the need to develop harmonised Community measures for the most relevant economic sectors and products contributing to acidification, eutrophication and formation of ground-level ozone.

#### 2.2.1. “Name and shame” efforts

The most gentle coercive measure is the press release indicating that a MS may be defaulting and finally the *auctoritas* of the ECJ ruling establishing that a MS has failed to fulfil its obligations according to the Treaty. The effectiveness of this name and shame effect on environmental policy led the Commission to launch the “*Name and Shame and Fame*” seminars. These seminars, which catch the attention of national media, are used to name those countries that are the worst performers concerning transposition and/or implementation of the requirements in a targeted sector or Directive.

#### 2.2.2. Infringement proceeding under Article 226 of the Treaty

If a Member State is in breach of EC legislation, the Commission can initiate an infringement procedure against the defaulting State. The infringement procedure aims at restoring legality and not to punish a MS. For this reason it is the Commission who decides with total discretion, whether to open and infringement case and bring the Member States to Court or not. The infringement cases against a MS, which eventually will end up being resolved by the European Court of Justice (ECJ), will be on the grounds of non-conformity or non-compliance with EC legislation.

## Assessment of the Effectiveness of European Air Quality Policies and Measures

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There are different types of non conformity cases. The first type is the non-communication cases where the Commission reacts to a Member State's failure to notify the transposing legislation, or other issues, such as plans and programmes, which according to the relevant Directive should have been elaborated and communicated to the Commission.

The second type is failure in transposing the targeted Directive into its national law. In many cases this action concerns failure to transpose the Directive on time and/or to draw up the national plan or programme within the time-limit imposed by the Directive. In many cases non-communication and non-transposition on time are part of the same action for non conformity. Finally the Commission will carry out a material analysis of the legislation to assess whether the MS communicated acts are a complete and correct transposition of the Directive. If the Directive is not fully and correctly transposed an infringement case for non conformity can also be opened.

Apart from non-conformity cases, the Commission can initiate infringement cases on the ground of non compliance of the Member States with EC law, i.e, for bad application of a Directive or non compliance with the reporting requirements of plans to meet emissions ceilings. For example, cases have been opened against Spain, France, Ireland, Italy, Luxembourg, Belgium and Greece for failure to comply with the requirements to report their plans to meet the emission ceilings under the NEC Directive.

All these actions can be brought before the ECJ even when the MS has already remedied the breach. There are mainly three reasons to explain the Commission's interest to continue an infringement case when the default has been remedied. The first reason is related to the "name and same" effect that a ruling condemning a Member State will have. The Commission has an interest in proving that the failure or breach existed, even if there is little practical effect in proving this<sup>28</sup>. The second reason to continue the proceedings is the possibility for the ECJ to settle about the legality of certain issues and to entitle individuals to have an action for indemnity against the MS<sup>29</sup>.

The conformity checking of plans and programmes is more complex. As mentioned before, there is no EC definition of what is a plan or a program<sup>30</sup>. The compulsory content of these plans and programmes will in many cases depend on the conditions and specifications set forth in the text of the Directive. For these reasons, almost all infringement cases related to plans and programmes were based on the ground of non-communication or failure to draw up a plan or programme in the prescribed period.

This has just happened with respect to the requirement under the Air Quality Framework Directive to submit plans for any areas in exceedence of the limit values of the substances under the first Daughter Directive. The deadline for first submission of plans was 31 December 2003. On 7 July 2004, the European Commission announced that it had sent an Article 226 letter of formal notice to Germany, Spain, France, Ireland, Italy, Luxembourg, Austria, Portugal, and the United Kingdom for failure to submit plans to reduce pollution in areas with Art. 8(1) exceedences.

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<sup>28</sup> As the ECJ has stated "the opposite argument would allow a State which so desired to denude the action of its purpose by bringing its illegal conduct to an end just before the judgment, thereafter remaining safe to carry on with its improper conduct in the absence of any judgement finding that it was in breach of its obligation". See i.e., Case 7/61, *Commission v. Italy*, [1961] ECR 317, [1962] CMLR 39.

<sup>29</sup> This is due to the so-called indirect effect of Directive and the supremacy of EC law expressly developed by the ECJ case-law in *Francovich*, *Brasserie du Pêcheur* or *Factortame*. Cases C-6/90 and 9/90, *Francovich and Bonifaci v. Italy* [1991] ECR I-5357, Case C-46/93, *Brasserie du Pêcheur S.A v. Germany* and Case C-48/93 *R v. Secretary of the State for Transport, ex parte Factortame* [1996] ECR I-1029

<sup>30</sup> Those cases where the Member argued the existence under national law of other measures equivalent to the required plan were dismissed and allowed for the deeper look at the content of the national plans and programmes. The ECJ has indicated that "incomplete practical measures and fragmentary legislation cannot discharge the obligation of a Member State to draw up a comprehensive programme with the view to attaining certain objectives". See Case C-298/97, *Commission v. Spain*, [1998] ECR I-3301 at §16.

## Assessment of the Effectiveness of European Air Quality Policies and Measures

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In addition, the Commission has signalled intention to lodge infringement cases for non designation of zones, using different methods to measure emissions or not providing information or explanation in case of exceedences of the Emission Limit Values or for non attainment of the objectives within the time limit.

Some earlier Directives (although not in the area of Air quality), such as Directive 76/464/EEC (dangerous substances to water) or Directive 91/689/EEC (hazardous waste), obliged the Commission to compare the national programmes to ensure sufficient coordination in their implementation". The Commission has reviewed the national programmes under Directive 76/464 but no legal actions have been taken to date with respect to any inadequacy of a plan and programme to attain the targeted environmental objectives.

### 2.2.3. Sanctions under Article 228 of the Treaty

Another more punitive tool exists under EC Law to compel compliance -- the possibility of carrying out an infringement case under Article 228 EC Treaty and to then impose sanctions.

The pecuniary fines inserted in Article 228 (former Article 171) by the Treaty of Maastricht, were inspired by a similar mechanism that exists in the Carbon and Steel Community Treaty. Article 228 of the Treaty provides that if the European Court of Justice has found a Member State has not fulfilled an obligation under the Treaty, the Member State shall be required to take the necessary measures to comply with the judgment of the Court of Justice. If the Commission considers that the Member State concerned has not taken such measures it can issue a reasoned opinion specifying the points on which the Member State concerned has not complied with the judgment of the Court of Justice. If the Member State does not comply with the Court's judgment within the time limit laid down by the Commission, the latter may bring the case before the Court of Justice again, and in so doing, specify the amount of a lump sum or penalty payment that it considers appropriate in the circumstances. If the Court of Justice finds that the Member State did not comply with its judgment, it may impose a lump sum or penalty payment on it. This has now been applied two times in cases related to the environment<sup>31</sup>.

The first case was against Greece<sup>32</sup> for failure to adopt the necessary measures to comply with the judgement of the ECJ that had found did not compliance with the requirements set fort in Directive 75/442/EEC (waste framework Directive) and Directive 78/319/EEC (on toxic and dangerous waste). The second time penalties were imposed has been in a recent case against Spain<sup>33</sup> relating to the Bathing water Directive.

So far, no cases have been brought before the ECJ for non-compliance or non-attainment of AQOs.

### 2.2.4. Financial incentives under the Cohesion Policy

One of the most powerful instruments managed by the Commission is the financial assistance under the Cohesion Policy. The EU Cohesion Policy has a budget of approximately 213 billion EUR to be spent in activities and projects that aim at promoting a high level of competitiveness and employment by helping those regions – or, in the case of the Cohesion Funds, countries – lagging behind and/or facing structural difficulties to achieved sustainable development. The different instruments that serve to put

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<sup>31</sup> In fact, until now Article 228 has only been used in cases related to environment. This is a interesting data giving an idea of the difficulties of ensuring compliance with Environmental legislation. There is an Article 228 case pending before the ECJ against France, this time for non compliance related to Technical conservation measures relating to the minimum size of fish, in particular hake (Case C-304/02). This is the first non-environmental case pursued under Article 228 EC Treaty, but even the content is quite related to the environment, as France was declared in failure to carry out between 1984 and 1987!controls ensuring compliance with technical Community measures for the conservation of fishery resources (Advocate General's Opinion 29 April 2004.

<sup>32</sup> C-387/97, *Commission v. Greece* (judgment, 4 July 2000), ECR [2000], I-5047

<sup>33</sup> C-278/01, *Commission v. Spain* (judgement 25 November 2003), ECR [2003]

## Assessment of the Effectiveness of European Air Quality Policies and Measures

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in place the economic assistance for regional policy (Structural Funds, Cohesion Funds and so on) contain provisions to the effect that “in its efforts to strengthen economic and social cohesion, the Community also seeks to promote the harmonious, balanced and sustainable development (...)” and that “those efforts should in particular integrate the requirements of environmental protection”.

Air quality is one of the areas where EU funding possibilities could be further explored for promoting Community objectives. The Regional Funds have already been used to finance costly environmental projects *inter alia* designation of zones within Natura 2000, wastewater management plants or waste related activities. Regional Funds have also been used to finance projects related to air quality, both directly and indirectly, including:

- technical infrastructure to preserve the quality of air,
- environmental planning,
- development of data bases on air quality data,
- awareness raising campaigns,
- reduction of pollution in large cities by control measures of air emissions for vehicles
- and so on.

Other projects have promoted development of public transport and given priority to rail and other more environmentally friendly public transport. These projects have been funded in most cases by the European Regional Development Fund (ERDF), for both Objective 1 and Objective 2 regions<sup>34</sup>.

Plans and programmes under the AQFD could potentially be used for linking the air quality management to regional development policies of the respective zone/agglomeration and for looking for financial assistance to finance the measures identified in the plan. Other possibilities include increasing the number of pilot programmes for developing more environmentally friendly public transport (as has already been done in the framework of PHARE), etc.

