

Acid News

PHOTO - IN PRINTED VERSION ONLY

SVEN ÅNGERMARK

ENVIRONMENTAL SPACE

Making pollution personal

HOW MUCH in the way of emissions of sulphur and nitrogen oxides should each one of us, figuratively, be allowed to cause if the critical loads for these pollutants are not to be exceeded? That is, if everyone in Europe were to toe the line. An answer to this question has just been worked out by a consultant* as regards Sweden, Spain, Poland, and Great Britain – chosen for their differing patterns of energy, transportation, and industrial structure.

To this end a new concept, called environmental space, has been linked together with the agreed critical loads for acid deposition and eutrophication. Environmental space is the term coined in 1992 by Friends of the Earth in the Netherlands (*Vereniging Milieudefensie*) to indicate how much each individual could, on an average, use up in the

way of resources, or cause to be emitted in the form of pollutants – yet without infringing on the possibilities for coming generations to meet their legitimate needs and without leading to a decline in biological diversity. As a matter of justice, the environmental space allowance should be equal for all, independently of where the individual happens to live.

As regards sulphur and nitrogen oxides, it should be noted that it will often be cost effective to reduce emissions more in some countries than in others, because of differences in the cost of making reductions. The damage caused by the emissions will also differ according to where they arise, although the amounts of the emissions may be the same. In the case of these two pollutants, cost effectiveness has

however not been taken into account when defining environmental space.

The concept does on the other hand call for the need to control the use of several resources and the emissions of several pollutants simultaneously, so as to achieve a sustainable way of life. It will therefore be necessary to choose solutions that are at the same time cheapest and fulfill all environmental aims. For example, although it may be possible to reduce emissions of sulphur and nitrogen oxides by 90 per cent by flue-gas cleaning, it would be more cost-effective to reduce them at least in part by cutting back on the use of fossil fuels – for the simple reason that the emissions of carbon dioxide will also have to be greatly reduced,

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Acid News

is a newsletter from the Swedish NGO Secretariat on Acid Rain, whose primary aim is to provide information on the subjects of acid rain and the acidification of the environment.

Anyone interested in these problems is invited to contact the secretariat. All requests for information or material will be dealt with to the best of our ability. Acid News is distributed free of charge.

In order to fulfill the purpose of Acid News, we need information from everywhere – so if you have read or heard about something that might be of general interest, please write or send a copy to:

The Swedish NGO Secretariat on Acid Rain
Box 7005, S-402 31 Göteborg, Sweden

Tel: +46-31-10 55 90. Fax: +46-31-711 46 20

E-mail: info@acidrain.org

Internet: www.acidrain.org

Editor: Christer Ågren

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THE SECRETARIAT

The Secretariat has a board comprising one representative from each of the following organizations: Friends of the Earth Sweden, the Swedish Anglers' National Association, the Swedish Society for Nature Conservation, the Swedish Youth Association for Environmental Studies and Conservation, and the World Wide Fund for Nature Sweden.

The essential aim of the secretariat is to promote awareness of the problems associated with air pollution, and thus, in part as a result of public pressure, to bring about the required reduction of the emissions of air pollutants. The eventual aim is to have those emissions brought down to levels – the so-called critical loads – that the environment can tolerate without suffering damage.

In furtherance of these aims, the secretariat operates as follows, by

- Keeping under observation political trends and scientific developments.
- Acting as an information centre, primarily for European environmentalist organizations, but also for the media, authorities, and researchers.
- Producing information material.
- Supporting environmentalist bodies in other countries in their work towards common ends.
- Acting as coordinator of the international activities, including lobbying, of European environmentalist organizations, as for instance in connection with the meetings of the Convention on Long Range Transboundary Air Pollution and policy initiatives in the European Union.
- Acting as an observer at the proceedings involving international agreements for reducing the emissions of greenhouse gases.

EDITORIAL

Will it bite?

ABOUT A YEAR from now, the EU directive on integrated pollution prevention and control (IPPC) must have become part of the member countries' legislation. After October 30, 1999, before coming into operation all new plants covered by the directive must have obtained a permit signifying application of the best available techniques (BATs) – as will existing plants eight years later, in 2007.

The crucial question is of course what the effect will be on the environment: how the directive will result in a more efficient use of energy, reduced consumption of raw materials, and a further decrease in the emissions of pollutants. As appears however from the article on pp. 11-14 in this issue, the question is almost impossible to answer.

For one thing the definition of BATs is wide open to interpretation, making it highly probable that national and local authorities in the member countries will draw different conclusions. The very fact of BATs being in the plural shows the possibilities, and suggests that this was intentional.

Furthermore it will take years for the Commission to work out standards for the different types of installation, and even then, these so-called reference notes will not be intended to serve as absolute requirements, but merely to inform and recommend. Naturally, too, the definitions and interpretations of BATs will change as industrial techniques develop and society's ideas of what is most important for the environment themselves change.

But despite these and other doubts, this directive should not be dismissed as of little use. One of its basic principles is the well-founded one of preventing pollution. If the directive really hastens the carrying out of that principle in practice, much will have been won for the environment.

It could also bring increased access to information, such as by making it mandatory for the member countries to arrange for applications for IPPC permits to be publicly available for review and comment. The member countries should also be obliged to inform their neighbours and others, and enter into consultation, if any action might af-

fect them adversely. Although by its wording the directive allows much leeway for interpretation in such cases too, it does nevertheless represent an improvement over the present situation.

An indirect, though far from unimportant disadvantage of the IPPC directive is that it gives many interests, within both the Commission and the member countries, an excuse for not producing any new requirements for restricting emissions, or tighten up old ones, just now.

A recent example is the long-awaited revision of directive 88/609/EEC on emissions of air pollutants (SO₂, NO_x, and particulates) from large combustion plants (AN 1/98, p.6). A proposal had been expected for the summer, but referring to the IPPC directive, the Commission has already made known that it only intends to tighten the requirements (in the form of emission-limit values) for new plants. In other words, nothing will be done about existing ones. Since however by far the greater part of the emissions in 10-20 years will still be coming from now-existing installations, the effect of this move will be extremely limited.

If the effects of air pollutants in the way of ill health, acidification of the environment, damage from ground-level ozone, and eutrophication are to be dealt with in any reasonable time, emissions from existing plants will have to be markedly reduced too. It is to be hoped that the IPPC directive will aid in this, but in view of the great allowance for interpretation, it can hardly be relied upon.

It is therefore highly important that the Council of Ministers (in other words, the member countries) and the Parliament should ensure that the revised LCP directive will also include binding requirements for existing plants to reduce emissions. Whether the requirements take the form of plant-by-plant emission-limit values, or of national emission ceilings, is of minor importance. Their result is what matters.

CHRISTER ÅGREN

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and these come, just, from the burning of fossil fuels and there is no method for cleaning them.

In calculating each individual's allowance for emissions of sulphur and nitrogen oxides, it has been assumed that acid depositions and eutrophication can be kept within the bounds of critical loads if the emissions of both pollutants are reduced by 90 per cent between 1980 and 2010 – and that the emissions of ammonia would be reduced by 75 per cent (see article pp. 20-21). The environmental "space" for each European in 2010 would then be 7.8 kilograms of sulphur dioxide per year, and 3 kilograms of nitrogen oxides (calculated as NO₂).

Although it had done much better than any of the other three countries at reducing emissions of sulphur between 1980 and 1995 (see Table 1), even Sweden will have to reduce them still more. In most European countries it is mainly heating, power generating, and industrial processes that are responsible for the emissions of sulphur dioxide. The relative size of the emissions will depend primarily on the amounts of oil and coal that are burned, the sulphur content of the fuel, and the extent to which the flue gases are cleaned. In comparison with most other countries, Sweden lies well to the fore in all of these respects.

As can be seen from Table 2, concerning nitrogen oxides, all four countries are more or less level – although with marked differences in the composition of the emission sources. While the emissions are smallest per head in Poland and Spain, this does not mean that

The environmental-space concept is an attempt to control the use of several resources and the emissions of several pollutants simultaneously, so as to achieve a sustainable way of life.

these countries will escape the need to reduce emissions, overall, by 90 per cent or more. In the case of nitrogen oxides the total amounts will depend on how much fuel is used, since these pollutants are formed whenever anything is burnt, as well as on the relative use of cleaning equipment and the combustion processes themselves.

The emission sources are the same as for sulphur, but with one large addition: road traffic. The average motorist lets out more than his annual environmental allowance of 3 kilograms in all four countries. The worst sinners are in Britain and Sweden, where the average emissions of nitrogen oxides from private cars were respectively 13 and 11 kilograms per head of population in 1990. They were some-

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A strategy for lowering the concentrations of ground-level ozone is being developed by the European Commission, and a study has now been presented of the way emissions and the degree of exposure would be affected under various scenarios.

Aircraft 10

Despite a prospect of greatly increased traffic, it should be possible, according to a Dutch study, by applying uniform taxation to make aviation pay for its cost to the environment.

Integrated control 11

A fundamental change in EU pollution policy is signalled by the directive on integrated pollution prevention and control. But what the changeover will involve, and how important it will be, remains uncertain – as revealed in a penetrating examination of the strengths and weaknesses of the directive.

NOx trading 15

To help protect public health from air pollution in the eastern United States, the EPA has proposed a trading scheme for emissions of nitrogen oxides – a key component in the formation of ozone.

Found to pay 16

In a recently presented study, the costs of reducing emissions of nitrogen compounds and VOCs have been weighed against the resulting improvements to health and the environment. Even though the costs tend to be overestimated, and the benefits underestimated, the benefits were still found to exceed the costs.

Biogas gains 19

Gas obtained from slaughterhouse waste and animal manure is being used to run the buses of a municipal transport system in Sweden. Compared with buses running on diesel fuel, this brings great reductions in the emissions of nitrogen oxides and carbon dioxide.

Not guilty 22

An OECD study of the effects of environmental policies on employment concludes: Environment-related job losses look almost irrelevant in comparison with those resulting from corporate decisions and government policies. Jobs are more likely to be at risk where environmental standards are low.

Table 1. Sulphur dioxide. Emissions and the reductions required to match individual environmental space in 2010.

	Kilograms per head			Env. space kg/head/yr	Needed reduction from 1995
	1980	1990	1995		
Poland	110	86	68	7.8	88%
Spain	86	57	53	7.8	85%
Great Britain	86	66	40	7.8	80%
Sweden	60	14	11	7.8	26%

Table 2. Nitrogen oxides. Emissions and amount of reduction required to match environmental space in 2010.

	Kilograms per head			Env. space kg/head/yr	Needed reduction from 1995
	1980	1990	1995		
Poland	40	45	29	3	90%
Spain	25	32	31	3	90%
Great Britain	42	48	39	3	92%
Sweden	50	47	41	3	93%

Greenhouse gases from transport

THE EU countries could halve the increase in emissions of carbon dioxide from the transport sector that is expected for 2010 – if a number of proposals that have already been put forward or are under preparation become fully implemented. According to a communication from the Commission.¹

Transport now accounts for some 26 per cent of the EU's total emissions of CO₂, but if no further measures are taken the figure will rise to almost 40 per cent by 2010, the Commission says. It warns that such a development would make it "extremely difficult" for the EU to achieve the 8-per-cent reduction in greenhouse-gas emissions to which it is committed under the Kyoto protocol.

It is pointed out that measures are especially needed

- to improve the fuel economy of cars (see article alongside).
- to include the external costs of transport in the prices charged for it. This alone would result in a reduction of CO₂ emissions by an average of 11.5 per cent, the Commission claims.
- to revitalize the railways.
- to bring about a better integration of the various modes of passenger and freight transportation.

The Commission will shortly publish a white paper on infrastructure charging, indicating how it intends to proceed in the matter of fair and efficient pricing.

Several environmentalist organizations have accused the Commission of issuing a weak proposal. "All they [the Commission] have done is to reiterate old policies that will not even stabilize the sector's emissions," opined T&E, and representatives of Climate Network Europe expressed similar views.

¹ **Communication on Transport and CO₂: Developing a Community Approach.**

Note. According to the communication, cars account for about 50 per cent of all CO₂ emissions arising from transportation, and trucks for around 35 per cent. Aviation is responsible for 12 per cent.

Legislation may be needed to cut emissions

THE EU environment ministers have relaxed their pressure on the motor industry to produce cars which emit less carbon dioxide.

