What will European air quality be like in the future?

Decisions on legislation for the future need to be based on the situation then, not on what it is now.

The community of official stakeholders (Commission personnel, Members of Parliament and Parliament Staff, Member State civil servants, academics, industry specialists and environmentalists alike) are all aware, through their own day-to-day experiences, media reports, and measurement data that 'we need to do something' to address current levels of air pollution. This view that 'something needs to be done' has existed for some considerable time. However, the legislators have not been idle, indeed they have been working extremely hard to alter the current situation. As a result, a number of initiatives and pieces of legislation aimed at improving air quality are already in place, and their mitigating impact can be seen now. In addition, other pieces of legislation have been approved but their effects are not yet apparent. The benefits that will result from these need to be considered before decisions are taken on further legislation to improve air quality.

IMPLEMENTED LEGISLATION

Legislation which is already having an effect includes the introduction of unleaded petrol, the 1988 emission ceilings stipulated in the Large Combustion Plant Directive (88/609/EEC), the requirements of the Sulphur in Liquid Fuels Directive (93/12/EEC), and the various controls on vehicle emissions introduced in the 1970s, 1980s and 1990s. Indeed significant improvements in air quality are already being reported, particularly reductions in measured sulphur dioxide, black smoke, particulates, carbon monoxide and lead concentrations. However, for certain pollutants (e.g. nitrogen oxides) the impact of 'past' initiatives has been somewhat masked by other changes, such as traffic growth.

LEGISLATION THAT IS YET TO BE IMPLEMENTED

So what else has been done to improve air quality in recent years, given this motivation that 'something must be done'? In fact a great deal is already committed to. Key initiatives currently being implemented include:

- the Large Combustion Plant Directive (88/609/EEC)—2003 SO_x and NO_x emission ceilings;
- directives on hazardous waste and municipal waste incinerators (94/67/EC, 89/369/EEC and 89/429/EEC);
- the UN-ECE VOC Protocol (Geneva 1991);
- the UN-ECE 2nd Sulphur Protocol (Oslo 1994);
- the Stage I Directive (94/63EC)—VOCs from petrol storage and distribution;
- the Integrated Pollution Prevention and Control Directive (96/61/EC); and
- national legislation at Member State level.

Perhaps more impressive is the number of legislative initiatives that are currently emerging from the Parliamentary approval stages and which *have yet to be implemented*, namely:

- Auto-Oil directives on emissions from passenger cars, light commercial and heavy-duty vehicles, and on the quality of vehicle fuels;

- Off-Road Vehicles Directive;
- Solvents Directive;
- revisions to the Sulphur in Liquid Fuels Directive; and
- revisions to the Large Combustion Plant Directive.

Numerous national legislative initiatives are also in the process of being implemented.

WHAT WILL THIS 'LEGISLATIVE PIPELINE' MEAN FOR FUTURE ATMOSPHERIC EMISSIONS?

Over the past few years, a great deal of work has been done to try to predict just this. The most recent work has been done by the International Institute of Applied Systems Analysis (IIASA) acting as consultants to Directorate General XI of the European Commission. Their work relies on input from a wide range of groups, and air quality modelling by EMEP (UN-ECE's 'Cooperative programme for monitoring and evaluation of air pollutants in Europe'). IIASA have produced what is called the 'Reference Scenario' which takes into account future energy projections, existing and emerging legislation and where the emissions reductions will be made.

Reference scenario emissions: 2010 compared with 1990

	% emission reductions			
country	SO_x	NO_x	*VOC*	NH_3
Austria	57	46	42	13
Belgium	43	46	48	1
Denmark	51	53	53	6
Finland	49	45	48	23
France	64	54	49	4
Germany	89	56	64	25
Greece	-8	0	21	8
Ireland	63	38	50	1
Italy	66	45	44	6
Luxembourg	71	55	63	0
Netherlands	64	48	52	42
Portugal	50	15	32	6
Spain	65	27	34	0
Sweden	44	44	43	21
United Kingdom	74	58	49	10
EU-15	71	48	49	12

The table compares the emission reductions in 1990 with those predicted to occur in 2010 for each EU-15 country in IIASA's latest report for the UN-ECE (March 1999). The predicted emission reductions are impressive, at least for SO_x, NO_x and VOCs, where the overall EU reductions are predicted to be 71 per cent, 48 per cent and 49 per cent respectively. Ammonia emission reductions, mainly from agriculture, are predicted to reduce by 12 per cent overall.