The INTERREG initiative aimed at promoting transnational cooperation could in particular be used more intensively to promote cross-border and transnational cooperation among regions with respect to AQ management. Cross-border planning is expressly mentioned among the eligible projects. Regions with similar problems could work together to draw up plans to manage common air quality issues more effectively. INTERREG has already provided funds for AQ related projects, e.g., the Atlantic RIM project intends to promote cooperation between France, Ireland, Portugal, Spain and the UK through the development of transport systems providing sustainable mobility and improving access to the information society as well as the development of transnational partnerships for, *inter alia*, air pollution prevention. Similar INTERREG projects can be found between Belgium and the Netherlands.

These possibilities for financing already exist within the Structural and Cohesion Funds and could be further deepened and developed for the next review and reform of the Cohesion Policy.

The Structural and Cohesion Funds could also be used as a coercive measure. In theory, EU financial assistance to MS under the Cohesion Policy is available only to finance efforts totally in compliance with EU requirements. If a zone is in exceedence of an AQLV, the Commission as administrator of Community funds could deny Community co-financing for projects that could lead to increased emissions, such as expansion of road transport infrastructure or construction of new industrial facilities. This threat of refusal of Community co-financing could be a powerful incentive for MS compliance with AQ requirements. However, this study could not find any examples of proposed projects that were refused EU funding on the grounds that they would not enable compliance with EU environmental quality requirements.

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<sup>34</sup> Objective 1 Regions are those whose internal GDP is inferior to 75% of the EU average. Objective 2 regions are those facing structural changes and difficulties.

### **3. ASSESSMENT OF THE EFFECTIVENESS**

#### **3.1. Environmental Effectiveness**

Only preliminary information is available to date on the status of attainment/nonattainment in the various Member States. A 2002 Commission report<sup>35</sup> summarizing the findings of some of the preliminary air quality assessments carried out in the EU Member States and Norway with respect to SO<sub>2</sub>, NO<sub>2</sub>/NO<sub>x</sub>, PM<sub>10</sub> and lead includes some data on the occurrence of exceedences of various air quality thresholds, including the number of countries with zones where exceedences were reported that were over the limit value (LV) and the margin of tolerance (MOT) set in the First Daughter Directive.

	No. of countries reporting on >LV+MOT	No. of countries with no zones >LV+MOT	No. of countries with some zones >LV+MOT	No. of countries with most zones >LV +MOT
SO <sub>2</sub>	8	6	2	0
NO <sub>2</sub> /NO <sub>x</sub>	9	3	5	1
PM <sub>10</sub>	7	2	2	3
Lead	9	8	1	0

The countries that reported no zones in exceedence of the limit values and margin of tolerance could be considered equivalent to zones in attainment. The table above considers a zone to have threshold exceedence if an exceedence occurs anywhere in the zone, irrespective of whether the entire zone or only a small spot is in exceedence. This is similar for the US where an exceedence in a given portion of the area enables classification as nonattainment for the standard.

Sometime in 2004, the Commission's Review Report on data from 2001 submitted by the Member States in their first reports on zones and threshold exceedences for these parameters is expected to become available.

#### **3.2. Compliance and enforcement**

The measures available to the Commission to enforce requirements with respect to plans and programmes are limited and cumbersome. The first problem is the discretion of the Commission. There are many examples in the past showing that a Member States can be in a position of illegality for years with no action taken by the Commission. The initiation of an infringement case depends upon the principle of opportunity and lengthy negotiations can precede the official initiation of an infringement procedure.

Once the procedure has finally been opened, the pre-judicial phase, developed between the Commission and the Member State, can also take years. In fact, the official procedure begins with a letter of formal notice that can be followed by a complementary letter of formal notice. If the Member State does not remedy the breach, a reasoned opinion is sent and this can also be followed by a complementary reasoned opinion. Only after that the Commission may decide to bring the Member State before the Court, not having any time limit for lodging the case. As a consequence, infringements dated from 1987 are still being pursued at this time.

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<sup>35</sup> *Overview of Methods and Results of the Preliminary Assessment of Air Quality in Europe under Directives 96/62/EC and 1999/30/EC* (European Commission, DG Environment, May 23<sup>rd</sup> 2002).

## **Assessment of the Effectiveness of European Air Quality Policies and Measures**

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Apart from the inconvenience due to the length of the infringement cases, these are effective and Member States tend to remedy the breach, seldom at the level of the letter of formal notice or reasoned opinion. For certain cases, the Commission considers that a condemnation is the most “opportune” action to compel the Member State and therefore the steps previous to lodging an action before the Court are faster and the Member State is brought before the ECJ within a reasonable time. Cases of non-communication or failure to transpose on time belong to this category of cases.

For plans and programmes the situation is different. As mentioned before, no infringement procedure has been carried out against a Member State for inadequacy of the plan or programme to attain the prescribe objectives. This may be due to two factors. One is the lack of definition and specification of the content of a plan or a programme and the other is the lack of resources of the Commission.

Concerning the first factor, the compulsory content of these plans and programmes will in many cases depend on the conditions and specifications set forth by the Directive. If the Directive is vague concerning the requirements of a plan or programme, an infringement procedure based on the non compliance of the plan and programme may be difficult to show. In some cases the Directive simply sets forth the obligation to elaborate a plan or a programme to attain an objectives and very little specification is given on the content of the plan or programme. The new generation of AQ Directives develop the requirements and design of the plans and programmes in more detail, which could enable a better monitoring of the adequacy of the measures. However, there is no provision entitling the Commission to compare the programmes or to analyse their adequacy to obtain the targeted objectives.

The deadline for first submission of plans under the first Daughter Directive was 31 December 2003. On 7 July 2004, the European Commission announced that it had sent an Article 226 letter of formal notice to Germany, Spain, France, Ireland, Italy, Luxembourg, Austria, Portugal, and the United Kingdom for failure to submit plans to reduce pollution in areas with Art. 8(1) exceedences.

In addition, the Commission has a lack of resources for assessing the adequacy of the national plans or programmes. As mentioned before, some earlier Directives, such as Directive 76/464/EEC or Directive 91/689/EEC, obliged the Commission to compare the national programmes to ensure sufficient coordination in their implementation”. Although nothing was said about the adequacy, not even this obligation was really fulfilled. A lack of resources led the Commission to abandon the monitoring of the programmes and the coordination was never adequately carried out. Thus even when it has had some power to do so, the Commission has not played an active role coordinating the national plans to better attain Community objectives.

This lack of resources is very important. There are too many environmental acts to monitor and analyse and the legislation of the Member States can be extremely complex, especially in areas, such as air quality, where the competence may be in the hands of regional or local authorities. The situation becomes more even more complicated when the Member State has a federal structure or is highly decentralised or de-concentrated. The existence of plans and programmes that in many cases are much more developed at regional level increase the amount of work and legislation to analyse. This issue, combined with the technical assessment that should be done to evaluate the adequacy of the programme, explains that infringement cases against plans and programmes only relates to non-communication or failure to draw-up the plan or programme on time.

**CASE STUDY 2: ANNEX III**

**US AMBIENT AIR QUALITY STANDARDS (NAAQS) &  
STATE IMPLEMENTATION PLANS (SIPs)**

*4 October 2004*

<b>1.</b>	<b><u>PLANNING IN THE U.S. AIR QUALITY MANAGEMENT SYSTEM</u></b> .....	<b>1</b>
1.1.	<u>Introductory Overview</u> .....	1
1.2.	<u>National Ambient Air Quality Standards (NAAQS)</u> .....	2
1.3.	<u>The State Implementation Plan Process</u> .....	5
1.3.1.	Area Designations .....	5
1.3.2.	State Implementation Plan.....	7
1.4.	<u>Main Components of Plan Implementation: Attainment-Demonstration SIPs</u> .....	9
1.4.1.	Emission Inventories .....	9
1.4.2.	Air Quality Modeling.....	9
1.4.3.	Development of Control Strategies.....	10
1.4.4.	Multistate Regional Control Strategies.....	11
<b>2.</b>	<b><u>INSTITUTIONAL ACCOUNTABILITY IN THE SIP PROCESS</u></b> .....	<b>12</b>
2.1.	<u>USEPA REVIEW AND APPROVAL OF SIPS</u> .....	12
2.2.	<u>MEASURES TO ENCOURAGE COMPLIANCE</u> .....	12
2.2.1.	Bump-up Provision.....	12
2.2.2.	Sanctions.....	13
2.2.3.	Conformity.....	13
2.2.4.	Penalty Fee .....	13
<b>3.</b>	<b><u>ASSESSMENT OF THE EFFECTIVENESS</u></b> .....	<b>14</b>
3.1.	<u>ENVIRONMENTAL EFFECTIVENESS</u> .....	14
3.1.1.	National Ambient Air Quality .....	14
3.1.2.	Number of nonattainment areas.....	15
3.2.	<u>ADMINISTRATIVE FEASIBILITY</u> .....	16
3.2.1.	Bureaucratic Process .....	16
3.2.2.	Emphasis on attainment demonstrations .....	16
3.2.3.	Uncertainty in modelling.....	16
3.3.	<u>COMPLIANCE AND ENFORCEMENT</u> .....	17
3.3.1.	Bump-up Provision.....	17
3.3.2.	Sanctions, Conformity and Penalty Fees.....	17
3.4.	<u>POLITICAL ACCEPTABILITY</u> .....	18





## **1. PLANNING IN THE U.S. AIR QUALITY MANAGEMENT SYSTEM**

### **1.1 Introductory Overview**

In the wake of air pollution's negative impacts on public health, ecosystems and the economy in the 1950s, the United States began its effort to understand the scientific complexity of air pollution problems and to develop an effective air quality management system. The first major efforts of the federal government began with the Air Pollution Control Act of 1955, which provided funds to local and state agencies for research and training. Over the next 15 years, these efforts continued through additional legislation including the Clean Air Act (CAA) of 1963 and the Air Quality Act (AQA) of 1967. The CAA of 1963 continued the federal funding for research and training, and the AQA of 1967 set Air Quality Criteria, Air Quality Control Regions (AQCRs), and the process for State Implementation Plans (SIPs). In 1970, two milestone events – the creation of the U.S. Environmental Protection Agency (EPA) and the passage of the CAA Amendments – laid out the basic framework by which air quality would be managed in the United States. This framework was further developed and refined with the passage of the CAA Amendments in 1977 and 1990.