In a remarkable climb-down at their Council meeting on March 23, the ministers decided not to ask the Commission to prepare legislation to force the car makers into action – despite having said, at their previous meeting in December, that the makers' proposals for reducing CO₂ from cars were "quite inadequate."

As previously reported (AN 1/98, p.6), commissioners and ministers had looked ready to get tough with the car industry, which they say has been unacceptably slow to improve the fuel consumption of new vehicles. The manufacturers were given an ultimatum: to come close to the Commission's target of 120 grams of CO₂ per kilometre by 2005, or face legislation enforcing compliance with the target (which even so would have meant a continued increase in emissions of CO₂ from road traffic).

The industry, speaking through its trade organization, ACEA, responded with the promise of an offer to meet a target of 140 g/km by 2008, subject to a number of conditions, notably that there should be no measures against diesel vehicles. Instead of dismissing this as unacceptable, the ministers welcomed it and used it as a reason not to ask the Commission for draft legislation.

"The motor industry is leading the ministers and the Commission

a merry dance on this issue," said Beatrice Schell, director of T&E, the European Federation for Transport and Environment. "There is no offer on the table, only a promise made by ACEA's president to the EU environment commissioner. Mr Meacher [British environment minister] has admitted that the offer and its conditions are 'not perfect and not everything we wanted,' but they have still accepted it. The Council and Commission should put an end to this fancy industry footwork and start calling the tune."

In a joint statement before the Environment Council, three NGOs – T&E, the European Environmental Bureau, and Climate Network Europe – called on the ministers to pursue the negotiations with the car industry while simultaneously preparing legislation in case the talks should fail. They said ACEA had only made the improved offer after the threat of regulation had come in December's Environment Council, hence the importance of keeping up the threat.

At their meeting in December, the environment ministers told the Commission that if by the March Council "no satisfactory result was obtained [the Commission should] submit to it a proposal for a directive containing binding restrictions."

CHRIS BOWERS

Originally published in T&E Bulletin No. 67, April 1998.

Fuel efficiency insufficient

It is not at all certain that fuel-efficient cars will lead to a lower overall consumption of fuel. At any rate, experience in the US seems to point in this direction. The doubling of the fuel efficiency of new cars between 1978 and 1985, for which the Corporate Average Fuel Economy scheme (CAFE) had been largely instrumental, failed to result in achievement of the ultimate aim of cutting oil imports. People were simply driving more.

New Scientist, April 25, 1998.

Signing-up on Kyoto

On April 29 the EU environment commissioner Ritt Bjerregaard signed the Kyoto Protocol on Climate Change, thus confirming the commitment on the part of the European Union to have reduced emissions of greenhouse gases by 8 per cent between 1990 and 2008-2012. But it is still not clear how the total figure is to be shared out among the member countries. During the spring several have given notice that they want to have a renegotiation of the burden sharing that was agreed upon over a year ago. The environment ministers are expected to reach a common position at their meeting in June.

OZONE

Far-reaching work on a strategy

Every summer, over a large part of Europe, the concentrations of ozone are so great at ground level as to be damaging to vegetation and human health, and a strategy is now being developed within the European Union to come to grips with this ever more troublesome problem.

For more than a year the European Commission has been engaged in working out a strategy for lowering the concentrations of ground-level ozone. In doing so it is keeping experts from member countries, industry, and environmentalist organizations continuously informed, and inviting them in turn to provide information and views on the matter. At a gathering of such experts in March, the effects of various scenarios on emissions and ozone exposure were presented by the Commission's consultants, the International Institute for Applied Systems Analysis (IIASA).

The results have been published in the fourth¹ of a series of interim reports, of which the first two dealt with acidification, and the third with ozone. The fifth, intended to be the

final one concerned with ozone, was expected in May. This should provide valuable material for the Commission's ozone strategy, scheduled for September. It will be followed by a sixth report, analyzing the problems relating to acidification and ozone (and perhaps eutrophication as well). The results will be used in formulating the directive on national emission ceilings for acidifying and ozone-forming air pollutants (SO₂, NO_x, NH₃, and VOCs), which is expected to be ready for presentation early in 1999.

Projections for 2010

In the fourth report, various ways have traced for selecting environmental-quality targets for the ozone strategy. Various scenarios

have been developed for testing the implications: the necessary reduction of emissions, the cost of abatements, and the consequent ozone exposure. In the computer modeling, the same target year has been set as for the acidification strategy, namely 2010. A reference scenario (REF) was constructed, based on projections of energy use and business activity, backed up by data on the effects of existing and planned legislation. To show the expected levels of emissions in 2010, the effects of national and international legislation have been lumped together with those that will arise from commitments made under the Convention on Long Range Transboundary Air Pollution.

Another, the MFR scenario, illustrates the potential for emission

reductions that would result from full application of the currently available control technologies. Here the turnover time for the capital stock is taken into account – which, since it includes cars as well as such things as power plants, will mean that legislation concerning new cars, for example, will not be fully effective until all existing vehicles have been scrapped. Note, too, that only technical controls are considered. In other words, no types of structural change, such as fuel switching, more efficient use of energy, modal shifts in transportation, and so forth, are taken into account. Table 1 shows the levels of emissions in the base year, 1990, together with the projected emissions in the European Union in 2010 according to the REF and MFR scenarios.

Effects on health and vegetation

To get at the effects of the emission reductions that would result from the application of the scenarios, the estimated ozone concentrations in 2010 have been set against the degrees of exposure that are known to cause damage to health and vegetation. The formula used in each case is AOT (Accumulated exposure Over a Threshold concentration) – in other words, the number of hours in which ozone concentrations exceed a certain threshold value, multiplied by the number of ppbs over that value. In the calculations the threshold value 60 ppb is used for health, and 40 ppb for vegetation. The AOT is usually expressed either as ppb-hours or ppm-hours.

Taking emission levels as they were in 1990, the highest AOT60 occurrences were in northern France, Belgium, and Germany. Assuming mean meteorological conditions, the highest levels of AOT60 would, under the reference scenario, have come down to 3 ppm-hours in 2010 – a reduction of the excess exposure by about 50 per cent, as compared with the situation in 1990. Under the MFR scenario, the highest levels of AOT60 would have dropped to about 1.5 ppm-hours, or 70-80 per cent below the 1990 levels.

Also investigated has been the “population exposure” for AOT60, expressed as ppm-hours per person.

Table 1. Emissions of NOx and VOCs in the EU in 1990, and in 2010 according to the REF and MFR scenarios (ktons).

	1990	REF	MFR
NOx	12843	7029 (-45%)	4035 (-69%)
VOCs	13531	7311 (-46%)	4869 (-64%)

The figures are obtained by using the average exposure per person multiplied by the population total. The IIASA emphasizes however that the resulting data is inadequate for making estimates of damage to health. The figures are therefore used in comparisons of the scenarios. The average excess population exposure in the European Union is expected to decline, according to the REF scenario, by 57 per cent, and by 84 per cent according to the MFR scenario.

The critical level for farm crops and natural vegetation (excluding forest trees) has been set for AOT40 at 3 ppm-hours for the three-month growing season. Taking the average meteorological conditions for a five-year period together with 1990 emissions, that critical level is now being exceeded in most of the EU countries, and most of all – up to 12-16 ppm-hours – in France, Italy, Germany, and Belgium. The reduction of emissions resulting from the REF scenario will produce a great decline in excess AOT40, but will not increase to any great extent the area where the critical

levels are no longer being exceeded. Peak levels will come down to 10-12 ppm-hours. Under the MFR scenario they would drop to 5-7 ppm-hours.

Just as has been done for AOT60 (health) an index for vegetation exposure has been sought out. For vegetation, the average excess exposure could be expected, under the REF scenario, to fall by 36 per cent, or distinctly less than in the case of health. By MFR reckoning, on the other hand, there would be a 63-per-cent reduction in the average excess exposure for vegetation.

Setting targets

Various ways of closing the gap between the present levels of ozone and the targets set for human health (AOT60) and ecosystems (AOT40) are examined in the fourth report. Among them are:

□ Making a general move towards the long-term target by applying measures aimed at improving the situation vis-à-vis the 1990 base year. In other words the regular gap-closure concept.

□ Taking steps to improve the situation in areas where the problems of ozone are greatest – that is, by establishing a uniform target value for exposure (a kind of ceiling) to be attained everywhere.

□ Combining the gap-closure and ceiling approaches.

One reason for investigating and possibly combining the above approaches is that each will result in a quite different allocation of the emission reductions – both as regards the pollutants to be reduced (NO_x and VOCs), and the size of the

Table 2. Emissions and control costs for the reference scenario (REF) and the combined AOT40 and AOT60 scenario (D7). Changes in per cent from the base year 1990.

	NOx-emissions				VOC-emissions				Costs million ECU/yr
	REF		D7		REF		D7		
	ktons	change	ktons	change	ktons	change	ktons	change	
Austria	115	-51	115	-51	305	-29	305	-29	0
Belgium	209	-42	131	-64	196	-43	105	-69	582
Denmark	128	-53	128	-53	92	-44	87	-47	8
Finland	155	-44	155	-44	108	-48	108	-48	0
France	811	-50	579	-64	1171	-45	937	-56	1188
Germany	1296	-51	1224	-54	1397	-55	976	-69	1380
Greece	324	-17	322	-18	205	-32	177	-41	183
Ireland	74	-31	58	-46	46	-59	46	-59	3
Italy	1166	-42	959	-52	1079	-42	837	-55	724
Luxembourg	10	-52	9	-57	8	-56	8	-56	1
Netherlands	270	-50	270	-50	203	-58	149	-69	216
Portugal	196	-6	114	-45	144	-34	124	-43	483
Spain	892	-23	682	-41	794	-25	616	-42	409
Sweden	220	-36	220	-36	287	-34	287	-34	0
UK	1163	-56	1163	-56	1276	-52	921	-65	713
EU15	7029	-45	6129	-52	7311	-46	5683	-58	5892

reductions to be made by different countries. The costs of abatement and the resulting environmental improvements will also be different.

Consequently a large number of so-called optimized scenarios have been investigated by IIASA. These are where the computer model finds the least-cost allocation of the emission reductions that are needed to attain the desired target. They include scenarios with various ceilings and different percentages for gap closure (for AOT60 and AOT40), as well as scenarios with combined targets. The "central" combined scenario, named D7, is described further on in this article.

Compensation mechanisms

In response to the Council Conclusions of December 16, 1997, concerning the EU's acidification strategy (see AN 1/98, p. 5), a mechanism has been developed to decrease the influence of single environmental targets (single grid cells on the EMEP maps) on the optimization results, while still preserving the overall level of ambition. This compensation mechanism, which is entered in the computer's optimization runs, allows a violation of environmental targets at individual grid cells as long as the excess over the target is compensated by extra

improvements in other grid cells in the same country. It is used in gap-closure scenarios only, as a means of overcoming the problem of extreme situations in isolated grid cells having an inordinate effect on the outcome of optimization.

In the scenarios that have been run so far, for AOT60, the compensation mechanism has been applied for all the grids of a country, and also for five meteorological years – the excess in some years being allowed to be compensated by extra improvements in other years. Moreover, population-weighting is used, so that excess AOT60 is compensated on a population-adjusted basis. Thus a small excess of AOT60 in a big city will have to be compensated by larger improvements in other, less populated areas. The population-exposure index of the optimized solution (after application of the compensation mechanism) may not exceed the index resulting from the original target for any country.

In a like manner, compensation for AOT40 is calculated on an ecosystem-area adjusted basis, with account taken of natural ecosystems as well as agricultural areas.

In optimizing ceiling scenarios for AOT60, any extreme situation (the worst of five meteorological years

Air quality discussed

The proposal for air-quality standards for sulphur dioxide, nitrogen dioxide, particulate matter, and lead, which was presented by the Commission last October (see AN 2/97 and 4-5/97), was up for discussion at the meeting of the EU environment ministers on March 23. A common position should now be emerging from their June meeting. The most controversial parts of the proposal were the standards for particulate matter and the possibilities for derogation. The views given by the European Parliament in May largely supported the Commission's proposal. The Parliament can however have little influence on the outcome.