CONCAWE's own predictions of the emissions from traffic only in 2010 (after implementation of Auto-Oil I) indicate that, compared with 1990 and for the EU-15 as a whole, there will be:

- 70 per cent reduction in NO_x emissions;
- 75 per cent reduction in CO emissions;
- 80 per cent reduction in VOC emissions;
- 85 per cent reduction in benzene emissions; and
- 75 per cent reduction in particulate emissions from diesel.

This is all the more impressive when we consider that road transport over this period is predicted to grow by 30 per cent.

Emissions are expected to decrease further, beyond 2010 as existing legislation takes further effect, e.g. greater penetration of Auto-Oil I vehicle measures into the car fleet. Nevertheless, 2010 does provide a useful snapshot of a generally improving situation.

WHAT WILL THIS LEGISLATIVE PIPELINE MEAN FOR FUTURE AIR QUALITY?

At the regional level

Predicted 2010 emissions (the IIASA Reference Scenario) have been run through the EMEP model to determine their impact on acidification, regional ozone air quality, secondary particulate matter

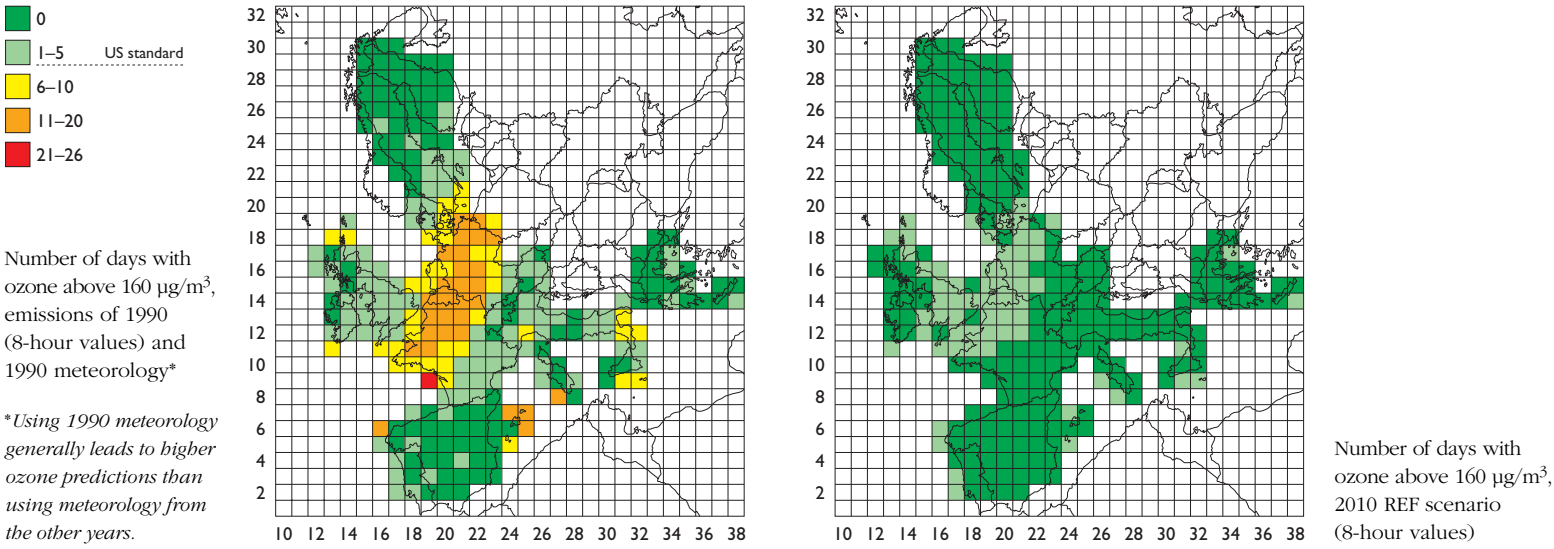
and eutrophication. The results suggests that, on a regional scale, the Reference Scenario will:

- deliver an estimated 63 per cent reduction in overall human exposure to ozone compared with 1990;
- deliver an estimated 42 per cent reduction in overall vegetation exposure to ozone compared with 1990;
- reduce the area unprotected from acidification from 24.7 per cent in 1990 to 4.3 per cent in 2010; and
- reduce the area unprotected from eutrophication from 55.3 per cent in 1990 to 40.2 per cent in 2010.

This situation can be compared to standards in other countries. For example, it is predicted that by 2010, all of Europe would be in compliance with the new US ozone air quality standard proposal.

These quantified improvements are illustrated in Figures 1 to 5. There are, however, other improvements that have not been quantified and published for the Reference Scenario. Given

FIGURE 1: COMPLIANCE WITH US HEALTH-BASED OZONE STANDARD (left: 1990 emissions; right: 2010 REF scenario)

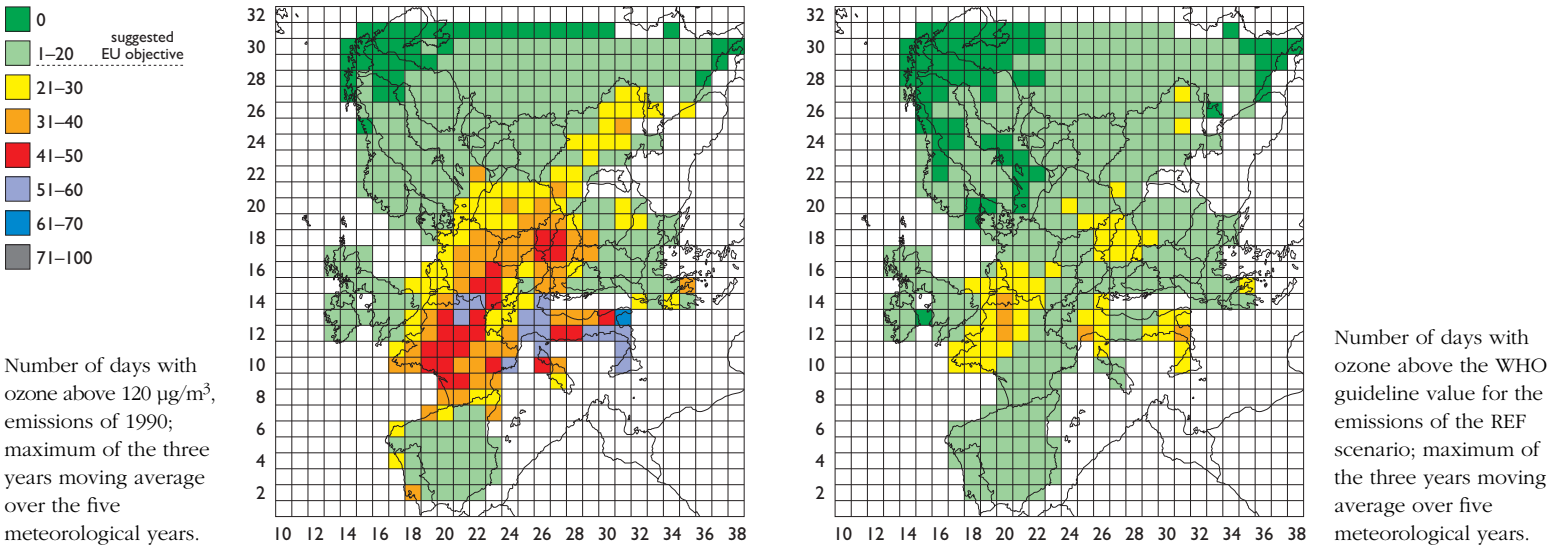


Number of days with ozone above 160 µg/m^3, emissions of 1990 (8-hour values) and 1990 meteorology*