Five major goals for protecting and promoting human health and public welfare are identified in the CAA as amended (NRC, 2004):

- Mitigating potentially harmful human and ecosystem exposure to six criteria pollutants: CO, NO<sub>2</sub>, SO<sub>2</sub>, O<sub>3</sub>, particulate matter, and lead (Pb);
- Limiting the sources of and risks from exposure to air toxics;
- Protecting and improving visibility impairment in national parks and wilderness areas;
- Reducing the emissions of pollutants that cause acid rain; and
- Curbing the use of chemicals that can potentially deplete the stratospheric ozone layer.

In addition, the CAA prescribes a complicated set of responsibilities and relationships among federal, states, tribal,<sup>36</sup> and local agencies. This matrix is referred to in this report as the nation's air quality management (AQM) system, and it operates through setting standards and objectives, designing and implementing control strategies, and assessing status and measuring progress.

The federal government coordinates with EPA and sets national air quality standards and approaches to pollution mitigation so that it can provide a basic level of environmental protection to all individuals in the U.S. State and local governments then develop, implement, and enforce specific strategies and control measures to achieve the national standards and goals. Once approved by EPA, these pollution control measures become federally mandated rules and regulations that state and local governments can enforce within their jurisdictional domains. Although many aspects of the AQM system assume a collaborative relationship between the federal, state, and local agencies, the CAA empowers EPA to oversee the activities carried out by these agencies. This oversight includes the power to impose sanctions and federally devised pollution-control plans on delinquent areas in some cases.<sup>37</sup>

The federal courts also have a role in AQM – final agency rules promulgated under the CAA are subject to judicial review, usually in the Court of Appeals for the District of Columbia circuit. The court can question the agency's reasoning in the rule-making record for critical factual conclusions, but it cannot substitute its judgment for that agency's malfeasants. A court will set aside an agency rule

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<sup>36</sup> Collectively, 550+ federally recognized Native American tribes own approximately 55.4 million acres of land in the United States. The 1990 CAA Amendments authorized EPA to "treat tribes as states" for purpose of developing administering, and enforcing air quality regulations within reservation boundaries, irrespective land ownership (42 USC § 7601(d)(2)(B)). Hereafter, "state" will be used as shorthand to denote both state and tribal authorities.

<sup>37</sup> See Section 3 for details on EPA oversight on the promulgation of SIPs.

# Assessment of the Effectiveness of European Air Quality Policies and Measures

A project for DG Environment carried out by Milieu Ltd, the Danish National Environmental Research Institute, and the Center for Clean Air Policy

only if it finds that the decision was not based on a consideration of the relevant factors or that the agency committed a clear error of judgment. Moreover, any citizen may file a civil action in district court against EPA that challenges the agency's failure to perform any nondiscretionary act or duty, and the court has the authority to order EPA to perform that act or duty and to compel agency action that is "unreasonably delayed"<sup>38</sup> (NRC, 2004).

## 1.2 National Ambient Air Quality Standards (NAAQS)

The first component of the U.S. AQM system is to set tangible air quality goals and standards. The CAA addresses two major categories of pollutants for which standards are set differently: criteria pollutants and hazardous air pollutants (HAPs). Criteria pollutants are those in the ambient air that originated from diverse mobile or stationary sources, whereas HAPs are not specifically defined except that they cannot be criteria pollutants (NRC, 2004). In general, criteria pollutants occur over a large geographic area and have greater impacts on the general population and ecosystems than HAPs. Therefore, criteria pollutants are regulated primarily through the setting of ambient air concentration and time standards, known as the National Ambient Air Quality Standards (NAAQS), and attaining these standards.

Criteria pollutants were first defined in the 1970 CAA Amendments, which directed the administrator of EPA to identify widespread ambient air pollutants that present a danger to public health or welfare (EPA, 2003d). In response, EPA developed and promulgated primary and secondary NAAQS for each criteria pollutant on the basis of air quality criteria, which is the current state of scientific knowledge on the effects of these pollutants on health and welfare.<sup>39</sup> Primary standards were set to protect public health, especially with an adequate margin of safety for most sensitive populations including asthmatics, children, and the elderly. Secondary standards were set to protect public welfare, including protection against decreased visibility and damage to animals, crops, vegetation, and buildings. In addition to specifying a maximum ambient concentration, NAAQS included descriptions of monitoring and statistical methods used to determine whether an area is in compliance with the standard. Primary standards were to be achieved by individually designated deadlines, and EPA was authorized to enforce pertinent states to meet those deadlines. Secondary standards, however, were not specified with either deadlines or enforcement authority.

The CAA requires EPA to conduct a review of the air quality criteria and NAAQS for each pollutant at least every 5 years. It is a fairly complex process that involves input and comment from independent scientific bodies and the general public. Since the first set of NAAQS that were established in 1971, the list and definitions of criteria pollutants have evolved. The current six criteria pollutants are: carbon monoxide (CO), nitrogen dioxide (NO<sub>2</sub>), sulfur oxides (SO<sub>x</sub>), ozone (O<sub>3</sub>), particulate matter (PM<sub>2.5</sub> and PM<sub>10</sub>), and lead (Pb). Details of the current standards are provided in Table 1. Some criteria pollutants are also further classified based on the severity of the pollution.

Table 1. National Ambient Air Quality Standards in Effect as of December 2003 (EPA, 2003a)

Pollutant	Primary Standards		Secondary Standards	
	Concentration	Type of Average	Concentration	Type of Average
CO	9 ppm (10 mg/m <sup>3</sup> )	8-hour <sup>a</sup>	None	

<sup>38</sup> CAA § 304(a)(2), 42 U.S.C § 7604(a)(2).

<sup>39</sup> CAA § 108. Air quality criteria are defined as a summary of "latest scientific knowledge useful in indicating the kind and extent of all identifiable effects on public health or welfare which may be expected from the presence of such pollutant in the ambient air."

## Assessment of the Effectiveness of European Air Quality Policies and Measures

*A project for DG Environment carried out by Milieu Ltd, the Danish National Environmental Research Institute, and the Center for Clean Air Policy*

	35 ppm (40 mg/m <sup>3</sup> )	1-hour <sup>a</sup>	None	
<b>NO<sub>2</sub></b>	0.053 ppm (100 µg/m <sup>3</sup> )	Annual arithmetic mean	Same as primary	
<b>SO<sub>2</sub></b>	0.03 ppm	Annual arithmetic mean	0.5 ppm (1300 µg/m <sup>3</sup> )	3-hour <sup>a</sup>
	0.14 ppm	24-hour <sup>a</sup>		
<b>O<sub>3</sub></b>	0.08 ppm	8-hour <sup>e</sup>	Same as primary	
	0.12 ppm	1-hour <sup>f</sup>	Same as primary	
<b>PM<sub>2.5</sub></b>	15 µg/m <sup>3</sup>	Annual arithmetic mean <sup>b</sup>	Same as primary	
	65 µg/m <sup>3</sup>	24-hour <sup>c</sup>		
<b>PM<sub>10</sub></b>	50 µg/m <sup>3</sup>	Annual arithmetic mean <sup>d</sup>	Same as primary	
	150 µg/m <sup>3</sup>	24-hour <sup>a</sup>		
<b>Pb</b>	1.5 µg/m <sup>3</sup>	quarterly avg.	Same as primary	

<sup>a</sup> Not to be exceeded more than once per year.

<sup>b</sup> the 3-year average of the annual arithmetic mean PM<sub>2.5</sub> concentrations from single or multiple community-oriented monitors.

<sup>c</sup> the 3-year average of the 98th percentile of 24-hour concentrations at each population-oriented monitor within an area.

<sup>d</sup> The expected annual arithmetic mean PM<sub>10</sub> concentration at each monitor within an area.

<sup>e</sup> The 3-year average of the fourth-highest daily maximum 8-hour average ozone concentrations measured at each monitor within an area over each year.

<sup>f</sup> (a) The standard is attained when the expected number of days per calendar year with maximum hourly average concentrations above 0.12 ppm is ≤ 1. (b) The 1-hour standard is applicable to all areas notwithstanding the promulgation of 8-hour ozone standards under Sec. 50.10. On June 2, 2003, (68 FR 32802) EPA proposed several options for when the 1-hour standard would no longer apply to an area.

The original 1970 CAA Amendments required all AQCRs to implement SIPs in order to demonstrate attainment of the primary NAAQS by 1977 at the latest. When most urban nonattainment areas failed to meet that deadline for one or more pollutants, Congress amended the statute in 1977 to postpone the deadline to 1987. Nonetheless, a number of nonattainment AQCRs failed to meet the 1987 deadlines, especially those that were dealing with pollutants with regional transport nature. In response, the 1990 CAA Amendments changed the NAAQS attainment deadlines that depended on how far an area was from reaching attainment in 1990 (see Table 2). Attainment deadlines have since evolved to reflect changes made in the NAAQS through its review process.

*Table 2. Attainment Dates for Nonattainment Areas for O<sub>3</sub>, CO, and PM<sub>10</sub>.*

Criteria Pollutant	Area Classification	Design Value (ppm)	Attainment Date
<b>O<sub>3</sub> (1-hr)</b>	Marginal	0.121 – 0.138	Nov 1993
	Moderate	0.138 – 0.160	Nov 1996
	Serious	0.160 – 0.180	Nov 1999
	Severe-15	0.180 – 0.190	Nov 2005
	Severe-17	0.190 – 0.280	Nov 2007
	Extreme	0.280 ≤	Nov 2010
<b>O<sub>3</sub> (8-hr)</b>	Marginal	0.085 – 0.092	Apr 2007
	Moderate	0.092 – 0.107	Apr 2010
	Serious	0.107 – 0.120	Apr 2013
	Severe-15	0.120 – 0.127	Apr 2019
	Severe-17	0.127 – 0.187	Apr 2021
			<i>AQ plans in the US / 3</i>

## Assessment of the Effectiveness of European Air Quality Policies and Measures

A project for DG Environment carried out by Milieu Ltd, the Danish National Environmental Research Institute, and the Center for Clean Air Policy

	Extreme	0.187 ≤	Apr 2024
<b>CO</b>	Moderate (low)		Dec 1995
	Moderate (high)		Dec 1995
	Serious		Dec 2000
<b>PM<sub>10</sub></b>	Moderate		Dec 2006*
	Serious		Dec 2010**

\* Or no later than the 6<sup>th</sup> year after designation

\*\* Or no later than the 10<sup>th</sup> year after designation

### 1.3 The State Implementation Plan Process

The state implementation plan (SIP) and the tribal implementation plan (TIP)<sup>40</sup> are the central organizing elements in the management of criteria air pollutants (NRC, 2004). Area designation based on the NAAQS assesses the different magnitudes of desired AQM over the entire geographic area of the U.S. Subsequent development of the SIP brings together local, state, regional and federal regulations which are necessary for an area to achieve or maintain compliance with the NAAQS. When implemented, the SIP serves as a link between state regulations and EPA oversight of state actions for attainment and maintenance of the NAAQS (see Figure 1). In addition, the SIP is used to formally establish state and local agency obligations to meet emission standards and goals related to regional haze, acid rain and hazardous air pollutants. In the following sections, the SIP process is discussed in detail.