No to less traffic

At the end of April, the EU ministers of transport and environment met at Chester in England, at the initiative of the British government, for "informal talks." There was no debate. Each member country simply presented its views on a number of matters, one being whether technical measures to mitigate pollution should be supplemented by steps to reduce the overall demand for transportation.

According to report, the idea of restricting the demand for transport was supported by several member countries. The EU transport commissioner Neil Kinnock made it clear however that it was not on his agenda. As he said afterwards: "Nobody is proposing a head-to-head attack on rising transport volumes. That would be unrealistic." The solution, he added, was to ensure that as the volume rose – "as it will" – it would be spread much more evenly over all modes.

Environment Watch: Western Europe. May 1, 1998.

Solvents directive

Legislation that should achieve a two-thirds cut in the emissions of volatile organic compounds from the use of organic solvents in industry by 2010 is set to go onto the EU statute book later this year, after the environment ministers had finalized an agreement on the text at their meeting in March. The ministers had reached a consensus on the directive already last June (see AN 4-5/97, p.10), but had to wait for the European Parliament's advisory opinion, delivered in January, before they could complete their accord. As expected, the ministers rejected virtually all of the Parliament's thirty-two amendments.

Environment Watch: Western Europe. April 3, 1998.

Differing on cars and fuels

As might have been expected, when they met in March the environment ministers were unable to agree to the Parliament's proposals after its second reading in February of the directives on fuel quality and emission standards for cars. The matter is now being put through a conciliation procedure, where a proposed directive on emission standards for vans and other light commercial vehicles will also be discussed. The latter was up for reading in the Parliament in April, but again it appeared that the Parliament and the Commission held widely divergent views.

The Parliament is mostly wanting stricter requirements, both for fuels and vehicles. But the greatest difference concerns the requirements for 2005. Whereas the Parliament wants to make them compulsory, the Commission would have them merely as guidelines. In most cases the Parliament's views largely coincide with those of the T&E and other environmentalist organizations.

Acidification strategy

The Commission's proposal for a strategy to combat acidification (COM(97)88, presented in March 1997) came up for debate in the Parliament in May. While approving the strategy, the Parliament is now urging the Commission to form the revision of the directive that is planned for 2004 so that "in principle depositions everywhere will come under the critical loads" by 2015. A number of measures for limiting the emissions of sulphur and nitrogen oxides from shipping are also proposed. The Commission should, too, develop a strategy for dealing with the environmental burden arising from agriculture (such as the emissions of ammonia).

Sulphur in oil

At its sitting on May 13, the Parliament passed approval of the Commission's proposal for reducing the sulphur content of certain liquid fuels, while at the same time insisting that it should be extended to cover bunker fuels and marine diesel. It also wanted a halving of the sulphur content of gas oils, from the 0.2 per cent proposed by the Commission to 0.1 per cent. The Parliament further thinks the directive should be legally based on Article 100a of the EU treaty, instead of Article 130t as proposed by the Commission. In other words, it wants rules for harmonization of the national requirements, instead of minimum requirements. This would greatly increase the Parliament's influence over decision making.

used in the model) would be excluded. In practice this means that taking each grid cell separately, the meteorological conditions of the year in which the environmental target is most difficult to attain would be ignored, but the target still attained for all the other four years.

Several targets in one scenario

An infinite number of environmental-quality targets can of course be defined, as can combinations of such targets. In this type of analysis, a main task is to find an "appropriate" balance between vegetation and health-related targets on the one hand, and improvements at hot spots together with a large-scale move towards the long-term target on the other. Such a balance is illustrated in the report by the D7 scenario in which several targets are combined, aiming at:

□ An overall reduction of AOT60 (health-related target) by at least 60 per cent.

□ A similar reduction of AOT40 (vegetation-related target) by 35 per cent.

□ Ensuring improvement in areas that were suffering from the highest exposure to ozone at that particular time, by prescribing that the maximum AOT60 should be kept below 3 ppm-hours, and the maximum AOT40 below 10 ppm-hours.

The cost of reducing emissions in accordance with D7 is put at ECU 5.9 billion per annum in 2010 for the EU as a whole (Table 2). Allocation of the reductions at least-cost for attainment of the targets would entail cutting the emissions of NO_x by 7 per cent and those of VOCs by 12 per cent (over and above the reductions already called for in the reference scenario). The result would be a 74-per-cent improvement in the cumulative population-exposure index, and 52 per cent in the cumulative vegetation-exposure index, compared with 1990.

The largest improvements in the population-exposure index (over and above those obtained through the reference scenario) are found to occur in the UK and Denmark (-27 and -25 percentage points respectively). In most other countries the improvement would lie between 10 and 20 percentage points. A similar pattern of improvement can be seen in the vegetation index.

As regards the additional cost of reduction in accordance with the D7 scenario, around 60 per cent

would have to be spent on control of VOCs from stationary sources, 20 per cent on NO_x from such sources, and 20 per cent on NO_x/VOC control of mobile sources.

Much remaining to be done

It should be noted that the purpose of running all these scenarios has been to show the likely effect. Before finalizing its proposal for an ozone strategy, the Commission should, among other things, establish interim targets for environmental quality for the year 2010. Much analyzing will therefore still be necessary.

For its fifth interim report, the IASA will be investigating:

□ Interactions between the ozone and the acidification strategy.

□ The effects of assuming a different energy scenario.

□ The role of non-EU countries, and particularly of those ten now seeking admission.

Further, some of the basic input data, such as the country-by-country energy scenarios and abatement costs, are to be reviewed and updated during the spring.

All measures worthwhile

In connection with its ozone strategy, the Commission has asked AEA Technology to evaluate the economic benefits of reducing emissions. At the March meeting with the experts, a preliminary assessment was presented of an analysis based on some of the scenarios in IASA's fourth interim report. The benefits for health were found to be outstanding, although the effects on crops and visibility would also be considerable. They would be negligible on the other hand for materials and forest growth. Damage to ecosystems and cultural objects was not assessed. The consultants' preliminary evaluation shows in any case that the benefits would outweigh the costs in all the scenarios, the MFR as well. A detailed description of the methodology used for this evaluation, and also the results, will appear shortly in a report.

CHRISTER ÅGREN

¹ *Fourth Interim Report to the European Commission: Cost-effective control of acidification and ground-level ozone.* M. Amann et. al. 1998. International Institute for Applied Systems Analysis, Austria.

Bad air in cars

According to a study made in Great Britain, people riding in cars are exposed to much higher levels of air pollution than those using other modes of travel. The concentrations of volatile organic compounds inside their cars will be four to six times higher than the urban background levels, and those of nitrogen dioxide three times higher, whereas the levels of these pollutants to which pedestrians and cyclists are subjected are only 2 and 1.5-2 times higher. For bus passengers they are somewhere between the figures for pedestrians/cyclists and car users.

The study was commissioned by the Department of Environment, Transport and the Regions, and carried out by the Environmental Transport Association in cooperation with the Institute for European Environmental Policy.

Road user exposure to air pollution. Literature review. By D. Taylor and M. Ferguson. Published by ETA, 10 Church Street, Weybridge KT13 8RS, England. Fax. +44-193 282 9015.

Carless in Naples

One Sunday each month the centre of Naples is closed to motor vehicles between 10 and 13 o'clock. The start for this move, introduced by the mayor, Antonio Bassolino, as a means of improving the city's air quality, came on January 25 this year. Every Wednesday, too, cars not equipped for exhaust-gas cleaning are banned from the area, and at weekends two of the principal streets are reserved for pedestrians.

Europe Environment No. 516. February 10, 1998.

Lower speeds, fewer deaths

Lowering the average speeds by ten kilometres per hour on non-urban roads in Sweden would save 140 lives a year, cut the numbers of badly injured by almost 700, and of these slightly injured by 1750, according to estimates made by the National Association for the Promotion of Road Safety (NTF). The slower driving would also result in a lowering of the emissions of carbon dioxide, nitrogen oxides, and hydrocarbons by 500,000, 4500 and 2300 tons a year. There would also be a saving of 700,000 tires. Although the extra costs from lengthened travel time would be close on 4 billion kronor a year, the net gain to the community would amount to 6 billion kronor.

Trafik & Miljö. No. 1, 1998.

GERMANY

Outlook is said to be black for the forest

IN GERMANY, 80 per cent of the forested area is getting an overdose of acid fallout, and more than 60 per cent of the trees show clear signs of damage. On the same day as the situation was made public, the German environmentalist organization Robin Wood staged a demonstration outside the Ministry of Agriculture under the slogan *Der Wald sieht schwarz*.

Dr Rudolf Fenner, spokesman for Robin Wood, affirmed that the annual reports of thinning of the crowns in forest trees gave far too favourable a picture of the trees' actual state. Dr Fenner claimed that the limit for damage should be set at 10-per-cent thinning, instead of the 25 per cent in the official view. Whereas the authorities reckon 25 per cent of the trees to be damaged, by Robin Wood's accounting the figure would be nearer 60 per cent. While admitting that it may be difficult to distinguish between natural and man-induced damage, Fenner insisted that the marked increase in the proportion of damaged trees during the eighties, culminating in the present steady high

figures, was indicative of an evident human disturbance of the ecosystems.

Dr Fenner was also careful to draw attention to the associated problem of soil acidification, which is perhaps still more serious. As he put it: "There is a time-bomb ticking in the forest soil." According to a report published last year by the German Ministry of Agriculture, 80 per cent of the soil in the forest areas is being subjected to depositions of acid that are higher than the critical loads.

The measures that Robin Wood claimed were necessary were:

- A reduction of the emissions of nitrogen oxides, in part through measures concerning road traffic.
- Reduction of emissions through measures in the agricultural sector, such as encouragement of ecological farming methods.
- The introduction of ecological forestry practices.

For further information, apply: Robin Wood, Nernstweg 32, 22765 Hamburg, Germany. Fax +49-40-392 848.

Proposing a policy

The introduction of a European tax on air transport of 0.18 ecu per litre of fuel could halve the projected growth in emissions from civil aviation in Europe, according to a policy paper¹ by the European Federation for Transport and Environment.

Calling for a balanced and integrated policy for sustainable development in the aviation sector, the T&E makes the following proposals:

- A Europe-wide ban on any form of direct or indirect financial support for the aviation sector (applicable both to airports and airlines).
- Abolition of all tax benefits for the sector (VAT should be payable both on tickets and aviation fuel; abolition of tax-free sales).
- Introduction of a Europe-wide environmental charge on aviation.
- Tougher standards for aircraft emissions and noise.

¹ **Sustainable Aviation – the need for a European environmental aviation charge.** Report 98/1. Available free of charge from T&E, Bd. de Waterloo 34, 1000 Brussels, Belgium. Fax +32-2-502 9908. E-mail: tande@knooppunt.be. Also available in a four-page summary (in English, French, German, and Spanish), entitled "Clear Skies."

Aircraft and climate

Aircraft emissions may have more than half the global warming potential of emissions from road transport, according to a draft of a new study by IPCC, the UN's Intergovernmental Panel on Climate Change, released in April.

Aircraft influence global warming in two main ways:

First, they emit carbon dioxide: aircraft consume around 3 per cent of the fossil fuels burned world-wide, a sixth as much as motor vehicles.

Second, they produce nitrogen oxides that are converted to ozone in the upper troposphere, between 9 and 13 kilometres above the ground, where most aircraft cruise. While ozone in the stratosphere blocks harmful ultraviolet radiation, lower down in the troposphere it also acts as a powerful greenhouse gas. According to the IPCC draft, the ozone produced by aircraft in the troposphere has as much effect on global warming as the CO₂ they produce.

This means that aircraft may be responsible for 5 to 6 per cent of the warming caused by greenhouse gases. But some authors of the study say the report's estimates are based on outdated models of the formation of ozone in the atmosphere, and the true figure could be 10 per cent or more.

Aircraft are currently not covered under international agreements for limiting greenhouse gases.

New Scientist, April 11, 1998.

Making it pay for the environmental cost

AIR TRAFFIC is steadily increasing, with indications of tripling between 1995 and 2015. One reason for the rapid increase is that civil aviation is almost entirely exempted from taxation. From a Dutch study¹ it does however now appear that it would be technically possible to introduce an all-European tax system, with appreciable gains for the environment.

Today almost everything concerning air travel is tax free. There are neither taxes on fuels nor value-added taxes. The one exception with any effect on the environment is the landing charges related to emissions and noise that are applied in Sweden and Switzerland (see AN 4-5/97, p.13).