**Using 1990 meteorology generally leads to higher ozone predictions than using meteorology from the other years.*

Number of days with ozone above 160 µg/m^3, 2010 REF scenario (8-hour values)

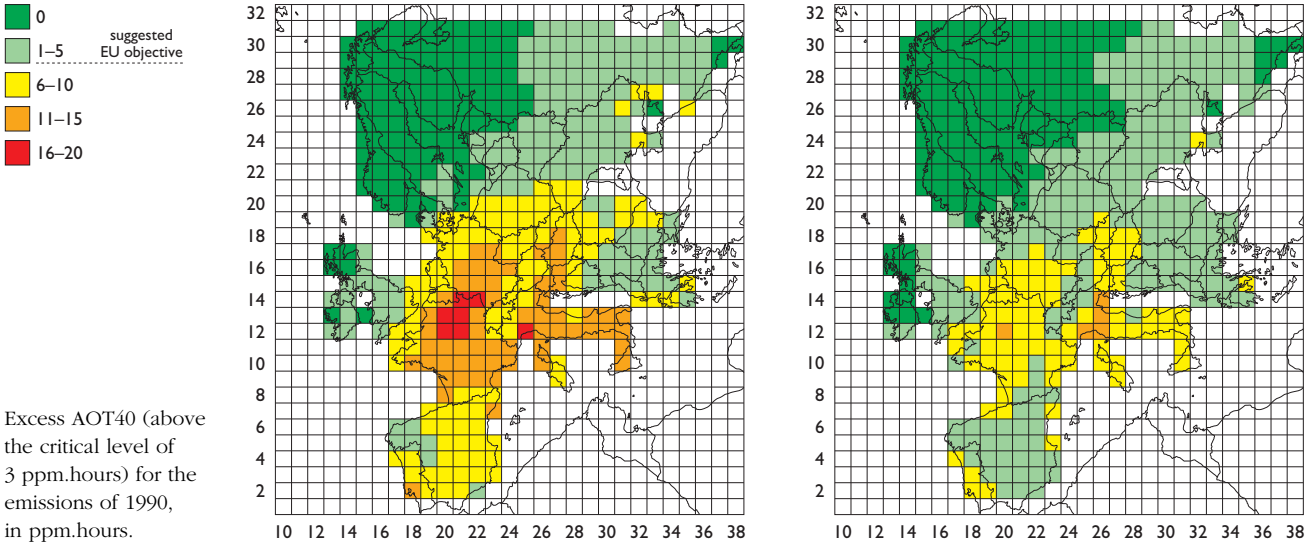
FIGURE 2: NUMBER OF DAYS WITH OZONE ABOVE 120 µg/m^3 (left: 1990 emissions; right: 2010 REF scenario)



Number of days with ozone above 120 µg/m^3, emissions of 1990; maximum of the three years moving average over the five meteorological years.

Number of days with ozone above the WHO guideline value for the emissions of the REF scenario; maximum of the three years moving average over five meteorological years.