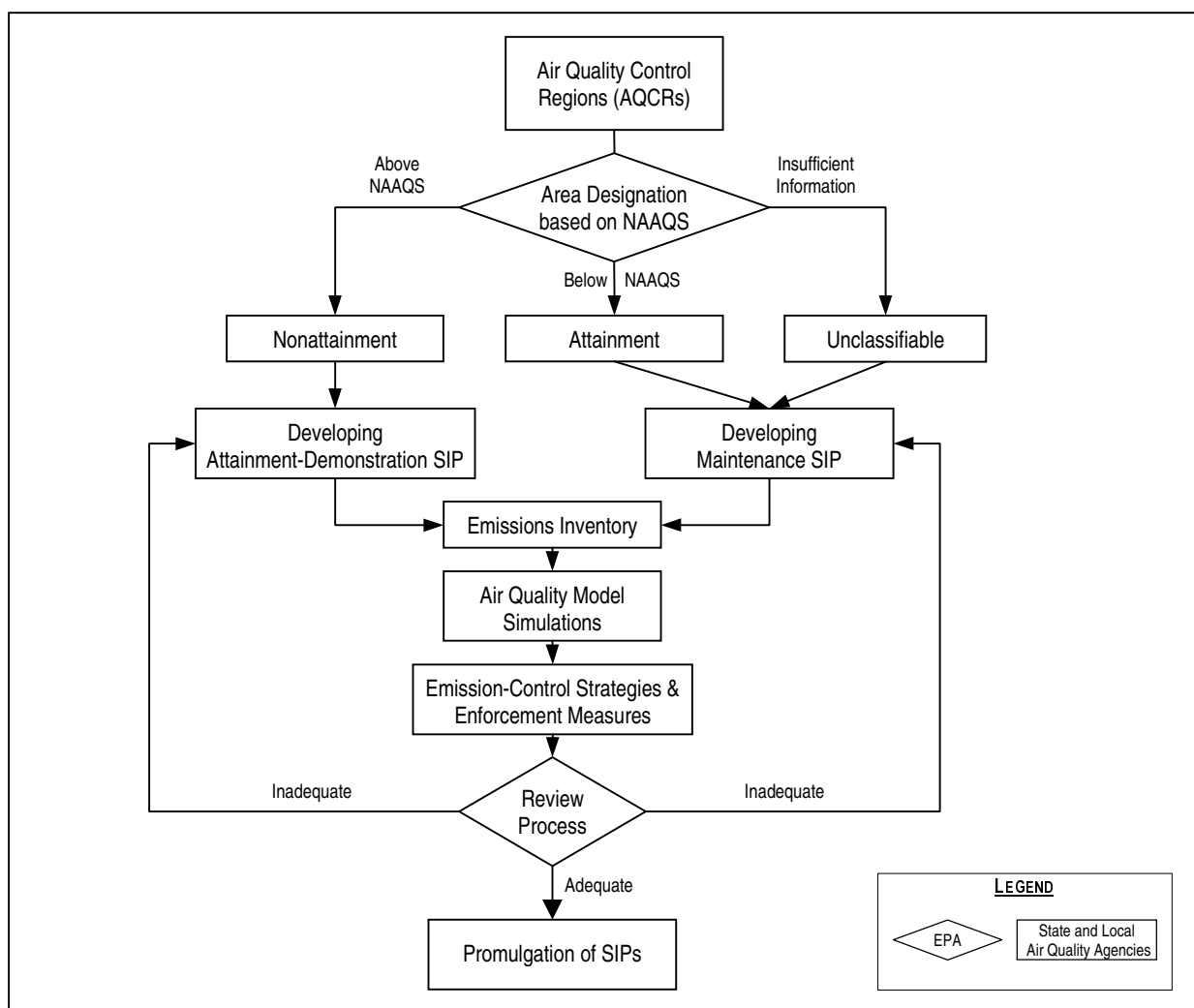


Figure 1. Flowchart of the U.S. AQM system<sup>41</sup>

#### 1.3.1 Area Designations

The CAA gave each state the primary responsibility for assuring air quality within the entire geographic area comprising the state.<sup>42</sup> For purposes of administering the AQM system, the CAA

<sup>40</sup> Hereafter, SIP is used as shorthand to denote both a SIP and a TIP.

<sup>41</sup> Although the development and review process for SIPs is the same, emission-control strategies and enforcement measures differ greatly depending on the area's designations and criteria pollutants.

## Assessment of the Effectiveness of European Air Quality Policies and Measures

A project for DG Environment carried out by Milieu Ltd, the Danish National Environmental Research Institute, and the Center for Clean Air Policy

adopted the air quality control regions (AQCRs), which were previously established under the Air Quality Act of 1967. The 1990 CAA Amendments updated the boundaries of AQCRs based on the Metropolitan Statistical Area or the Consolidated Metropolitan Statistical Area (C/MSA).<sup>43</sup> As a result, a number of major intrastate areas were grouped into one AQCR if such action deemed necessary or appropriate for administering the AQM system. For instance, greater New York City area includes counties in New York, New Jersey and Connecticut (see below).

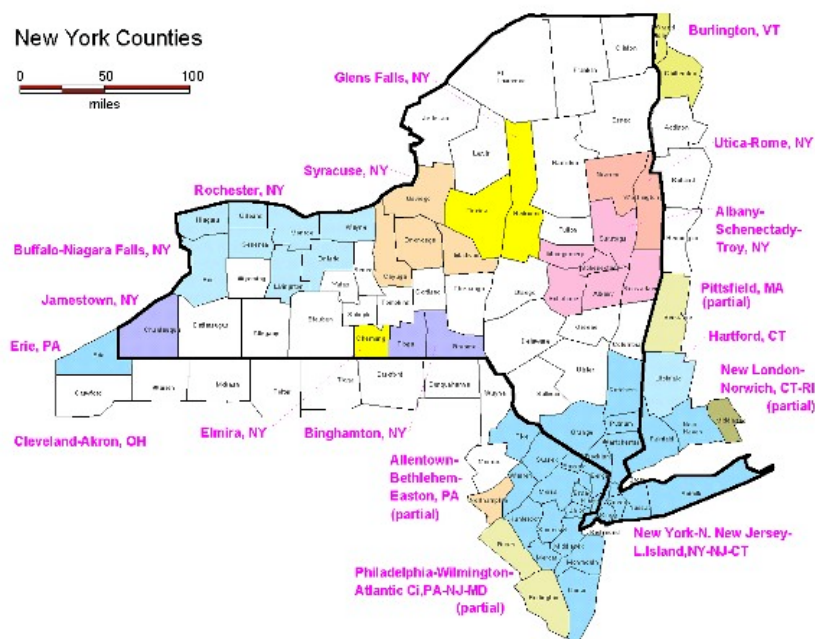


Figure 2. Air quality control regions shown in colored C/MSAs in New York State (EPA, 2002d)

AQCRs are then classified into three categories of area designations as follows:

- *Nonattainment*. any area that does not meet (or that contributes to ambient air quality in a nearby area that does not meet) the primary or secondary NAAQS for the pollutant;
- *Attainment*. any area that meets the primary or secondary NAAQS for the pollutant and does not contribute to the violation of the standards in a nearby area;
- *Unclassifiable*: any area that cannot be classified on the basis of available information as meeting or not meeting the primary or secondary NAAQS for the pollutant.

In addition, the CAA classifies O<sub>3</sub> nonattainment areas as marginal, moderate, serious, severe, and extreme; CO nonattainment areas as moderate or serious; and PM<sub>10</sub> areas as serious and moderate (see Table 2).

Based on these classifications, states are required to submit EPA a list of initial area designations for the AQCRs under their jurisdiction within 1 year after promulgation of new or revised NAAQS.<sup>44</sup> In order to compare the ambient concentration of criteria pollutants with the NAAQS, local and state

<sup>42</sup> CAA § 107.

<sup>43</sup> A complete list of C/MSAs and their boundaries can be found in the *Statistical Abstract of the United States* developed by the U.S. Bureau of the Census.

<sup>44</sup> CAA § 107(d).

## Assessment of the Effectiveness of European Air Quality Policies and Measures

*A project for DG Environment carried out by Milieu Ltd, the Danish National Environmental Research Institute, and the Center for Clean Air Policy*

authorities first derive the area's "design value" for the pollutant, based on the data gathered from the national air monitoring stations (NAMS) and state and local air monitoring stations (SLAMS). A design value is a "mathematically determined pollutant concentration at a particular site that must be reduced to, or maintained at or below the NAAQS to assume attainment" (EPA, 1986). If the design value of the area exceeds the NAAQS, the area is designated as a nonattainment area. Because the statistical form of the standard varies from one pollutant to another, EPA provides guidelines for the method used to determine the design value for each pollutant. Upon receiving a list of initial area designations and consulting with the state authorities, EPA announces final area designations within 2 years of promulgation of the NAAQS. In addition to a mechanism for identifying and designating nonattainment areas, the CAA also specifies a process by which a nonattainment area can be redesignated as an attainment area.