As matters stand, there are simple explanations for this. If one country should slap a tax on fuel, aircraft would tank up somewhere else. International conventions also stand in the way.

The Dutch study, which has been financed by the EU Commission together with the governments of Denmark, the Netherlands, Norway, and Germany, shows how it would be possible, by applying uniform taxation over the whole EES area (the EU and Norway), to make aviation pay for its cost to the environment. Five alternatives are examined:

1. A tax on emissions, based on an estimate of the aircraft's emissions of carbon dioxide, nitrogen oxides, hydrocarbons, and sulphur when flying within the European airspace. The income would be divided among the EES countries. A similar tax would be exacted in addition by the airport, according to the aircraft's emissions at landing and take-off (the LTO cycle).

2. An emission tax, with the difference that the income would be divided among the operators.

3. An emission tax based solely on emissions during the aircraft's LTO cycle, with the income going to the country where the airport is situated.

4. A tax on aviation fuel, based on the average emissions of carbon dioxide and other pollutants per unit of fuel consumption, with the

addition of an emission tax for the LTO cycle (in combination with tighter NOx emission requirements).

5. A passenger tax, exacted on each ticket.

The tax/charge level that has been considered would correspond to 0.23 ecu per litre of aviation fuel. When subsequently applied in the various alternatives, it does however produce greatly differing environmental effects.

The best effect would come from a tax purely on emissions. As regards carbon dioxide, the emissions from European aviation would be 30 per cent lower in 2025 than they would be under a status quo. If the income were returned to the airlines, the emissions would still be 25 per cent lower.

But even the most successful solution would have only a limited effect on the volume of traffic. The annual growth would be slowed only from 4 to 3.7 per cent, and the rise in price for a single 500-kilometre flight would be no more than 1-6 ecus.

Several factors will have to be taken into consideration when choosing a system of taxation for air transportation. A tax on fuel only would entail the risk of operators fuelling their aircraft at places just outside the EES, and one on ticket sales could have a similar effect.

Although an emission tax could produce side effects, the authors of the study deem them to be surmountable, for instance by subsidizing tourist resorts in Greece that might lose visitors to Turkey.

While it may be taken as proven that aviation could be taxed, and successfully, it is more doubtful whether the European governments will be prepared to introduce a tax that would apply throughout the EES. Most states want the right to decide on their own taxes.

MAGNUS NILSSON

¹ *A European Environmental Aviation Charge. Feasibility study.* Centre for Environmental Technology and Energy Conservation, Delft University, The Netherlands. Price 63 guilders. Can be ordered from Milieuboek, Amsterdam. Fax +31-20-623 5203. Also available on internet: www.smn.nl/avia2.htm.

POLLUTION

Integrated control imminent

Offering the prospect of a dramatic reshaping of industrial regulation in the European Union, the directive on integrated pollution prevention and control will soon have to be incorporated in the law of the member countries. The question is how important the transformation will be.

Directive 96/61/EC on Integrated Pollution Prevention and Control (IPPC)¹ is set to become a focal point for efforts to reconcile the goals of environmental protection and industrial development in the EU. Its main thrust is the establishment of an integrated approach for the licensing of installations in the major polluting industries. This is a fundamental change in EU pollution policy, compared to the more traditional route of applying separate controls for air pollution, water pollution, and waste management. Indeed, elements of the old legislation, such as Directive 84/360/EEC on emissions to air from industrial plants, will cease to apply as IPPC takes effect.

The IPPC directive applies to the larger industrial installations in five major sectors, covering energy,

metals, minerals, chemicals, and waste management, and a group of other assorted sectors including pulp and paper production, textile treatment, tanning, food production, and the intensive rearing of poultry and pigs. Licensing of installations in accordance with the directive has not yet started in the member states, although the critical implementation period is nearly upon us. The deadline for transposition into national law is October 30, 1999. After this time all new installations covered by the directive must obtain a permit before they begin operating. A period of eight years is allowed to bring existing installations under control.

The directive therefore offers the prospect of a dramatic reshaping of industrial regulation in the EU, beginning next year and building to-

wards complete application by 2007. But what exactly will this transformation involve, and how important will it be? These questions are considered below, by looking at the core philosophy of IPPC, the central requirements of the directive and its main strengths and weaknesses.

Core philosophy

The integrated approach of the IPPC directive is reflected in its stated purpose of achieving "a high level of protection of the environment taken as a whole." The concept of integrated environmental protection is by no means unique to the directive, however. Indeed, it is widely applicable across the environmental policy arena. This was demonstrated by the OECD in 1991, when it adopted a Recommendation and guidance on IPPC² which went well

beyond industrial licensing. The OECD recognized that “substances can move among environmental media (air, water, soil and biota) as they travel along a pathway from a source to a receptor,” and that “controls over releases of a substance to one environmental medium can result in shifting the substance to another environmental medium.” Accordingly, it was recommended that “member countries practice integrated pollution prevention and control, taking into account the effects of activities and substances on the environment as a whole and the whole commercial and environmental life cycles of substances when assessing the risks they pose and when developing and implementing controls to limit their release.”

The OECD also spelled out ways in which the philosophy of IPPC could be given effect. As well as industrial permitting, a number of other routes were suggested. They included linking environmental instruments with land-use planning, the wider application of environmental impact assessments includ-

ing, for policy proposals, the establishment of integrated inspection and enforcement authorities, and the use of economic instruments.

Thus IPPC has a broad sense and a narrow sense. In the broad sense illustrated by the OECD, the philosophy and underlying rationale for

By no means the last word in integrated environmental policy

integration are more important than any individual means of delivery. The EU directive, meanwhile, demonstrates the application of IPPC in a narrower sense, by defining one of several specific ways to put the theory into practice. The directive is therefore only a subset of the broader IPPC philosophy, and is by no means the last word in integrated environmental policy.

Principal requirements

PERMITTING REQUIREMENTS AND BEST AVAILABLE TECHNIQUES. When

an installation first comes under IPPC it must obtain a permit allowing it to operate. Permits must include conditions to protect air, water and land, and these conditions should be “fully coordinated ... to guarantee an effective integrated approach.” The spirit of the directive therefore favours the determination of controls in an holistic manner, rather than use of conditions fixed separately for different media.

The key performance requirement of the IPPC directive is Best Available Techniques (BAT). BAT is defined in the directive, but its practical interpretation for industry sectors or installations is left for the member states. In simple terms, the selection of BAT involves balancing the desirability of environmental protection against the costs of achieving it. This is because, within BAT, “available” is defined as meaning economically and technically viable, taking into consideration “costs and advantages.” This leaves considerable room for interpretation. As a result BAT does not reflect a single, fixed level of pere

Area	Strength	Comments
Integrated approach	Advances from previous legislation dealing separately with air, water, waste, etc. Makes operators and authorities think about all emissions and impacts in design of whole plant ('clean technology') rather than promoting 'end-of-pipe' techniques.	May be difficult to find right balance to turn theory into practice. Some member states may adopt over-complex methods to weigh different effects, or alternatively retain medium-specific controls with integration on paper only.
BAT	In theory, BAT allows for optimal balance of environmental, social and economic costs to be achieved in fixing controls.	Difficult to turn theory into practice. Relies on adequate technical competence and commitment of regulators. Some ambiguity/discretion in text also may leave result open to abuse/political manipulation.
Environmental impacts	Brings wide range of environmental impacts previously excluded from industrial licensing into consideration, eg waste minimization and recycling, energy efficiency, site restoration, consumption of raw materials and water.	Limited detail, and some ambiguity, as to how these factors are to be considered and permit conditions defined. Nevertheless, much better in than out, and a significant advance on previous legislation.
Site-specific approach	Permit conditions are to take account of local geography and environmental conditions. Allows permit to be tailored for local factors, eg by responding to regional pollution problems, geology, environmental quality, etc.	Increases complexity of permitting, but for good reason. Some risk of misuse of discretion provided, or simply poor administration.
Environmental quality standards	Requirement to comply with environmental quality standards takes precedence if BAT alone would permit higher emissions.	Important safeguard, but limited to topics where environmental quality standards exist.
Trans-boundary effects	All permits must contain provisions to minimize long-distance and transboundary pollution. Bilateral consultation mandatory in event of significant negative impact.	Outcome of transboundary consultation is a matter of bilateral relations, not EU law. Directive provides no rights to affected member state beyond consultation, though in theory the significance attached to an environmental effect should be the same whether inside or outside country of origin.
Provision of information	Results of monitoring are to be made public. Polluting Emissions Register (PER) to provide an inventory of principal emissions and sources.	Usefulness of PER will depend on structure and content, yet to be established.
Exchange of information	Exchange of information will allow production of BREF notes. These should support member states' application of IPPC and may increase transparency.	Utility of the BREF notes will depend upon their structure, content and quality. They must be taken into account by member states but are not definitive.

formance, but rather offers scope to weigh various factors in determining the appropriate level of control for a particular circumstance. In this exercise, special consideration must be given to certain factors listed in the directive. These include the use of low-waste technology, the use of less hazardous substances, the furthering of recovery and recycling, the consumption of raw materials and water, and energy efficiency.

Reaching a judgment on BAT is a vital prerequisite to laying down individual permit conditions, and particularly emission limit values (or "equivalent parameters or technical measures"), which must be set for pollutants likely to be emitted in significant quantities. Such limits usually will be based on BAT, "taking into account the technical characteristics of the installation concerned, its geographical location and the local environmental conditions." If attainment of an environmental quality standard would not be provided by BAT alone, then stricter conditions must be included in the permit. All permits must also contain conditions to minimize long-distance and transboundary pollution. An "indicative" list of the main pollutants for which emission

limits may be required is set out in the directive (and includes the main acidifying substances), although this does not mean that limits should not be set for any substances excluded from the list.

The directive additionally specifies a number of general principles of which authorities must take ac-

*Operators must ensure
no significant pollution
is caused*

count in determining permit conditions. Specifically, operators must take all appropriate preventive measures against pollution, ensure no significant pollution is caused, avoid waste production and recover or safely dispose of waste produced, use energy efficiently, take measures to prevent accidents, and clean up the site upon cessation of the industrial activity.

Fundamentally, the IPPC directive establishes a procedure and the principles to be applied in setting permit conditions, rather than laying down any explicit operating re-

quirements itself. Considerable discretion is afforded to national authorities, both in determining BAT and in taking account of local factors when setting emission limits.

After initial authorisation under IPPC, any substantial modification to an installation will require further approval. Authorities also must reconsider permit conditions "periodically," or immediately in certain cases, such as when excessive pollution occurs or technical developments allow significant emission reductions without excessive cost.

EXCHANGE OF INFORMATION AND EMISSION LIMIT VALUES. The directive requires an exchange of information between member states and the Commission on national assessments of BAT and emission limits. The results of this process are to be published by the Commission. The directive states that this should happen every three years, with the first publication based on data due to be submitted by April 30, 2001. In practice, however, the Commission has already initiated the information exchange. In particular, an IPPC Bureau has been established to support the production of a series of so-called BAT Ref-

Area	Weakness	Comments
Ambiguity	Some parts of the directive are ambiguous, eg due to compromises during negotiation. Hence some legal requirements are unclear and open to interpretation.	May leave decisions open to legal challenge, or allow an 'escape route' for industry in some areas if authorities wish to justify lesser environmental protection. Ambiguity is a problem in much of EU legislation, not just in IPPC.
Uncertain end result	Wording of directive, eg for definition of BAT and determination of permit conditions, leaves significant discretion to national authorities as to how to balance costs of control, environmental benefits, local factors etc. So no specific end result is guaranteed by IPPC.	Scope for variations in BAT and permit conditions is legitimate, but possibility of misuse exists. Some safeguards provided by requirement for 'high level of protection' and 'no significant pollution' plus precedence of environmental quality standards. Exchange of information may reveal any gross disparities.
Review of permits	Unless a specified situation arises in the meantime, reconsideration of permits must be undertaken only 'periodically'. Lack of specific period creates open-ended obligation.	Safeguard is that any substantial change in BAT should demand permit reconsideration before periodic review anyway. But likely to be difficult for a third party to press case for this if regulator is inactive. Publication of BREF notes every three years should inform any such argument.
Enforcement	Directive states that permit conditions must be complied with but is silent as to how to respond to violations. May be difficult for third parties to check/enforce compliance in practice if regulatory action is lacking.	This is typical of EU environmental law, on grounds of subsidiarity.
Public consultation	In contrast to some other measures (eg EIA directive 85/337/EEC), while public must be able to review IPPC applications, there is no explicit obligation for regulators to take account of public comments.	Domestic public law will determine member states' requirements to consider public comments in absence of explicit EU obligation. Regulator should apply IPPC objectively and, depending on legal standing/access to justice, may be required to justify decision.
Aggregation of effects	IPPC provides for permitting of individual installations, but some environmental problems, eg acidification, derive from multiple sources in combination.	Other measures, eg environmental quality standards, emission ceilings, etc, can provide a link to or basis for control which takes account of other sources. But limited existence of such measures at EU level.

erence (BREF) notes, which are scheduled to cover all of the main IPPC industry sectors by 2002. Once published, the BREFs are to be taken into account by member states in their own determinations of BAT. The BREFs therefore provide an EU mechanism to inform and influence the consideration of BAT by member states – and by extension the emission limits and other controls to be included in permits – but without defining any specific levels of performance which must be met.