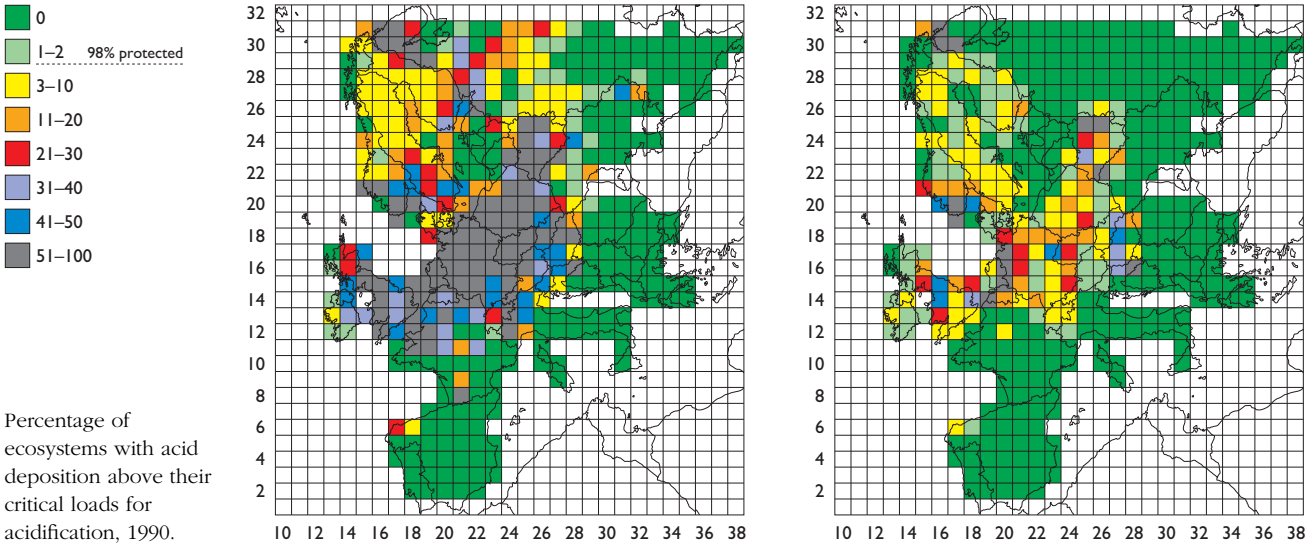
FIGURE 3: EXCESS AOT40 ABOVE THE CRITICAL LEVEL OF 3 PPM.HOURS (left: 1990 emissions; right: 2010 REF scenario)



Excess AOT40 (above the critical level of 3 ppm.hours) for the emissions of 1990, in ppm.hours.

Excess AOT40 (above the critical level of 3 ppm.hours) for the emissions of the REF scenario, in ppm.hours.

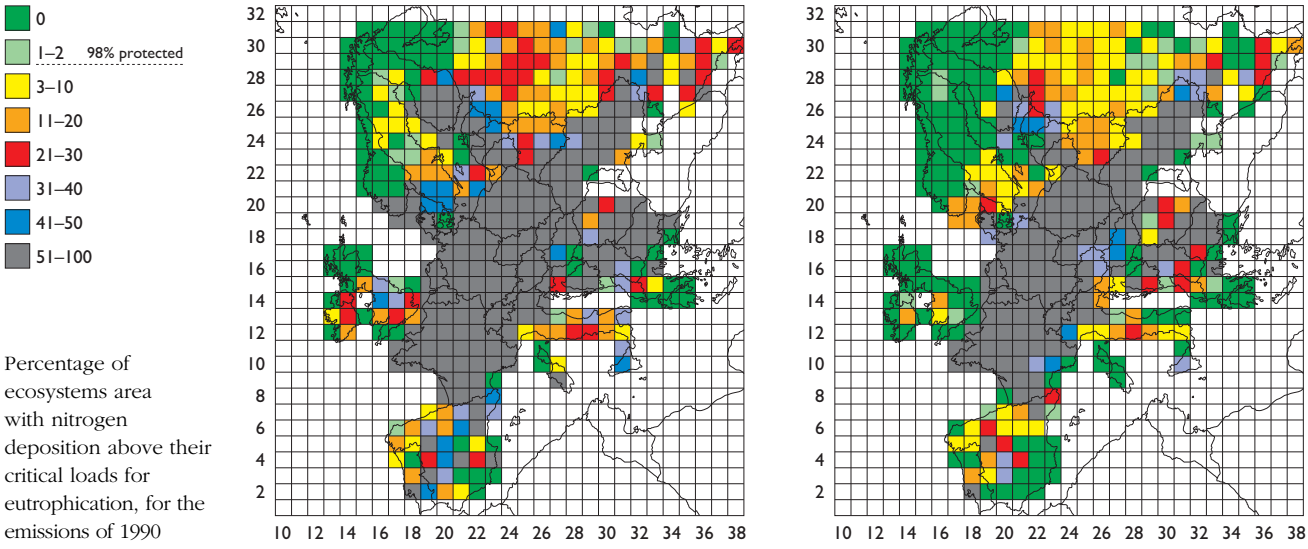
FIGURE 4: PERCENTAGE OF ECOSYSTEMS WITH ACID DEPOSITION ABOVE THEIR CRITICAL LOADS FOR ACIDIFICATION (left: 1990 emissions; right: 2010 REF scenario)