### 1.3.2 State Implementation Plan

The CAA requires each state to adopt and submit a plan that would "implement, maintain, and enforce" primary standards in each AQCRs within 3 years after the promulgation of the NAAQS and subsequent area designations.<sup>45</sup> For nonattainment areas, SIPs should specify local, state, regional and federal regulations necessary for the area to demonstrate attainment of the NAAQS. For attainment and unclassifiable areas, SIPs should specify regulations to maintain compliance and prevent significant deterioration of air quality. There are also explicit requirements for emission control strategies and enforcement measures for each criteria pollutant. Because of these pollutant-specific requirements and timing differences, each state produces a separate implementation plan for each criteria pollutant in the pertinent AQCR.

The procedural and substantive requirements become more stringent and extensive as the number of nonattainment areas increases. The basic requirements for states in general and for the AQCRs in nonattainment of one of more NAAQS are listed in the Box 1. Given that the U.S. AQM system has developed more expansive regulatory protocol for reducing air pollution rather than preventing deterioration, the following sections of this report will focus on the "attainment-demonstration" SIPs.

#### Box 1 Clean Air Act Requirements for State Implementation Plans (NRC, 2004)

##### A. For all states<sup>46</sup>

SIPs must be submitted within 3 years of promulgation of new NAAQS and provide for "implementation, maintenance, and enforcement" of the standard. Among other things each SIP must

- Include enforceable emission limitations and controls as well as schedules and timetables to ensure compliance.
- Provide for the monitoring of ambient air quality.
- Include a program to enforce the emission limitations and control measures.
- Contain adequate provisions prohibiting emissions within the state to contribute significantly to nonattainment of NAAQS in any other state.
- Ensure that the state will have adequate personnel, funding, and authority to carry out the plan.
- Require stationary emission sources to monitor and provide periodic reports of their emissions.
- Meet requirements relating to consultation, public notification, and prevention of significant deterioration of air quality.
- Provide for air quality modeling and provide related data to demonstrate how emissions affect air quality.
- Require owners or operators of major stationary emission sources to pay fees to cover (1) reasonable costs of reviewing and acting upon permit applications, and (2) reasonable costs of implementing and enforcing the terms and conditions of the permit.
- Provide for participation by local political subdivisions affected by the plan.

##### B. For nonattainment areas<sup>47</sup>

Attainment-demonstration SIPs must be submitted within 3 years of an area being designated a nonattainment area. In addition to the

<sup>45</sup> CAA § 110.

<sup>46</sup> CAA § 110.

<sup>47</sup> CAA § 172.

# Assessment of the Effectiveness of European Air Quality Policies and Measures

A project for DG Environment carried out by Milieu Ltd, the Danish National Environmental Research Institute, and the Center for Clean Air Policy

## Box 1 Clean Air Act Requirements for State Implementation Plans (NRC, 2004)

items listed in part A, the SIP must

- Provide a plan for the implementation of reasonably available control technologies (RACT) and attainment of primary NAAQS, for the offsetting of emissions of new or modified major stationary sources, and for the installation in major new stationary sources of technology capable of achieving the lowest achievable emission rate (LAER).
- Include a comprehensive emissions inventory for all relevant pollutants.
- Implement a new-source review (NSR) before construction, and for all new or modified stationary sources, implement a permit program that mandates use of control technologies that obtain the LAER and provides sufficient emission offsets from other sources in the area to ensure reasonable progress and attainment of NAAQS.
- Provide for the implementation of contingency measures in the event that the area fails to make reasonable progress or meet its attainment deadline.

For a nonattainment area to be redesignated an attainment area, a revised SIP must be submitted and approved. This plan<sup>48</sup> must

- Provide for the maintenance of NAAQS compliance for at least 10 years after the redesignation.
- Include additional measures, if any, to ensure such maintenance.

### C. For O<sub>3</sub> nonattainment areas<sup>49</sup>

In addition to the items listed in parts A and B, SIPs for marginal and above O<sub>3</sub> nonattainment areas must

- Include a vehicle emission-control inspection and maintenance (I/M) program.
- Include a volatile organic compound (VOC) and nitrogen oxides (NO<sub>x</sub>) emissions inventory every 3 years for the area.
- Implement an NSR for VOC sources that includes an offset ratio of emission reductions to new emissions of at least 1.1:1.

In addition, SIPs for moderate and above O<sub>3</sub> nonattainment areas must

- Provide a plan for VOC emission reductions as specified in the CAA.
- Provide a plan for comprehensive introduction of RACT for specified VOC sources.
- Implement a vapor recovery program requiring gasoline service stations to install special refueling equipment to prevent the escape of VOCs.
- Implement an NSR for VOC sources that includes an offset ratio of emission reductions to new emissions of at least 1.15:1.

In addition, SIPs for serious and above O<sub>3</sub> nonattainment areas must

- Include an attainment demonstration using a photochemical grid model.
- Demonstrate that reasonable progress is being made through appropriate 3% per year reductions in VOC emissions (or its O<sub>3</sub>-equivalent in NO<sub>x</sub> emissions) and submit triennial compliance demonstrations beginning in 1996 showing emission reductions are being met.
- Implement an NSR for VOC sources that includes an offset ratio of emission reductions to new emissions of at least 1.2:1.
- Implement a program of enhanced air quality monitoring.
- Provide for an enhanced vehicle I/M program.
- Include a clean fuel (such as natural gas and propane) vehicle program for centrally fueled fleets.
- Demonstrate conformity with regional transportation plans.

In addition, SIPs for severe O<sub>3</sub> areas must

- Implement transportation control measures (TCM) to reduce single-occupancy-vehicle use through high-occupancy vehicle (HOV) lanes and car-pooling and van-pooling programs.
- Implement an NSR for VOC sources that includes an offset ratio of emission reductions to new emissions of at least 1.3:1 (or 1.2:1 if areawide best available control technology [BACT] is used).
- Implement a reformulated fuels program.

In addition, SIPs for extreme O<sub>3</sub> areas must

- Include a plan for use of clean fuels and advanced technology for electric utility, industrial, and commercial boilers.
- Implement an NSR for VOC sources that includes an offset ratio of emission reductions to new emissions of at least 1.5:1 (or 1.2:1 if areawide BACT is used).
- Implement a reformulated fuels program.

<sup>48</sup> CAA § 175(a)

<sup>49</sup> CAA § 182.



## **1.4 Main Components of Plan Implementation: Attainment-Demonstration SIPs**

The key components of an attainment-demonstration SIP are as follows (NRC, 2004):

- An emissions inventory.
- An analysis involving air quality model simulations, observational data and related evidence to determine the amount and types of emission reductions needed to demonstrate attainment by the deadline.
- A description of the emissions control strategies and enforcement measures to be adopted to achieve the required reductions.

### *1.4.1 Emission Inventories*

The first step in developing an emission control strategy for a criteria pollutant is to develop a comprehensive emissions inventory. The CAA requires SIPs to list all sources of the pollutant or its precursor and the rate of emission at these sources for all areas under the general SIP requirements.<sup>50</sup> In addition, the CAA authorized EPA to require other emissions data as deemed necessary for SIP development in nonattainment areas to attain NAAQS, especially for the criteria pollutants with regional transport.<sup>51</sup> EPA provides a general procedure for developing emissions inventory of four sources: point, area, mobile, and biogenic (EPA, 1997a). Point sources are stationary sources which emit a threshold amount or more of at least one criteria pollutant (i.e. electric power plant). Area sources are small or diffuse stationary sources which emit less than the threshold amount individually but can collectively emit significant amount of pollutants (i.e. dry cleaners and wildfires). Mobile sources are any kind of vehicle or equipment with a gasoline or diesel engine; airplane; or ship. Biogenic sources are natural processes occurring throughout the ecosystems and geological activities.

Inventories are generally developed using a combination of direct measurements and emission models (NRC, 2004). Emissions monitoring, the most direct way to determine the rate at which a pollutant is emitted into the atmosphere, is used for large stationary sources. As a requirement of the Acid Rain Program, a number of electrical utility boilers in the US are now using continuous emissions monitoring systems (CEMS). The data from these sources are reported to and made public by the EPA. For sources that are difficult to measure emissions, EPA provides models to estimate emissions (EPA, 2004e). Emissions models are used for estimating on-road emissions and air emissions from landfills, storage tanks, wastewater collection and treatment systems, wind erosion, fugitive dust from roads, material handling, agricultural tilling, and construction and demolition. These models generally estimate the emission rate of pollutant by multiplying the emission factor (in units of tons of emissions per unit of activity) by the activity level for that specific emission (NRC, 2004). For instance, for mobile sources, emissions factors are derived from measurements made on a selected set of vehicle types and ages deemed to be representative of the fleets in use and activity levels are derived from estimates of vehicles miles travelled and fuel consumption statistics. EPA compiles and periodically updates emission factors and activity levels for a large number of sources.

### *1.4.2 Air Quality Modeling*

Once an emissions inventory is complete, state agencies analyze the amount of emission reductions needed to achieve attainment of the NAAQS using air quality models. A model is used to simulate one or more of the historical events that contributed to the area's design value and to demonstrate that appropriate emission controls will prevent future NAAQS violation during similar events. In addition to the historical events, future projections incorporate a variety of factors that affect emissions, such as vehicle miles travelled and the effectiveness of emission control technology. The air quality models used in these analyses are designed to allow policymakers to link pollutant emissions to concentrations

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<sup>50</sup> CAA § 110(a).

<sup>51</sup> CAA § 172(c)(3)

## Assessment of the Effectiveness of European Air Quality Policies and Measures

A project for DG Environment carried out by Milieu Ltd, the Danish National Environmental Research Institute, and the Center for Clean Air Policy

in the atmosphere quantitatively. Over the past 30 years, EPA and state agencies have used several types of models, and these models have continuously evolved in their capabilities and technological comprehensiveness through a close collaboration between the scientific, engineering, and regulatory communities (Russell and Dennis, 2000). The three major classes of air quality models are as follows (see box 2 for detail):

- *Statistical and empirical models* are based on observed relationships between pollutant concentrations and emission rates. There is little or no explicit consideration of the underlying physical and chemical processes that determine these relationships.
- *Deterministic models* use mathematical equations on the physics and chemistry of air pollutant emissions, formation, transport, and removal.
- *A hybrid of the two* makes use of physically and chemically based algorithms, although essentially empirical or statistical in its approach.