The exchange of information also may identify the need for action to set EU emission limit values for specific sectors or substances. This would involve the adoption of “daughter” directives to IPPC through the usual EU legislative procedure. It appears unlikely that any such daughter directives will be established in the foreseeable future, however, as a number of member states argue that they would conflict with the flexibility and site-specific approach embodied in the IPPC directive. In the meantime, the standards specified in various existing EU instruments – such as Directive 88/609/EEC on large combustion plants – are to serve as minimum emission limit values. This status as “minimum” requirements means that if an objective assessment of BAT were to determine a stricter obligation, this should be reflected in the IPPC permit.

PUBLIC INFORMATION AND TRANSBOUNDARY CONSULTATION. Member states are required to ensure that applications for IPPC permits are made available for public review and comment before a decision is reached. The decision, the permit, and the results of any monitoring of releases also must be publicly accessible. The requirements for public release of data are subject to the restrictions set out in Directive 90/313/EEC on access to environmental information. This means that material may be withheld from the public on grounds of commercial confidentiality or for certain other reasons.

The directive also addresses transboundary effects. A member state must provide copies of the permit application for an installation in its own territory to any other member state which may suffer a significant negative environmental effect. The member state receiving the application must then allow its own public to comment on the ap-

plication. This provides a basis for consultation between the member states that are concerned.

THE POLLUTING EMISSIONS REGISTER. An inventory of principal emissions and responsible sources under IPPC is to be published every three years, using data supplied by the

Directive provides only a framework for industrial regulation

member states. The format and particulars of this so-called Polluting Emissions Register have yet to be determined, so it is not presently clear exactly what data it will provide, or to whom.

Strengths and weaknesses

Key strengths and weaknesses of the IPPC directive are shown in the tables on the preceding pages. As noted in the comments columns, many of the points on either side may be tempered by other aspects of the directive or other items of EU legislation.

Summary and conclusions

In one fundamental way IPPC is a significant step forward in EU environmental policy. It marks a shift from medium-specific to multimedia control, by integrating the regulation of industrial emissions to air, water, and land. Moreover, it complements this integrated control of emissions by bringing other important factors, such as energy efficiency and waste minimization, into the frame of regulation. Applied properly, therefore, IPPC should help to promote the increased use of clean and efficient technologies, rather than end-of-pipe approaches which simply shift pollution between media, or prevent emissions at the cost of increased consumption of energy or raw materials.

In some other respects, however, IPPC is a double-edged sword. This is because some potential weaknesses stem directly from the flexibility and reliance on the discretion of national authorities which are central to the design of the directive. On the positive side, we have the latitude offered by IPPC to find the optimal balance of environmental, social, and economic costs, and the best way of applying controls in the light of site-specific fac-

tors. A thorough and empowered regulator should be able to make good use of this tool as part of a wider move towards sustainable development. On the negative side, the very same discretion, complemented by more than a touch of ambiguity, means that the end result of applying IPPC is uncertain and potentially open to abuse. An under-resourced, under-qualified, incompetent or politically-misdirected regulator could apply the directive to much lesser effect. Safeguards such as environmental quality standards and the production of BREFs provide only limited defence against this, while truly effective EU mechanisms to address such problems are presently lacking.

Overall, the integrated approach of IPPC can be welcomed, together with some of the specific elements of control which the directive introduces. However, we must remember that the directive provides only a *framework* for industrial regulation, not a detailed prescription of every requirement and procedure to be followed. It does not negate the need for continued efforts in areas such as checking the application and enforcement of EU environmental law, or providing improved access to justice. Nor does it define every end-result to be achieved, so it is not an automatic solution to all of the environmental impacts associated with industry. This is particularly true for issues which have a strong EU or even international dimension, such as acidification or climate change.

It would be unwise simply to cross our fingers and hope that the independent application of IPPC alone by fifteen member states solves our common problems by serendipity. We have to be smarter than that.

NEIL EMMOTT

Research Fellow, Institute for European Environmental Policy, 52 Horseferry Road, London SW1P 2AG, England. Phone +44 171 799 2244. Fax +44 171 799 2600. E-mail: nemmott@ieeplondon.org.uk

¹ OJ L257, 10.10.96.

² OECD Environment Monograph No 37, *Integrated Pollution Prevention and Control*, April 1991.

Editorial comment on p. 2.

A promising market

SALES IN JAPAN of Toyota's new hybrid, Prius, got off to a flying start. During the first month, 3500 orders came in, as against the expected 1000. With both petrol and electric drive motors, the Prius cost 2.15 million yen, or US\$17,000 at February exchange rate. The environmental qualities are good, the tailpipe emissions of carbon dioxide being about half of those of a comparable purely petrol-driven car. The emissions of other toxic substances have been reduced by 90 per cent.

California should offer a very large market for hybrids. It has previously been decreed that 10 per cent of the cars sold by any manufacturer in 2003 must be zero-emission vehicles. But so far only electric cars can meet that requirement, and the present demand for them is very weak. Of the General Motors EV1 electric car, which

started to be marketed a year ago, only 300 have been sold.

The California Air Resources Board is considering allowing manufacturers to meet 40 to 60 per cent of the 10-per-cent target with other very low-emission vehicles, such as hybrid cars.

"Electric vehicles will primarily be urban vehicles. The high cost of batteries will always be an issue. Hybrids will become more like current vehicles in terms of use," says John Wallance, Director of the Ford Motor Co.'s alternative-fuel-vehicles program.

The Air Resources Board is planning to hold hearings on revision of the 10-per-cent target mandate during the year, and to vote on a final proposal for a revision of its emissions standards in November.

Source: **Car Lines**, February 1998.

USA

Turn for locomotives

within a reasonable time. Locomotives are usually remanufactured five to ten times during their lifetime, which is typically forty years or more.

Source: **Car Lines**, February 1998.

More dangerous

The health risks of breathing in small particles have been reassessed upwards several times during the last few years, and now it has happened again.

The connection between the concentrations in the air of PM_{10} (particles with a diameter of less than 10 micrometers) and deaths from lung disease has been known for some time, but now scientists at Harvard University have discovered that the even tinier particles called $PM_{2.5}$ could cause heart disease as well. High levels of $PM_{2.5}$ were found to correlate with lower heart-rate variability – an indication of less strength and flexibility and a greater risk of heart disease. The exact mechanisms remain to be sorted out, even if the researchers do have some hypotheses.

New Scientist, May 9, 1998.

HITHERTO UNREGULATED, locomotives will now be subject in the US to the new emission standards set by the Environmental Protection Agency. When fully implemented in 2005, the new standards will eliminate something like two-thirds of their present emissions of nitrogen oxides – which will be equivalent to taking 20-30 million cars off the roads. Furthermore, emissions of hydrocarbons and particulate matter will be halved.

Most of the locomotives in the US are powered by diesel engines. They are calculated to be responsible for 5.5 per cent of all the emissions of nitrogen oxides in the country. The reduction by 2005 is estimated to be 300,000 tons per annum. Unique for the new ruling is that it also extends to the remanufacturing of existing locomotives. This was judged to be necessary in order to achieve the full effect of the standards

USA

Proposal for trading NOx credits

THE US Environmental Protection Agency has proposed an emissions trading program that will help protect public health from air pollution in the eastern United States. The program is part of a regional strategy for cost-effectively meeting EPA's new public-health standard for ozone, by reducing by 35 per cent the nitrogen-oxide pollution from "upwind" states that contributes to smog in the eastern half of the United States. Called "cap and trade," the program would allow industries great flexibility in choosing pollution controls because under it they could buy and sell market-based "credits" to reduce their emissions of nitrogen oxides.

In November, EPA proposed that twenty-two states and Washington DC should reduce emissions of air pollution that blow across state boundaries. This proposal was based on the recommendation of 37 states, known as the Ozone Transport Assessment Group, that identified power plants as the most significant source of nitrogen-oxide emissions – a key component in the formation of ozone. The OTAG states also identified those states that contribute to transboundary air pollution problems, and the level of reductions necessary to meet the health standard.

The proposed emissions-trading program would allow each state to establish a cap on nitrogen-oxide emissions and provide flexibility for power plants and other sources that reduce these emissions in greater amounts than required to sell credits to facilities that cannot reduce their emissions as quickly or as cost-effectively.

This regional strategy will bring the vast majority of the areas in the twenty-two states and Washington DC into attainment with the new standards for ozone without additional controls, according to EPA.

Source: EPA Press Release, April 29, 1998. Further information can be found at the EPA's homepage: www.epa.gov.

Benefits of reduction assessed

By whatever reckoning, the benefits are found to exceed the costs

AT THE MEETING last March of the Working Group on Strategies for the Convention on Long Range Transboundary Air Pollution, the results were presented of a new study,¹ involving an economic assessment of the benefits from reducing the European emissions of sulphur, nitrogen oxides, ammonia, and volatile organic compounds (VOCs). Commissioned by the UK Department of the Environment, Transport and the Regions, the study was intended to provide information for use in the negotiations that are now going on within the convention for a new protocol covering multi-pollutants and multi-effects (also known as the "super-NOx"-protocol).

The aims were principally to state, in monetary terms as far as possible, the effects on health and the environment of reducing emissions of nitrogen compounds and VOCs, and set these effects against the costs of abatement.

The methodology employed was largely the same as that developed under the ExternE Project of the Research Directorate (DGXII) of the European Commission. A new computer model called ALPHA (Atmospheric Long-range Pollution Health-environment Assessment), which was especially developed for this study, is also being used for another by the same consultants (the latter having been ordered by the Environment Directorate (DGXI) of the European Commission in connection with the EU strategies for acidification and ozone).

The scenarios

Examined were the benefits and costs that arose when the emission reductions entered in a so-called MFR scenario were substituted for those in the reference scenario. The reference scenario (REF) shows the trend of emissions if the effects of existing and planned legislation are taken into account, as well as those of international commitments made under the convention. The MFR scenario – meaning Maximum (technically) Feasible Reductions – gives a realistic presentation of

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It is always difficult to insert immaterial values into economic models. What price label, for instance, can be put on the beauties of nature?

the possibilities for reducing emissions by technical means by 2010. In other words, it takes account of the turnover rates of the capital stock – power plants, motor vehicles, etc. Non-technical measures for abatement, such as structural changes in the various sectors, including fuel switching, are on the other hand not considered. Moreover, the underlying energy scenario takes no account of international

commitments to reduce emissions of the greenhouse gas carbon dioxide. It is therefore most likely that the resulting costs will be distinctly overestimated.

The emission levels for each of the four pollutants as they were in 1990, and would be under the two scenarios, can be seen from the table. The extra annual cost of the change from the REF scenario to the MFR is estimated to be ECU 86 billion for the year 2010.

Total European emissions in 1990, with preliminary estimates of the levels to which they would have been reduced under each of the two scenarios, REF and MFR, in 2010.

	1990	REF 2010	MFR 2010
SO ₂	37,440	15,586 (-68%)	3,604 (-90%)
NO _x	22,707	14,493 (-36%)	6,636 (-71%)
NH ₃	7,729	6,484 (-16%)	4,212 (-45%)
VOCs	23,055	15,022 (-36%)	8,175 (-65%)

Estimated benefits

The benefits of the reductions were assessed according to the effects on health (morbidity and mortality), materials (but not on historical buildings and other cultural objects), farm crops, forest productivity (effects of ozone only), natural ecosystems, and visi

bility. A thorough presentation is made of the methodology and the data that were used, without concealing the resulting uncertainties. An attempt was also made to rank the different kinds of effect according to assumed reliability.