Percentage of ecosystems with acid deposition above their critical loads for acidification, 1990.

Percentage of ecosystems with acid deposition above their critical loads, REF case.

FIGURE 5: PERCENTAGE OF ECOSYSTEMS AREA WITH NITROGEN DEPOSITION ABOVE THEIR CRITICAL LOADS FOR EUTROPHICATION (left: 1990 emissions; right 2010 REF scenario)



Percentage of ecosystems area with nitrogen deposition above their critical loads for eutrophication, for the emissions of 1990

Percentage of ecosystems area with nitrogen deposition above their critical loads for eutrophication, for the emissions of the REF scenario.

the improvements listed above, it is logical to expect the Reference Scenario would also deliver significant reductions in ambient SO_x, NO_x, VOC (including Benzene) and secondary particulate matter concentrations compared with 1990.

It is important to note that the results of the IIASA work are uncertain and that, for a number of reasons, IIASA and EMEP were unable to take into account in their analyses the anticipated improvements in air quality due to:

- the Integrated Pollution Prevention and Control Directive (96/61/EC);
- the Nitrates Directive (91/676/EEC);
- controls needed to meet EU Directives stipulating air quality standards/targets for SO_x, NO_x, PM, Pb, CO, Benzene, Ozone, Nickel, Cadmium, Mercury, and polyaromatic hydrocarbons;
- the implications of Common Agricultural Policy reforms and livestock reductions on NH_3 emissions; and
- EU measures to reduce CO_2 emissions in response to the Kyoto protocol.

If these measures were also taken into account, future air quality would be predicted to be even better.

At the city level

Predictions of air quality in European cities were carried out as part of the Auto-Oil I programme and indicated significant improvements in air quality at the local scale for all pollutants, and compliance with stringent air quality targets for CO, Benzene, PM and NO_x. Further predictive air quality modelling (including the modelling of so called 'hot spots') is being carried out as part of the Auto-Oil II programme, again under the auspices of DGXI and its consultants. The results of this modelling work are due shortly but early indications (even for hot spots) are very positive.

CONCLUDING COMMENTS

It is hoped that this article will reinforce growing recognition that the focus should be on 'what *still* needs to be done', rather than 'something needs to be done'. It is also hoped that the information above offers a significant basis for optimism about air pollution in the future—optimism which is expected to be substantiated by air quality measurements over the coming years.

It is important to note that the Reference Scenario does not come cheap. IIASA's estimates suggest a figure of Euros 58.75 billion per year. From anyone's perspective, this is an enormous figure, but one that the European Union will be facing over the next 10 years or more.

In this context, industry in general is concerned that, without careful consideration, new initiatives may be poorly directed at greatly diminishing returns. This has come to light particularly in relation to recent discussions concerning binding National Emission Ceilings for SO_x, NO_x and VOCs, which would increase costs to 64.45 billion Euros *per year*. Indeed, it is easy to deduce from the recent cost-benefit analyses that costs will outweigh the benefits of such proposals, especially when taking into account the uncertainties, particularly the lack of evidence to support fundamental assumptions in the benefits calculations (see the article on Monetary Benefits on page 3).

Society's limited resources need to be allocated wisely. Consideration should now be given to switching the main focus of legislative initiatives away from air quality to areas which may be more pressing in 2010.