### Box 2 Air Quality Models (NRC, 2004)

#### A. Empirical Rollback Model

This model, the simplest one available for AQM, assumes that an air pollutant's concentration in an airshed is directly proportional to the total emission rate of the pollutant in the airshed. Although easy to use, the underlying assumption of linearity between emissions and concentrations makes it only suitable for pollutants with relatively simple chemical-production mechanisms. They are also unable to simulate spatial and temporal variations in pollutant concentrations. As a result, these models were used extensively in AQM before the mid-1970s and have since been largely supplanted by more sophisticated models. They nevertheless continue to be used in some applications, most notably in the design of urban strategies to meet the NAAQS for carbon monoxide (CO).

#### B. Receptor Models

Receptor models are similar to rollback models in their dependence on observed concentrations and their neglect of chemical and meteorological processes. Yet, these models can adopt more sophisticated statistical techniques to derive a more complex (and possibly more accurate) description of the relationship. They have been used most successfully and most widely in estimating the relative contributions of various emission sources to measure ambient air particulate matter (PM) composition at a monitoring site. The estimates are made by relating the measured elemental and organic tracer composition of ambient PM to the known elemental composition of the sources of PM in the region. Reviews of these methods can be found in Brook et al. (2003) and the references therein.

#### C. Emissions-Based Air Quality Models

Emissions-based models are used to estimate the amount of O<sub>3</sub> and CO emission reductions required to meet a specific air quality goal or standard. These models use a mathematical representation of the relevant physical and chemical processes and then solve the governing equations (usually numerically) in time and space to determine the relationships between pollutant emissions and pollutant concentrations. One of the major advantages of these models is their predictive capability: because they calculate pollutant concentrations as a function of pollutant emissions, they can be run in a prognostic mode to predict the air quality response to any hypothetical change in pollutant emissions.

Emissions-based air quality models can vary in complexity. The simplest are box models, which simulate the evolution of pollutant concentrations in an idealized well-mixed parcel of air. Dispersion models, such as ISC3 and CalPUFF (EPA, 1995a,b), simulate a plume parcel of air as it advects and mixes with ambient air. The most complex are state-of-the-science three-dimensional (3D) chemical transport models (CTMs), which attempt to recreate the observable distributions of chemical species in time and space. The chemical transport models require an extensive amount of data and other modeling input, which makes it the most time-consuming and resource-intensive model.

### 1.4.3 Development of Control Strategies

After conducting an emission inventory and determining the amount of emission reductions needed, state agencies develop strategies for emission control and enforcement to demonstrate attainment status by the required date. The emission-control strategy is typically developed in stages by identifying applicable federal, local (mandatory or additional), and multistate regional measures.

## Assessment of the Effectiveness of European Air Quality Policies and Measures

*A project for DG Environment carried out by Milieu Ltd, the Danish National Environmental Research Institute, and the Center for Clean Air Policy*

*Federal.* The CAA authorized EPA to impose nationwide emission control measures on selected industries (i.e. motor standards). If these measures are expected to achieve emission reduction of the criteria pollutant of the nonattainment area, state agencies can count the anticipated reduction towards their strategy development. EPA provides guidelines and models to estimate anticipated emissions reduction from these federal measures. For most states, federal measures make up a significant portion of the emission reductions in the respective SIPs, therefore easing the burden of state and local authorities in developing attainment-demonstration SIPs.

*Multistate Regional.*<sup>52</sup> In recognition of the substantial contribution of upwind emission sources to local air pollution, SIPs also include measures that cross state boundaries. More discussion of this is under section 1.4.4.

*Local – Mandatory.* As described above, the CCA specifies mandatory local measures to be included in the SIP, depending on the type and severity of the criteria pollutant (i.e. enhanced inspection and maintenance program for severe ozone nonattainment areas). EPA provides guidelines and models to estimate anticipated emissions reduction from these local measures.

*Local – Additional.* If federal, regional, and mandatory local measures are insufficient to achieve required emission reduction for attainment of the NAAQS, additional local measures must be clarified. These can include more stringent controls on the sources already regulated or new controls on previously unregulated sources.

### *1.4.4 Multistate Regional Control Strategies*

The 1990 CAA Amendments required implementation of multistate air pollution mitigation strategies through the creation of regional planning organizations (RPOs). By issuance of EPA and voluntary adoption by states, rules and regulations of RPOs can be mandated and hence counted towards developing attainment-demonstration strategy.<sup>53</sup> In addition, section 126 of the CAA allowed any state or political subdivision to petition EPA for finding that emissions from major stationary sources in upwind States contribute significantly to nonattainment (or interfere with maintenance) of a NAAQS in a petitioning State. If EPA makes such a finding, it can impose additional regulatory measures for the emitting State (i.e. NO<sub>x</sub> SIP Call for ozone NAAQS<sup>54</sup>). *Box 3* provides a summary of how this has been implemented under the NO<sub>x</sub> SIP Call, see case study 1 for more detail.

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<sup>52</sup> In 1970s, poor air quality of the nonattainment areas was thought to be caused from the pollution sources within the area, and the CAA therefore held the local agencies accountable for promulgating pollution mitigation strategies. Later in the 1980's, the effects of upwind emission sources on distant local air pollution was recognized and addressed in the 1990 CAA Amendments.

<sup>53</sup> As a result, Ozone Transport Commission (OTC) in the eastern half of the United States and the ad hoc Ozone Transport Assessment Group (OTAG) were established to implement further reduction of NO<sub>x</sub> emission (see Case Study #1 Ozone section). In the west, the Grand Canyon Visibility Transport Commission (GCVTC) and Western Regional Air Partnership (WRAP) were established (see Case Study #4 Particulate Matter).

<sup>54</sup> See Case Study #1: Regional Air Pollution – Ozone section for detail.

*Box 3 US NO<sub>x</sub> SIP Call*

In 1997, eight Northeastern states filed 126 petitions against power generators and other sources of NO<sub>x</sub> in the Midwest, South and Northeast. An additional 3 states filed petitions in 1999. These petitions were considered within and alongside the OTAG process, described above, and helped result in EPA's final NO<sub>x</sub> SIP Call determination.

In response, the EPA developed an emissions trading system known as the "NO<sub>x</sub> SIP Call." Under the NO<sub>x</sub> SIP Call, EPA established NO<sub>x</sub> emissions caps for 22 member states and the District of Columbia based on each state's contribution to the problem rather than its attainment status with its SIP. States deemed to contribute to ozone nonattainment were given NO<sub>x</sub> emission budgets, while those deemed not to contribute were excluded from the program. States may choose to participate in an interstate trading program to reach compliance with the SIP Call by accepting the major elements of a trading program defined in EPA's model rule.

## **2 INSTITUTIONAL ACCOUNTABILITY IN THE SIP PROCESS**

### **2.1 USEPA Review and Approval of SIPs**

The agency or agencies responsible for preparing an attainment-demonstration SIP are different from state to state due to the AQCRs of various geographic spans. Often, SIPs are prepared by the relevant state authority, a local government, or a regional government. Once completed, the SIP is submitted to EPA for review to check if the plan meets its requirements. If EPA approves the plan, the SIP becomes enforceable as a matter of federal and state law and therefore subject to lawsuits for failure to comply. EPA can disapprove a SIP if it does not meet the procedural and substantive requirements, and require a resubmission with revisions. A SIP is also subject to change in order to reflect new federal or state requirements, new information, or change in status of NAAQS attainment. Likewise, SIP revisions must be reviewed and approved by EPA before it is enforceable. If a state fails to generate a SIP, then EPA has the power to control the air quality management programs for that state or area. In extreme cases where the state has an inadequate SIP or fails to implement its SIP, EPA can replace a SIP with a federal implementation plan (FIP).

### **2.2 Measures to Encourage Compliance**

The failure to meet the 1980s deadlines also incited the Congress to consider measures with which EPA can effectively hold AQCRs accountable for promulgating attainment-demonstration SIPs. However, the Congress was unable to provide EPA with any measures directly coerce states to comply with the NAAQS or the SIP process because such measures would exceed the U.S. federal government's constitutional power. As a result, the 1990 CAA Amendments adopted non-coercive measures that would help EPA administer national AQM without exercising unconstitutional power over states (McCarthy, 1999). These measures include: aggravating stringency of existing regulations, preconditioning the disbursement of federal grants, and threatening of federal assumption on currently state-run programs. Details on these measures are described below.

#### *2.2.1 Bump-up Provision*

The 1990 CAA Amendments also added a provision to encourage timely attainment demonstration of ozone nonattainment areas. Known as a "bump-up" provision, EPA reclassifies an ozone nonattainment area ranked below 'severe' that fails to achieve attainment by the specified deadline to "the higher of (i) the next higher classification for the area, or (ii) the classification applicable to the

## Assessment of the Effectiveness of European Air Quality Policies and Measures

*A project for DG Environment carried out by Milieu Ltd, the Danish National Environmental Research Institute, and the Center for Clean Air Policy*

area's design value as determined at the time of finding failure to attain.”<sup>55</sup> Once reclassified, the AQCR is required to develop and promulgate a new SIP in accordance with more stringent pollution control measures that are mandatory of the new classification. In addition, the area is labeled with a new stigma of having a 'serious' or 'severe' air quality problem although the area's pollution would not have necessarily worsened. With increased pollution control measures and a new 'dirtier' reputation, the reclassified AQCR faces increased administrative burdens and difficulty attracting new businesses. Therefore, a bump-up provision has been perceived like a sanction to many ozone nonattainment areas that feared of the undesired consequences of reclassification.

### 2.2.2 Sanctions

The 1990 CAA Amendments authorized EPA to impose sanctions when a nonattainment area fails to submit an adequate plan (or revised plan) or to demonstrate attainment by the deadline.<sup>56</sup> There are two types of sanctions: “2-to-1” emission offsets and the withholding of federal highway funds. The 2-to-1 emission offset sanction requires newly constructed or expanded major stationary sources to reduce emissions from other facilities twice the amount they project to emit at the new development. Under the federal highway fund sanction, funds for transportation projects within the nonattainment area are withheld, with the exception of projects designed to improve safety, transit, and air quality. Once the failure or deficiency of a nonattainment area is determined, EPA sends a notice that the area has 18 months to remedy the problem, often referred as “sanctions clock.” If the area has not resolved the problem within 18 months of the sanctions clock, EPA imposes the 2-to-1 offsets sanction, followed by withholding of federal highway funds 6 months later if the problem still persists.