HEALTH. Predominant among health effects is the mortality resulting from chronic exposure (see box) to fine particles (sulphate, nitrate, and ammonium aerosols originating from emissions of SO₂, NO_x, and NH₃). It is here however that there appears to be the highest degree of uncertainty. There is better evidence of other effects of air pollution on health. Although the benefits are usually lower than they are estimated to be for chronic effects on mortality, they are nevertheless still substantial in these other cases.

The effects as regards morbidity² have been divided into three categories: restricted activity days (RADs), chronic-bronchitis suffering, other effects. The extra benefits, as between the REF and the MFR scenarios, are put at ECU 10.5 billion per year.

Both the acute and chronic effects were considered for mortality, with two methods for estimating the value of lost life-years: VOSL and VOLY (see box). Put briefly, a low valuation of the acute effects on mortality brought benefits of ECU 37 billion, whereas in a high valuation they came to ECU 68 billion per year. In a VOLY calculation, which produces lower figures, the benefits of reduced effects on chronic mortality came to about ECU 52 billion.

Since the resolution of the atmospheric model is inadequate for cor-

rect reproduction of the urban concentrations of primary pollutants at ground level, their levels will be distinctly underestimated – so the effects on human health (as well as the benefits from reduced emissions) will also be underestimated.

Since there has been some debate as to the best way to estimate the benefits to health, especially as regards mortality, three different figures can be given: the first comprising only the low estimates for effects on acute mortality, the second the high estimates for those, and the third the high estimates for acute mortality plus the low estimates for effects of the chronic type.

MATERIALS. The benefits of further reduced emissions, in the way of less damage to modern materials, should be about ECU 700 million a year. But here again, due to the inadequacy of the computer model, the effect may have been greatly underestimated.

CROPS. As regards the effects on agricultural crops, both the positive and the negative effects of reducing emissions have been noted. On the positive side is a reduction of the damage that would otherwise have occurred as a result of elevated concentrations of ozone. Negative is loss of benefit from nitrogen fertilization. On the whole, however, the benefits to crops were estimated to add up to about ECU 4.6 billion per year.

FORESTS. The effects on forest productivity of reduced exposure to ozone (considering growth only) were estimated to result in benefits to the amounts of ECU 170 to

Continued on next page

CLRTAP

Two new protocols ready

AT A MEETING in Geneva last February the finishing touches were put to the drafts of two new protocols under the Convention on Long Range Transboundary Air Pollution. The one on heavy metals, the other on persistent organic pollutants (POPs). Both are expected to be adopted and signed at Århus, Denmark, in June, during the fourth ministerial *Environment for Europe* conference.

The protocol on heavy metals deals with three particularly harmful substances: lead, cadmium and mercury. One of its basic obligations will compel countries to reduce their emissions of these three metals to levels below those of 1990 (or any alternative year between 1985 and 1995). The aim is to cut emissions from industrial sources, combustion processes, and incineration of waste. Stringent limit values are set for emissions from stationary sources, and suggestions given for best available techniques for controlling emissions from such sources. Countries will be required to phase out leaded petrol, and measures for lowering heavy-metal emissions from other products, such as mercury in batteries, are also included in the protocol.

The protocol on persistent organic pollutants covers sixteen substances that have been singled out according to certain risk criteria. The ultimate objective is to eliminate any discharges, emissions, and losses of POPs.

The production and use of some products – aldrin, chlordane, chlordecone, dieldrin, endrin, hexabromobiphenyl, mirex, and toxaphene – are banned outright, and others are scheduled for elimination at a later stage. The protocol also severely restricts the use of DDT, HCH (including lindane), and PCBs. Limited uses of these substances, when they are thought to be essential and there are no adequate substitutes, can however be allowed.

More information is available on the ECE internet site: www.unece.org/env/env_eb.htm

Placing a value on mortality

The effects on human health are usually classified as “acute” or “chronic.” The acute effects are those arising from short-term exposure to air pollution, the chronic from long-term exposure (over periods of years, rather than days).

The value of a statistical life (VOSL) is essentially a measure of the willingness to pay for reducing the risk of premature death. In the study the figures for VOSL were set at zero (low bound) and ECU 2.2 million (high bound) for acute effects on mortality, and ECU 1.1 million (low bound) and 2.2 million (high bound) for chronic effects. Although commonly used in the analyses of the environmental benefits in connection with air pollution, these figures can be

questioned. Is it logical, for instance, to allot the same monetary value to the premature death of someone who has just a few more days to live, as to someone with tens of years remaining?

Moreover, it appears that chronic mortality studies assess population mortality, which is related to reduced life expectancy. The consultants have therefore explored mortality valuation according to life-years lost, called VOLY, the value of a life year. In their study, the central figures for VOLY were set at ECU 110,000 for acute effects on mortality, and ECU 67,000 for chronic effects. The effects of assuming discount rates that were higher and lower (10 per cent and zero) than the central fig-

Continued from previous page

250 million a year. The effects of acidification and eutrophication were not considered, nor were any of the other values associated with forests (such as the amenity aspect).

VISIBILITY. The assessment of the benefits of improved visibility (meaning, increase in visual range) is the first that has been made for Europe, US "willingness-to-pay" data having to be used in the absence of any figures from Europe. On that basis, the benefits were estimated to lie between ECU 4 and 9 billion a year. Since, however, very little concern has been shown in Europe about this problem, the consultants say they suspect the figures may represent great overestimates.

ECOSYSTEMS. It has proved extremely difficult to assess damage to ecosystems in terms of money – and this shows up in the study. Having only a few geographically limited studies of willingness to pay on which to base estimates, the consultants put the benefits of reduced damage from acidification at ECU 200 to 400 million a year. Taking the same route for eutrophication resulted in much higher figures: ECU 800 million to 1.7 billion a year. It is however emphasized that there is a high degree of uncertainty attaching both to the methodology and to the results.

Comparing benefits with costs

When it came to comparing the benefits with the costs, some of the benefit figures (those that could be regarded with the least confidence) were left out. The sums of the benefits for which comparison was made were: *Materials*: ECU 0.7 billion. *Crops*: ECU 4.6 billion. *Morbidity*: ECU 10.5 billion. *Acute mortality* (low estimate): ECU 37 billion; *Acute mortality* (high estimate): ECU 68 billion. *Acute mortality* (high estimate) + *chronic mortality* (low estimate): ECU 120 billion.

When the effects of chronic exposure on mortality are included, the added net benefits for Europe of substituting the MFR for the reference scenario are estimated to lie around ECU 50 billion per year. If the chronic effects are excluded (because of the uncertainty of the estimates), the result would be a yearly net cost of ECU 2 billion. Since the cost data tend to be overestimates, while the benefits have usually been underestimated, and many of them have not been – indeed cannot be –

assessed in monetary terms, it may be concluded that in Europe, even under the MFR scenario, the overall benefits will still exceed the overall costs. Similar comparisons made by using "optimized" abatement scenarios would therefore be most likely to result in still higher net benefits.

It should be remembered that all these figures are by no means final. As knowledge improves, methodologies for estimating costs and benefits are developed, and new data becomes available, the assessments will be revised. In the meantime there can be no doubt that benefit evaluations of this type will

be of use to policy makers – for example during negotiations for the new super-NOx protocol and in the working out of new legislation within the European Union.

CHRISTER ÅGREN

¹ *Cost benefit analysis of proposals under the UN ECE multi-pollutant, multi-effect protocol* (February 1998). M. Holland et. al., AEA Technology, 156 Harwell, Oxfordshire, OX11 0RA, UK. The results of the study are summarized in the UN ECE CLRTAP report *Economic assessment of benefits*, EB.AIR/WG.5/R.97.

² *Morbidity (Med.)* The state of being diseased; the sick-rate in a community.

UN ECE

Convention to admit public participation

A DRAFT of the convention on access to information, public participation, and access to justice in environmental matters, developed under the auspices of ECE, the UN Economic Commission for Europe, was agreed in March. It is expected to be officially adopted and signed at the *Environment for Europe* conference of ministers at Århus in June.

The convention rests on three pillars:

□ A first dealing on the one hand with the "passive" obligation for public authorities to provide environmental information to the public on request, and on the other with the "active" obligation on them to disseminate information (such as, for instance, by making it accessible through the internet).

□ Another concerning the right to participate in various kinds of decision making affecting the environment.

□ A third concerning the right of the public to challenge breaches of environmental law. There is also a proposal that the convention should include an international non-compliance mechanism, providing the public with the right to initiate complaints if governments fail to implement the convention.

Here is an exciting concept. Such a convention could have a major political significance, setting a precedent for other regions of the world, and

paving the way for democratic reforms in other areas besides the environment. Concrete, legally binding measures empowering the public to act as environmental watchdogs could in any case bring benefits across the full range of environmental issues.

Although it contains many useful provisions, the present draft is far from being a blueprint for participatory democracy. During the negotiations some governments – notably Russia, Germany and Turkey – were strongly opposed to any progressive proposals, while others were apathetic and failed to defend even measures that are well-established in their own countries. Some western countries preferred to see the convention as a tool for bringing eastern Europe "up" to western standards, thereby ignoring major deficiencies in western Europe.

So the outcome is likely to be a mixed one, which could be summed up as "much worse than it should have been, much better than it might have been."

JEREMY WATES

The author, working for the European Environmental Bureau, has coordinated the NGO participation in the negotiation process. He can be reached by phone/fax +353-27-51333, or by e-mail: jwates@foeire.iol.ie.

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BIOGAS

Great benefits from use in buses

EUROPE'S LARGEST plant for the production of biogas is in Linköping, a town of 120,000 inhabitants in South Sweden. The municipal transit company has already started using the gas, and will soon only have vehicles running on this fuel. Compared with emissions from a diesel-driven bus, the switch is estimated to eliminate 1.2 tons of nitrogen oxides and 30 tons of carbon dioxide per annum every time one of the new vehicles is put into traffic. An aim is also to use biogas for garbage trucks, construction machinery, and taxis.

The plant, which came on line last autumn, has a capacity sufficient for 80 buses or 2000 private cars. It cost 80 million kronor (\$10 million) to build, of which 10 million kronor was a government subsidy. The raw material is slaughterhouse waste and animal manure. The mixture is first pasteurized and then subject to anaerobic decomposition for one month. Before being distributed the gas is cleaned and compressed, while the residue of the process is used by farmers as an excellent soil improver.

The energy content of all the biogas now being produced in Sweden

amounts to about 1.5 TWh (billions of kilowatt-hours) per annum, and some ten largish plants will soon be coming into operation. There is thought to be a potential for 5-15 TWh per annum. While most of the 200 existing plants use sewage sludge, about a third of them are plants extracting methane gas directly from waste dumps.

Both biogas and natural (fossil) gas consist mainly of methane, and can in principle be put to the same uses – for generating electricity and heat, and as a fuel for vehicles. Biogas gains over natural gas in the environmental aspect in that it is renewable and so does not give rise to a net emission of carbon dioxide; but it is also a cleaner fuel in other respects. Only biogas could be qualified as a Class 1 fuel in a recent Swedish study. At present it is however mostly used in Sweden for the production of heat and electricity – the main reason being that it has to be freed of carbon dioxide and corrosive substances before it can be used as a fuel for motor vehicles.

Sources: *Energikällan*, No. 4, 1997. *Ny Teknik* No. 36, 1997.

Healthy exercise

As part of an effort to reduce sick leave, the Norwegian components manufacturer Hydro Raufoss Automotive is offering 150 of its employees a small addition to their pay if they leave their cars at home instead of riding to work. For cycling they get 1 krone per kilometre, and for walking 3 kroner. If the scheme makes for healthier workers, it will be extended to all the company's employees.

Dagens Nyheter, April 24, 1998.

Road closed

Researchers in London have concluded that closing of roads does not necessarily cause traffic congestion – as is frequently argued by opponents of pedestrian zones. Looking at closures around the world, both lasting and temporary, they found that they could cause around 25 per cent of traffic to disappear. The reason, the researchers say, is that when motorists hear that a road has been closed, they either find a different means of transport or do not make the journey.

T&E Bulletin 67, April 1998.

Taxing diesel higher

The British government will be the first in Europe to have taxed diesel fuel more heavily than petrol. In his annual budget speech in March, minister of finance Gordon Brown announced, besides a general increase in fuel taxes of more than 6 per cent above inflation, an extra penny per litre on diesel – reflecting a growing concern about the effect of emissions of nitrogen oxides and particulates. Brown also increased the tax difference between normal grade and ultra-low-sulphur diesel – with the aim of driving the normal grade out of the market.

T&E Bulletin 67, April 1998.

Low-sulphur petrol

Beginning in 2000, under an agreement with the German Automobile Industry Association, Germany's oil industry plans to offer high-octane petrol with a sulphur content of 30 parts per million. The new type of petrol would, besides improving air quality, allow for a more widespread use of the fuel-efficient direct-injection engines, which require catalytic converters that are very sensitive to sulphur. The Swedish oil industry recently committed itself to cutting sulphur levels in regular petrol to a maximum of 50 ppm, also from 2000.

Environment Watch: Western Europe. April 3, 1998.

Continued from page 3

what lower in Spain (7 kilograms), and still lower in Poland (4.5 kilograms). In the latter, private-car ownership is however rapidly on the increase.

The educational aim of the environmental space concept is to impress on people the extent of the changes that will be needed in order to attain environmental targets, and to indicate how much will be required of each individual. But as the consultant points out, there is little the individual can do about sulphur dioxide – since the choice of fuel and cleaning equipment for heat and power generation and for industrial processes will almost always be made on a higher level. Individuals can of course cut down on their use of electricity and heat, for instance by using more energy-efficient appliances and lowering indoor temperatures. In Sweden they can, too, contract for a supply of electricity from non-polluting sources (see AN 3/97, pp.12-13).

When it comes to nitrogen oxides, on the other hand, the individual does have a fairly good opportunity for restricting his own emissions – largely because transportation, and in particular the private car, accounts for so much of the total. There are however considerable differences in daily travel distances. A Swede will travel on an average 36 kilometres every day as against 29 kilometres for a Briton and 20 for a Pole. (There is no figure for Spain.) To hold back the emissions arising from travel, people can use cars that have a low fuel consumption and are equipped with a catalyzer. They can, further, refrain from using their cars so

much – by joining car pools, using public transportation, cycling, or going on foot. They can also contribute to environmental improvement by buying goods that are produced in the immediate vicinity, thus again cutting down on transportation.

Friends of the Earth have put the environmental space for carbon dioxide in 2050 at 1.7 tons per head per year (assuming a world population at that time of 7.2 billion). Reducing the use of fossil fuels to the extent that would be required in order to meet that figure would, incidentally, largely solve the problems of sulphur dioxide and nitrogen oxides as well. Assuming that coal, oil, and natural gas would be reduced equally, Poland and Spain would then have to lower their emissions of sulphur by a further 15 per cent (as from 1990), and Great Britain by 6 per cent. Sweden would not have to make any additional reduction.

Since the conversion of energy systems will take a relatively long time, and increased use of biofuels will in itself lead to further emissions of nitrogen oxides, technical and structural changes will have to go on simultaneously.

MIKAEL JOHANNESSON

*Birgit Nielsen, *Melica Miljökonsulter*. An English version of this study, which was commissioned by the Swedish NGO Secretariat on Acid Rain, will be published shortly in the Secretariat's Air Pollution and Climate series. More about the environmental space concept can be found in *Towards a Sustainable Europe – The Handbook* and *Towards a Sustainable Europe – The Study*, published in 1995 by Friends of the Earth Europe.

ENVIRONMENTAL SPACE (CONT.)

Ammonia also enters the picture

EVEN IF the emissions of sulphur and nitrogen oxides are cut down by 90 per cent, that will still not suffice to solve the problems of acidification and eutrophication in Europe. The emissions of ammonia will also have to be controlled. The question is, whether there will be any point in calculating for this pollutant the environmental space that would be available, as described for sulphur and nitrogen oxides in the preceding article.

Between 80 and 95 per cent of the emissions of ammonia in Europe are estimated to come from farming. Some 80 per cent of that total is traceable to animal manure, and 20 per cent to artificial fertilizer – so it is hardly surprising that attention should have tended to focus on evaporation from the former. Assuming that the emissions need to be reduced by 75 per cent, it would be relatively easy to work out, on the basis of present emission and population figures, the individual environmental space and required overall reduction, country by country, as has been done for sulphur and nitrogen oxides.

But as Nielsen points out, such figures would be of little use to individuals wishing to mitigate their share of environmental damage. So in order to arrive at a more practical approach, the consultant has chosen to trace the entire nitrogen flow in agriculture.

Artificial fertilizer brought about a marked change in farming practice. Previously the number of animals and the amount of feedcrops the farm could produce would usually balance each other, and manure from the animals served to fertilize the fields. But artificial fertilizer made it possible either to farm without animals or raise more livestock than could be fed from the farm's own fields – relying for feed on crops grown elsewhere with the aid of artificial manure.

Animal manure consequently becomes a waste product on farms with intensive stock raising, while those concentrating on grain growing have to make up for a shortage of nutrient by using artificial fertil-

Top ten emitters

The countries with the greatest per-capita emissions. Europe in the mid-nineties.

Sulphur dioxide

(kg SO₂ per head per year)

1. Bulgaria	176
2. Czech Rep.	106
3. Iceland	96
4. Estonia	91
5. Hungary	69
6. Poland	68
7. Slovenia	60
8. Spain	53
9. Greece	51
10. Macedonia	50

Nitrogen oxides

(kg NO₂ per head per year)

1. Iceland	85
2. Norway	53
3. Finland	51
4. Luxembourg	50
5. Denmark	48
6. Sweden	40
7. Czech Rep.	40
8. Great Britain	39
9. Italy	38
10. Belgium	34

Sources: OECD Environmental Data 1997 plus EMEP Report 1/97, for non-OECD countries.

cial fertilizer, airborne depositions, imports of feedstuffs, and microbiological fixation of nitrogen – farmyard manure being an occurrence within the system. The outputs consist of the nitrogen content of the foodstuffs that are produced, the nitrogen that leaks out in the form of ammonia and nitrate, and losses from denitrification (a microbiological process).

In all cases the input of nitrogen proved to be very much greater than the eventual content in human foodstuffs and the animal feed produced from farming. The difference was least in Poland, where about half of the nitrogen turned up in the foodstuffs. In Sweden it was about a third, but only a fifth in Spain and Britain. See Table 1.

Great quantities of nitrogen are thus not being utilized. The outflow from evaporation of ammonia has been estimated, in a study of Swedish farming quoted by Nielsen, to be about as great as that from the leakage of nitrate, or about 20 kilograms per hectare of farmland per annum.

According to Eurostat, the EU statistical office, ammonia emissions per hectare of farmland are greatest in Poland and Great Britain (Table 2). But according to Nielsen's estimates of flow (Table 1), the excess in Poland is considerably less than the British (26 as against 112 kilograms). Here is a discrepancy that will need looking into, because even if there should be some uncertainty in the flow estimates, it seems hardly likely that the ammonia emissions should be the same in both countries.

Individual farmers can do their part in reducing nitrogen leakage by ensuring suitable storage and spreading practices for animal manure, such as by rapidly ploughing it under. Consumers could help by eating less in the way of animal products – since ammonia evaporates mostly from animal husbandry. But as Nielsen notes, evaporation is also due to the overuse of artificial fertilizer in conventional farming. Choosing food and other things produced without the aid of such fertilizer would therefore also be a way for the individual to help in attacking the ammonia problem.

MIKAEL JOHANNESSON

izer. Since so much of the feedstuff production is now dependent on the use of artificial fertilizer, it can be said, according to Nielsen, that the ammonia that now emanates from animal manure has in fact had its origin in the artificial kind.

The amount of ammonia evaporated will depend, by and large, on the number and kind of animals, and manure management. With a surplus of farmyard manure, resulting from the use of artificial fertilizer for growing animal feed, the farmer has no incentive to use care in handling it. Where farming operations are thus unbalanced, nitrogen is continually being added in the form of artificial fertilizer, and leaks out into air and water in great quantities.

Farming practices differ in the four countries studied, and so do the flows of nitrogen. Nielsen has compared the average inputs and outputs of nitrogen per hectare

of agricultural land (ploughland and pasture) in 1990 in each of the countries. Inputs come from artifi-

Table 1. Inflow and outflow of ammonia in an average hectare of farmland in 1990. Kilograms per hectare.

	Poland	Spain	Britain	Sweden
Nitrogen inflow ¹				
- total	59	66	141	86
- in artificial fertilizer	39	35	85	62
Yield ²	33	14	29	28
Excess of nitrogen ³	26	52	112	58

¹ Additions to the system in the form of artificial fertilizer, atmospheric depositions, imports of feedstuffs, and nitrogen fixation. Since it circulates within the system, farmyard manure is not included.

² Remaining in animal and vegetable foods.

³ Including nitrogen leakage in water runoff, evaporation of ammonia to the air, denitrification, and retention in soil and vegetation.

Table 2. Emissions of ammonia, 1990.

	Total from farming	kg/ha farmland	kg per capita
Poland	458,000	24	12
Spain	315,000	10	8
Great Britain	449,000	25	8
Sweden	45,000	14	5

Source: Eurostat

Cases where ecotaxes have been effective

THE LAST TENS YEARS have seen a steady increase in the use of economic instruments for achieving environmental aims. And charges and taxes have in fact led on the whole to a lowering of emission levels, with consequent benefit to the environment. The same can also be said of cases where charging was initially intended as a source of income – as it was in the Netherlands for water – rather than as a disincentive to extravagant use.

The OECD has recently given examples of cases where ecotaxes have proved to be effective:

□ In Sweden the tax on sulphur emissions, introduced in 1991, has resulted in the average sulphur content of fuel oils now being almost 40 per cent below the maximum legal limit.

□ Differentiated taxes on leaded and unleaded petrol – together with a series of other measures – in Canada, Denmark, Finland and Sweden led to a sharp decline in the consumption and market share for leaded petrol and its eventual withdrawal from the market.

□ Systems of tradeable permits may well perform as predicted. That set up in the United States under the 1990 amendment of the Clean Air Act is, for instance, expected to have lowered the cost for reducing the emissions of sulphur dioxide in 2000 and 2010 by 20 to 50 per cent.

Numerous other examples of the application of economic instruments are cited and evaluated in the report. It also points out, however, that while the results have mostly been good, little has been done to examine the effects with the aim of modifying policy so as to make it function still better.

Among its conclusions the OECD notes that there would be benefits from a wider evaluation of the use of economic instruments, as well as of the use of environmental policy instruments in general.

Evaluating Economic Instruments for Environmental Policy. OECD 1997. Obtainable from OECD Publications, 2, rue André-Pascal, 75775 Paris Cedex 16, France.

Environment-related job losses irrelevant

THE EFFECT of environmental policies on employment has been studied by the OECD. Its conclusion is that job losses in the industrialized world caused by environmental policies since the 1970s have been trivial, adding that there is compelling evidence that the net employment effects of environmental measures have been neutral or positive.

The study reviews the debate on jobs versus the environment that has been taking place in recent decades, and emphasizes the difficulty of estimating in particular the indirect effects on the labour market of new measures.

It appears that positive effects on employment have been studied most comprehensively in Germany, the United States, and France. In the German estimate, the number of jobs supported by environmental spending in 1994 amounted to 956,000 – a figure that was projected to rise to 1.12 million in 2000 if all the proposed measures now under discussion were implemented. In that case, environmental measures would be supporting 2.5 per cent of all jobs in the former West Germany and 5-6 per cent in the East. Of course not all of these jobs would be new: many in waste and sewage management, for instance, have been there for a long time. But the German example, supported by similar studies made in the United States and France, gives an indication of the significant additions to the amount of environment-related work that have been made in recent years and are likely in the immediate future as a result of further environmental measures.