### 2.2.3 Conformity

Another instrument for encouraging compliance is a conformity determination. The 1990 CAA Amendment<sup>57</sup> s and the Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991<sup>58</sup> mandated close integration of air quality and transportation planning authorities to make their plans conform to each other (Howitt and Moore 1999). These regulations mainly affect the procedure by which metropolitan planning organizations (MPOs) develop Transportation Improvement Program (TIP), which identifies major highway and transit projects that the area will undertake. Each TIP must include an EPA-madated analytical procedure and regulatory test, during which computer simulations forecasts 20 years of transportation-related emissions by taking into account changes in demographics, land use, economic development, and transportation infrastructure and services (Howitt and Moore, 1999).

If the forecasted emissions exceed the emissions budget outlined in the SIP, an MPO must amend its TIP not to exceed the budget. Otherwise, the SIP must be amended to include additional control measures for mobile or stationary source. In addition, an MPO must demonstrate that it has sufficient financial resources to timely implement transportation control measures outlined in SIPs. If an MPO does not satisfy the aforementioned requirements, the area falls into a conformity “lapse” or “freeze.” During this period, the MPO can neither begin new transportation projects nor use federal transportation funds. For some metropolitan areas, this loss of transportation funds can be more than \$100 million per year (NRC, 2004). Similar to the federal highway fund sanctions, conformity lapse applies only to new projects and exempts projects designed to improve safety or air quality of the pertinent areas.

### 2.2.4 Penalty Fee

The 1990 CAA Amendments authorized the local government of the severe and extreme ozone nonattainment areas to collect a penalty fee from major stationary sources in case of failure to timely attainment.<sup>59</sup> Each major source located in the area is required to pay \$5,000 per ton of VOC or NO<sub>x</sub>

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<sup>55</sup> CAA § 181(b)(2)

<sup>56</sup> CAA § 179

<sup>57</sup> CAA § 176

<sup>58</sup> ISTEA of 1991 was later replaced by the Transportation Equity Act for the 21<sup>st</sup> Century (TEA-21) in 1997.

<sup>59</sup> CAA § 185

# Assessment of the Effectiveness of European Air Quality Policies and Measures

A project for DG Environment carried out by Milieu Ltd, the Danish National Environmental Research Institute, and the Center for Clean Air Policy

emitted in excess of 80% of the stationary source's permitted level of emissions until the area demonstrates attainment, with the exception of areas with a total population under 200,000. State governments are responsible for determining how fees would be collected and used.

## 3 ASSESSMENT OF THE EFFECTIVENESS

### 3.1 Environmental Effectiveness

The environmental effectiveness of the SIP process can be considered by looking at two factors – air quality and rate of attainment.

#### 3.1.1 National Ambient Air Quality

The National Research Council (2004) refers to two metrics to assess the effectiveness of the SIP process: a general trend in pollutant concentrations across the US and a more specific trend in criteria pollutant concentrations in nonattainment areas. In terms of the general air quality trends, there have been improvements over the past 20 years for all six criteria pollutants (EPA, 2003c; See Table 3). Since 1970, aggregate emissions of criteria pollutants have decreased 48%, despite the significant increases in GDP (164%), energy consumption (42%) and vehicle miles traveled (155%). Yet, there are still 160 million tons of pollutants emitted each year that put approximately 146 million people under unhealthy conditions at times. Out of 296 metropolitan statistical areas (MSAs), 140 areas that are home to 56% of the U.S. population had peak concentrations exceeding the NAAQS levels for at least one criteria pollutant in 2002 (EPA, 2003c). Moreover, 36 MSAs showed significant upward trends in at least one criteria pollutant, although its ambient concentration was below the NAAQS (with the exception of ozone).

Table 3. Percent change in air quality and emissions in the United States (EPA, 2003c).

Percent Change in Air Quality			Percent Change in Emissions		
	1983-2002	1993-2002		1983-2002	1993-2002
NO <sub>2</sub>	-21	-11	NO <sub>x</sub>	-15	-12
O <sub>3</sub>	1hr	-2 <sup>a</sup>	VOC	-40	-25
	8hr	-14	SO <sub>2</sub>	-33	-31
SO <sub>2</sub>	-54	-39	PM <sub>10</sub> <sup>c</sup>	-34 <sup>d</sup>	-22
PM <sub>10</sub>	--	-13	PM <sub>2.5</sub> <sup>c</sup>	--	-17
PM <sub>2.5</sub>	--	-8 <sup>b</sup>	CO	-41	-21
CO	-65	-42	Pb <sup>e</sup>	-93	-5
Pb	-94	-57			

-- Trend Data not available.

<sup>a</sup> Not statistically significant.

<sup>b</sup> Based on percentage change from 1999.

<sup>c</sup> Includes only directly emitted particles.

<sup>d</sup> Based on percentage changed from 1985. Emission estimates prior to 1985 are uncertain.

<sup>e</sup> Lead emissions are included in the toxic air pollutant emissions inventory and are presented for 1982-2001.

The progress has been especially slow for ozone. After the progress made in the 1980s, the national average 1-hour and 8-hour ozone levels have remained fairly constant over the past 10 years (EPA, 2003c). The Air Quality Index (AQI), a composite measure of 5 criteria pollutants (CO, Ozone, PM10, SO2 and NO2), reflects this lack of progress. Between 1992 and 2001, areas with serious or worse ozone nonattainment status experienced almost no change in the number of days with AQI values

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greater than 100,<sup>60</sup> despite reductions for other pollutants (EPA, 2003c). Over the same time frame, the percentage of days where ozone was the principle cause of AQI values greater than 100 increased from 94 to 98 percent. Taken as a whole, reductions in criteria pollutants have improved the general urban air quality over the past decade despite a lack of progress on ozone.

### 3.1.2 Number of nonattainment areas

Similarly, the number of nonattainment areas has decreased substantially for most of the criteria pollutants except ozone (Table 4). Out of 57 CO, Pb, SO<sub>2</sub>, or NO<sub>2</sub>, nonattainment areas in 1992, 43 areas have demonstrated attainment to date. In case of O<sub>3</sub>, the total number of moderate and marginal nonattainment areas has decreased substantially. Except the three serious O<sub>3</sub> nonattainment areas which were bumped up, the rest of the O<sub>3</sub> nonattainment areas are scheduled to achieve attainment within a couple of years. With the recent area designation for the 8-hr O<sub>3</sub> and forthcoming area designations for PM<sub>2.5</sub>, states are expecting to ascertain additional SIP requirements.<sup>61</sup> Therefore, the effectiveness of current SIP process in addressing serious and above O<sub>3</sub> nonattainment has yet to be determined (NRC, 2004).

Table 4. Classifications and Number of Nonattainment Areas in 1992 Remaining in Nonattainment as of May 17, 2004 (NRC, 2004; EPA 2004d)

Pollutant	Classification	1992	2004	change
CO	Serious	7	6	-1
	Moderate	4	1	-3
	Moderate	32	3	-29
NO <sub>2</sub>	-	1	0	-1
Pb	-	13	3	-10
O <sub>3</sub>	Extreme	2	2	0
	Severe-17 <sup>a</sup>	5	5	0
	Severe-15 <sup>b</sup>	7	7	0
	Serious	13	10	-3
	Moderate	29	6	-26
	Marginal	43	19	-25
	Other <sup>c</sup>	2	1	-1
PM <sub>10</sub> <sup>d</sup>	Serious	8	8	0
	Moderate	78	51	-27
SO <sub>2</sub>	Primary	48	15	-33
	Primary, Secondary	6	6	0
<b>Total</b>		<b>310</b>	<b>146</b>	<b>-164</b>

<sup>a</sup> "Severe-17" nonattainment areas have 17 years to attain standards.

<sup>b</sup> "Severe-15" nonattainment areas have 15 years to attain standards.

<sup>c</sup> This category includes areas that violate the O<sub>3</sub> standard and have a design value of less than 0.121 ppm. That occurs when the exceedance is higher than the O<sub>3</sub> standard exceedance rate of 1.0 per year, even though the estimated design value is less than the standard.

<sup>d</sup> This is not an official list of nonattainment areas. See the *Code of Federal Regulations* (40 CFR Part 81) and pertinent *Federal Register* notices for legal lists and boundaries (<http://www.epa.gov/oar/oaqps/greenbk/pfrnrpt1.html>). For an area designated as being in nonattainment of the NAAQS for PM<sub>10</sub>, Section 188 of the CAA outlines the process for classification of that area and establishes that area's attainment date. At the time of designation, all PM<sub>10</sub> nonattainment areas are initially classified as moderate by operation of law. A moderate area can subsequently be reclassified as serious either before the applicable moderate area attainment date, if EPA determines the area cannot "practicably" attain the PM<sub>10</sub> NAAQS by this attainment date, or after the passage of the applicable moderate area attainment date, if EPA determines the area has failed to attain the standards.

<sup>60</sup> State and local agencies use AQI value to inform daily air quality to the public. Because an AQI value greater than 100 indicates that at least one criteria pollutant has reached levels at which people in sensitive groups are likely to suffer health effects, the number of days with AQI values greater than 100 provides an indicator of air quality in urban areas (EPA, 2000a).

<sup>61</sup> EPA is expected to announce final area designations for PM<sub>2.5</sub> in December 15, 2004.

### 3.2 Administrative Feasibility

#### 3.2.1 Bureaucratic Process

The SIP process is quite an extensive system that requires substantial time and resources from local, state and federal agencies to carry out a legalistic, and often frustrating, proposal and review process focused on compliance with intermediate process steps. For instance, consider the process required for revisions to SIP. Every SIP revision must be approved via a rule-making or legislative action at the state level that can take months or even years to complete. Then the revision must receive a full formal review by EPA and EPA's own federal rule-making process. Despite a major overhaul of the process in 1989 encouraging the use of 'direct final notices' and 'conditional approvals' to reduce the time needed to approve a state submittal, the process remains "largely duplicative, resource-intensive and time consuming" (NRC, 2004). Critics argue that this procedural inefficiency probably discourages innovation and experimentation at the state and local levels, overtaxes the limited financial and human resources available to the nation's AQM system, and draws attention and resources away from the more germane issue of ensuring progress toward the goal of meeting the NAAQS (NRC, 2004).