Turning to the matter of the supposed threat to jobs, the OECD study is clearly dismissive, noting that “Despite all complaints of lay-offs and job losses due to environmental regulation, the business community and labour unions have hardly generated any data to substantiate their claims.” In the United States the Bureau of Labor Statistics has found that the employers themselves had attributed just 0.1 per cent of the lay-offs in

1987-90 to environmental measures. In the OECD view, environmental regulations were in most cases “the straw that broke the camel’s back,” hastening the shut-down of plants that were already doomed for other reasons.

But the OECD has also considered the extent to which tighter environmental controls in the home country may have led to the location or relocation of industries in “pollution havens.” It says that the evidence of such shifts is “scanty and anecdotal.” The extreme fewness of such moves shows, it says, that the costs attributable to environmental requirements are only a small part of the total costs, and that other factors carry greater weight in investment decisions. It has been shown in West German studies, for instance, that access to markets, supplies of raw materials, labour costs, political stability, the availability of infrastructure, and transport costs were far more important than the environmental costs.

The study’s conclusion from the available material is that “environment-related job losses during the past two decades look almost irrelevant in comparison with job losses resulting from other corporate decisions and government policies (e.g. automation of plants, foreign investment, or budget cuts) or from substantial changes in exchange rates. Moreover, jobs are more likely to be at risk were environmental standards are low and no innovation in terms of cleaner technologies is taking place.”

The study ends with a discussion of future trends with environmental implications – such as green tax reforms, the continuing shift towards cleaner production processes, and more sustainable patterns of consumption – and their possible effects on employment.

PER ELVINGSON

Environmental Policies and Employment. OECD 1997. Obtainable from OECD, 2 rue André-Pascal, 75775 Paris Cedex 16, France. E-mail: sales@oecd.org

Recent publications

Regional Air Pollution in Developing Countries (1998)

Ed. J. Kuylenstierna and K. Hicks, Stockholm Environment Institute. A background document describing the air pollution problem in general, as well as important aspects and future emission scenarios, in particular for Asia.

120 pp. Available from SEI, Box 2142, S-103 14 Stockholm, Sweden. Fax +46-8-723 0348. Internet: www.sei.se.

Whole ecosystem nitrogen manipulation (1997)

A study reviewing the research that has been done of the effects of nitrogen on various ecosystems in northwestern Europe and of the attempts to determine the critical loads.

68 pp. Available free of charge from The Enquiry Service, English Nature, Northminster House, Peterborough PE1 1UA, England.

Acid Atmospheric Deposition and its Effects on Terrestrial Ecosystems in The Netherlands (1997)

Edited by G. J. Heij and J. W. Erisman. Describes the results and conclusions of the third and final phase of the Dutch acidification research program, executed between 1985 and 1994.

716 pp. 450 guilders. Studies in Environmental Science, Vol. 69. ISBN 0-444-82037-X. Published by Elsevier Science Ltd.

Climate change, transport and environmental policy (1998)

Edited by S. Proost and J.B. Braden. A state-of-the art assessment of the ways economic models can be used to attack environmental problems.

272 pp. £55.00. Published by Edward Elgar Publishing, 8 Lansdown Place, Cheltenham, Glos GL50 2HU, England. Internet: www.e-elgar.co.uk.

Taxing Automobile Emission for Pollution Control (1998)

By M. Sevigny. Examines the role an automobile emission tax could play in reducing emissions in the US.

128 pp. £35.00. Available from Edward Elgar Publishing, address as above.

Renewable Energy Policy in IEA countries. Volume 1: Overview (1997)

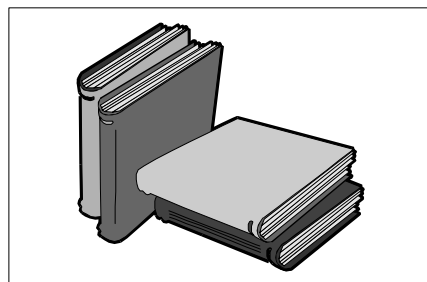
A comprehensive survey of the renewable-energy policies currently in place among the members of the International Energy Agency (IEA), as well as the status and likely evolution of renewable-energy use.

50 pp. 70 francs. Obtainable from OECD, 2 rue André-Pascal, 75775 Paris Cedex 16, France. Fax +33-1-4524 8003. E-mail: sales@oecd.org.

Energy Policies of IEA Countries: 1997 Review

A detailed analysis of energy policy and energy-market developments in the member countries of IEA.

328 pp. 370 francs. Available from OECD, address as above.



CO₂ Emissions from Transport (1997)

An account of what the OECD countries have done to reduce the emissions of carbon dioxide from the transportation sector. Draws attention especially to the behaviour of the auto industry and the technical possibilities of making vehicles with lower emissions.

180 pp. 195 francs. Obtainable from OECD, address as above.

Improving the Environment Through Reducing Subsidies (1998)

Large sums are being paid out in the form of subsidies to agriculture, energy use, transportation, etc. The effects on the environment often run contrary to the aims of national and international agreements. This report lists those that are harmful and considers how they can be abolished or at least cut down.

130 pp. 180 francs. Available from OECD, address as above.

Reforming Energy and Transport Subsidies: Environmental and Economic Implications (1997)

Proceeding from a number of case studies from different countries, this report picks out the types of support where reform might be of benefit to the environment, and suggests ways in which national governments and the international community might go to work in order to join environmental with social and economic agendas.

171 pp. 190 francs. Obtainable from OECD, address as above.

Towards Sustainable Development: Environmental Indicators (1998)

A report detailing country data on fifteen environmental and eighteen socio-economic indicators of environmental significance, providing a tool for evaluating the environmental performance of OECD countries and tracking their course toward sustainable development.

130 pp. 155 francs. Obtainable from OECD, address as above.

Transport, Energy and Climate Change (1997)

Nearly a third of the total emissions of carbon dioxide in the OECD countries comes from the transportation sector. Unless targeted measures are taken, these emissions are likely to go on increasing. Here are set forth practical ways of slowing them down or reducing them, with national circumstances and policy barriers taken into account.

116 pp. 160 francs. Can be ordered from OECD, address as above.

Economic Evaluation of Air Pollution Damage to Materials (1997)

Ed. V. Kucera, D. Pearce and Y.M. Brodin. Transactions of a workshop that was held in 1996 to evaluate the gains, in monetary terms, from less corrosion of the materials of buildings and cultural objects resulting from reduced emissions of air pollutants.

236 pp. 224 kronor. Report 4761. Published by the Swedish Environmental Protection Agency, 106 48 Stockholm, Sweden. Fax +46-8-698 1515. E-mail: kundtjanst@environ.se.

Alzheimer's disease and risk in relation to aluminium exposure (1997)

A critical examination of the connection between exposure to aluminium and Alzheimer's disease. Part of a Swedish EPA project entitled *Health risks in conjunction with the acidification of land and water* (see AN 3/97).

74 pp. 110 kronor. Order No. 4721. Published by the Swedish EPA, address as above.

Particles in the ambient air as a risk factor for lung cancer (1998)

An inventory of the emission sources for particles, the way they behave in the air, and the effects of exposure to them. 128 pp. 155 kronor. Order No. 4804. Available from the Swedish EPA, address as above.

The Concept of Environmental Space, Implications for Policies, Environmental Reporting and Assessments (1998)

58 pp. 7.00 ecus. Published by the European Environment Agency, Kongens Nytorv 6, 1050 Copenhagen, Denmark. Internet: www.eea.dk.

Working for Better Air Quality in the Baltic Region (1998)

A book describing the problems of air pollution in the Baltic region and various solutions to them. It gives examples of field studies and other educational approaches developed within the framework of the UNESCO Baltic Sea Project.

166 pp. Order No. 97:332. Obtainable from Liber Distribution, Publikationstjänst, 162 89 Stockholm. Fax +46-8-69 099 550.

Success story

UNUSUALLY for a propaganda film, early in June *Sex, Sulphur and a Fishy Business: a kind of twisted documentary on acid rain in Scandinavia* (announced in AN 1/98) was shown on prime time on Swedish television, as well as being shown in Norway. But then it had already won – in competition with 1600 entrants from 28 countries – four prizes, two silver and two bronze, at the US International Film and Video Festival in Chicago.

A video version is being distributed by the Swedish NGO Secretariat

on Acid Rain together with a freshly produced eight-page leaflet, *For cleaner air – it will pay to reduce acidifying emissions*, exposing the effects of acidification and – still more – what can be done to stop it. Also available is the 96-page paperback, entitled *Acidification & Air Pollution: Still With Us*, where the subject with associated problems is treated at length and in more detail.

Single copies of the film and the printed matter can be had free of charge (only in Europe) from the Secretariat.

Visit our website!

SINCE THE MIDDLE OF JUNE the Swedish NGO Secretariat on Acid Rain has been on internet. On our home page you can read Acid News, download it or get information, background material and commentary on hot subjects, or order mate-



rial from the Secretariat. You will also find a list of interesting items from other publishers, as well as links to complementary home pages.

Here is the address:
www.acidrain.org

New report

Environmental space. As applied to acidifying air pollutants. As is by now well known, European emissions of acidifying air pollutants will have to be reduced drastically if large areas of the continent and adjoining parts are not to go on being subjected to depositions that are more than the environment can tolerate. Combining this need with the concept of environmental space, a consultant has worked out what these reductions will mean in terms of each European, and what the responsibility will be for each one of us. The report is reviewed in this issue of Acid News.

Other reports on this and related subjects that are available from the Secretariat include:

Better together? A discussion paper on a common Nordic-Baltic

infrastructure for energy. (1996)
Attacking air pollution. Critical loads, airborne nitrogen, ozone precursors. A presentation of scientific knowledge concerning the critical loads for acidifying and ozone-forming air pollutants. (1996)
Doing more than required. Plants that are showing the way. Report of an investigation that was commissioned by the Secretariat as a contribution to the debate on a revision of the EU directive on acidifying emissions from large combustion plants. Revealed that there were already large plants in operation that were not only meeting current requirements but had brought down their emissions to levels even below those being proposed by the Commission to accord with Best Available Technique. (1996)

Coming events

2nd World Conference and Exhibition on Photo Voltaics. Vienna, Austria, July 6-10, 1998. *Inquiries:* WIP, Sylvensteinstrasse 2, 81369 München, Germany. Fax. +49-89-7201291. renewables@mail.tnet.se.

First World Congress on Health and Urban Environment. Madrid, Spain, July 6-10, 1998. *Inquiries:* TILES A OPC, S.L., C/Londres 17, 28028 Madrid, Spain. E-mail: tilesa@wpa.es.

SUN21: First International Week for a Sustainable Energy Future. Basel, Switzerland, July 27-August 1, 1998. *Inquiries:* SUN21, P.O. Box 332, 4010 Basel, Switzerland. Internet: www.sun21.ch.

1st conference on children's health and environment. Amsterdam, The Netherlands, August 11-13, 1998. Organized by the Dutch Association of Environmental Medicine. *Inquiries:* Conference Secretariat ICCHE '98: c/o VVAA conference service, PO Box 8153, 3503 RD Utrecht, The Netherlands. Fax: +31-30 2474647. E-mail: congres@vvaa.nl

First International Symposium on Issues in Environmental Pollution – The State and Use of Science and Predictive Models. Denver, CO, USA, August 23-26, 1998. *Information:* Lyn Quirke, IEP'98 Secretariat, P.O. Box 101, Wantage, Oxon OX12 0QS, England. E-mail: lynquirke@compuserve.com.

Working Group on Strategies under the Convention on Long Range Transboundary Air Pollution. Geneva, Switzerland. August 31-September 4, 1998.

EuroSun 98. ISES-Europe Solar Congress and Exhibition. Portoroz, Slovenia, September 14-17, 1998. *Inquiries:* E-NET – Centre for Efficient Use of Energy, Ljubljana, Ambrozevtrg 5, Slovenia. Fax. +386-61-1729283.

1998 World Renewable Energy Congress. Florence, Italy, September 20-25, 1998. *Inquiries:* Prof. A.A.M. Sayih, 147 Hilmanton, Lower Early, Reading RG6 4HN, England. Fax +44-118-9611365.

6th Energy Efficiency and Business Week. Prague, Czech Republic, October 6-8, 1998. International conference and exhibition. *Inquiries:* SEVEN, Slezka 7, 120 56 Praha 2, Czech Rep. Fax. +420-2-24247597. E-mail: seven@ecn.cz.

Fourth Conference of the Parties to the Climate Convention. Buenos Aires, Argentina, November 2-13, 1998.