#### 3.2.2 Emphasis on attainment demonstrations

The SIP process statutorily emphasizes AQCRs to demonstrate attainment of the NAAQS by certain deadlines. Based on air quality model simulations, state agencies are able to estimate the magnitude of emission reductions needed and develop pollution control measures accordingly. Yet, the use of attainment demonstration as a one-time prediction of how air quality in a given area will evolve over a multiple-year time scale does not take into account the significant modeling, socioeconomic, and control-technology uncertainties implicit in such a process (NRC, 2004). In addition, the attainment demonstration may provide a false sense of assurance, which can discourage a review of the underlying assumptions of the plan until attainment has been achieved much later on. Finally, it is extremely difficult to review and amend SIPs as new information and updated modeling simulations become available due to the full and complex review and approval process.

#### 3.2.3 Uncertainty in modelling

The emission inventories and air quality modelling used in AQM have been critiqued extensively for their uncertainty. Most of the uncertainties in current emission inventories are from the use of emission models to derive the inventories for mobile and area sources. Because the total emissions of these sources are estimated using an average emissions factor based on the measurement of a small subset, uncertainty and chance of error is systematically inherent. Current emission inventories are generally held to have an uncertainty of about a factor of two or more, and the consequences of errors can be profound (NRC, 2004). For instance, during the 1970s and 1980s, VOC emissions were greatly underestimated and NO<sub>x</sub> emissions from power plants were somewhat overestimated due to the error in the inventories. Critics suggested that collectively these errors probably contributed to the adoption of less-than-optimal control strategies for ozone pollution in many regions of the U.S. (NARSTO, 2000).

Likewise, air quality model simulations to estimate emission reduction targets have been criticized for their uncertainties as well. In addition to potential inaccuracies in the emissions inventories used as inputs, these uncertainties arise from potential errors in the structure and parameterization of the air quality models themselves. Literature estimates for individual components of an air quality model<sup>62</sup> typically indicate uncertainties of 15-30%, or significantly higher if the supporting data sets are weak (NRC, 2004). In fact, NARSTO (2000) suggests that the significant uncertainty and subsequently distorted output of the air quality model poses problems to the current AQM's reliance on models to resolve emission-control issues or to demonstrate attainment of NAAQS.

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<sup>62</sup> Emissions, chemistry, transport, vertical exchange, deposition



### **3.3 Compliance and Enforcement**

It is widely agreed that the compliance and enforcement tools mandated by the CAA are useful tools (McCarthy, 1999). Nevertheless, whether or not these have been a pivotal impetus for states to comply with the SIPs remains uncertain.

#### *3.3.1 Bump-up Provision*

EPA has generally not complied with its statutory obligation to determine the nonattainment areas' failure to attain by the deadlines and thereby change their nonattainment status (McCarthy, 2004). In some cases, EPA granted additional time to demonstrate attainment for areas of which a major cause of continued nonattainment was transport of emissions from other areas. However, EPA has been sued over its failure to reclassify several areas, and has lost all three of the suits that have gone to trial by finding that the downwind extension policy was invalid.<sup>63</sup> As a result of these trials, EPA has reclassified these areas along with other areas that failed to demonstrate attainment by the statutory deadline<sup>64</sup> (McCarthy, 2004).

#### *3.3.2 Sanctions, Conformity and Penalty Fees*

As of March 13, 2004, EPA has had to impose one or more of the sanctions mandated in the 1990 CAA Amendments in 28 instances. An additional 39 areas are currently under the clock facing sanctions in the near future unless they correct the relevant deficiency or deficiencies (FHWA, 2004a). In cases where the sanctions were imposed, areas quickly addressed the deficiency to have them removed within relatively short periods. In almost all cases where highway sanctions were imposed, areas did not actually lose highway funds because there were no proposed projects during the brief periods when the sanctions were in effect.<sup>65</sup>

From 1997 to April 2003, 56 of the 159 transportation planning areas with nonattainment area designations (35%) have experienced at least one conformity lapse, although few had to change their TIPs to resolve the lapse (GAO, 2003). In 26 cases, MPOs lacked the time and resources to complete the conformity process by the required deadlines or experience administrative and/or technical problems. In 18 cases, MPOs had difficulty developing TIPs that meets the emissions budget, but in 6 of these cases, the difficulty was with the conformity process itself and not with the amount of emissions that would be generated by the projects in their TIPs. In remaining cases, areas lapsed for a variety of other reasons, such as not having an EPA-approved SIP with an emissions budget in time for the conformity demonstration. While some took longer, about 65% of all lapses took 6 months of less to correct, mostly by correcting administrative or technical issues given and taking the needed time to complete the conformity process. Another 11 areas recalculated to the emissions budget to solve the lapse, and only 5 areas revised their TIPs to meet the conformity regulations. As of June 8, 2004, there are 9 MSAs<sup>66</sup> in a conformity lapse (FHWA, 2004b).

Typically, conformity requirements have posed greater challenge for nonattainment areas that are rapidly growing and are subsequently under substantial economic and political pressure to expand transportation infrastructure (NRC, 2004). Whereas in older, more slowly growing metropolitan areas, highway networks and transit systems are mature and well-established, leaving little transportation projects potentially jeopardized by conformity requirements. Therefore, conformity regulations have not necessarily coerced all metropolitan areas to make major adoptions to date. Besides, the withholding of federal highway funds for a short period of time generally does not translate into

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<sup>63</sup> Washington, D.C.; St. Louis, Missouri; and Beaumont-Port Arthur, Texas. See EPA (2004a) for more information.

<sup>64</sup> Baton Rouge, Louisiana; Atlanta, Georgia; Dallas-Fort Worth, Texas. See EPA (2004a) for more information.

<sup>65</sup> Highway sanctions remained in effect in only one case (East Helena, MT).

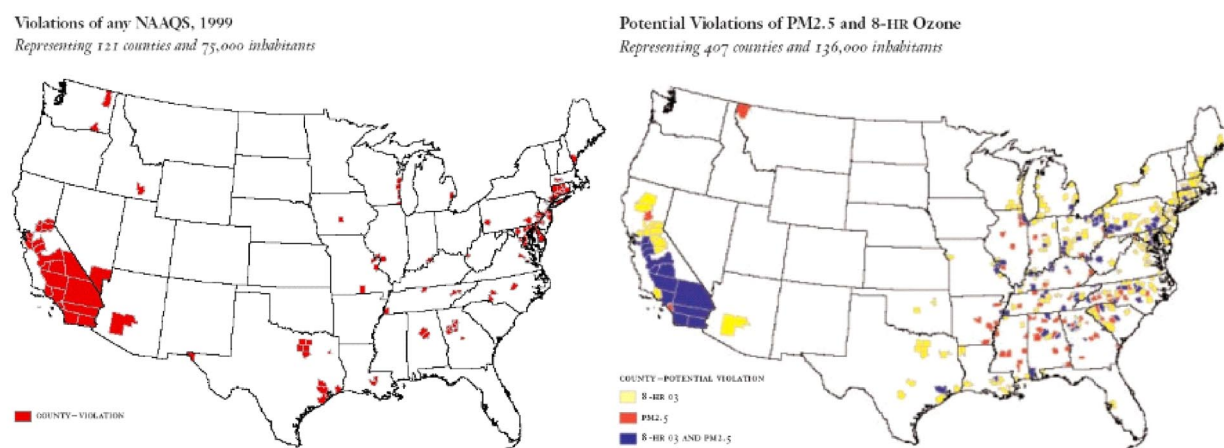
<sup>66</sup> Searles Valley portion of San Bernardino County, CA; Thurston County, WA; Billings, MT; Missoula, MT; Beaumont, TX; Northwestern Indiana; Grand Rapids and Holland, MI; Lake Tahoe, CA-NV; Ventura County and Southeast Desert Air Basin, CA

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ultimate economic loss – under the TEA-21, highway funds are made available for a multi-year period during which a lapsed area can revise its deficiencies and eventually receive the funds withheld (McCarthy, 1999). As a result, the imposition of sanctions and conformity lapses has had relatively minor impact on the affected areas and states.

Nevertheless, the impact of conformity requirements is expected to increase in the next few years for several reasons (McCarthy, 2004). First, conformity demonstration has become increasingly more difficult with higher rates of growth in vehicles miles traveled (VMT) than anticipated and increasing emissions from SUVs and other light trucks. Second, ongoing implementation of more stringent ozone standard (8-hour average) and the new PM<sub>2.5</sub> standards may at least triple the number of nonattainment areas what will be subject to the SIP and conformity processes (see *Figure 3* below). These new nonattainment areas are expected to raise administrative burdens at EPA, the U.S. Department of Transportation, state air quality and transportation agencies, and MPOs (Harrington et al., 2003). As a matter of fact, about one third of the 253 MPOs surveyed by U.S. General Accounting Office in 2003 expected to have more difficulty demonstrating conformity in the future.



*Figure 3.* Projected increase in nonattainment areas for NAAQS with new 8-hour ozone and PM<sub>2.5</sub> NAAQS implementation (Harrington et al., 2003).

To date, there has been no reporting of state government collecting penalty fees from major stationary sources.

### 3.4 Political Acceptability

During the air quality debate, representatives from areas with severe pollution problems insisted that a uniform standard be developed to prevent disproportionate economic impacts. They were concerned that without uniform standards, companies would move away from states with stringent air quality requirements to avoid the costs of environmental controls. By requiring that all states meet minimum standards and prevent deterioration, the concerns of industry-flight were allayed. In addition, policymakers opted for a system that would relegate much administrative authority to state and local governments, which helped overcome fears of an intrusive federal government. However, since state and local officials are less insulated from political pressures, they may have been hesitant to propose policies at odds with their political base.