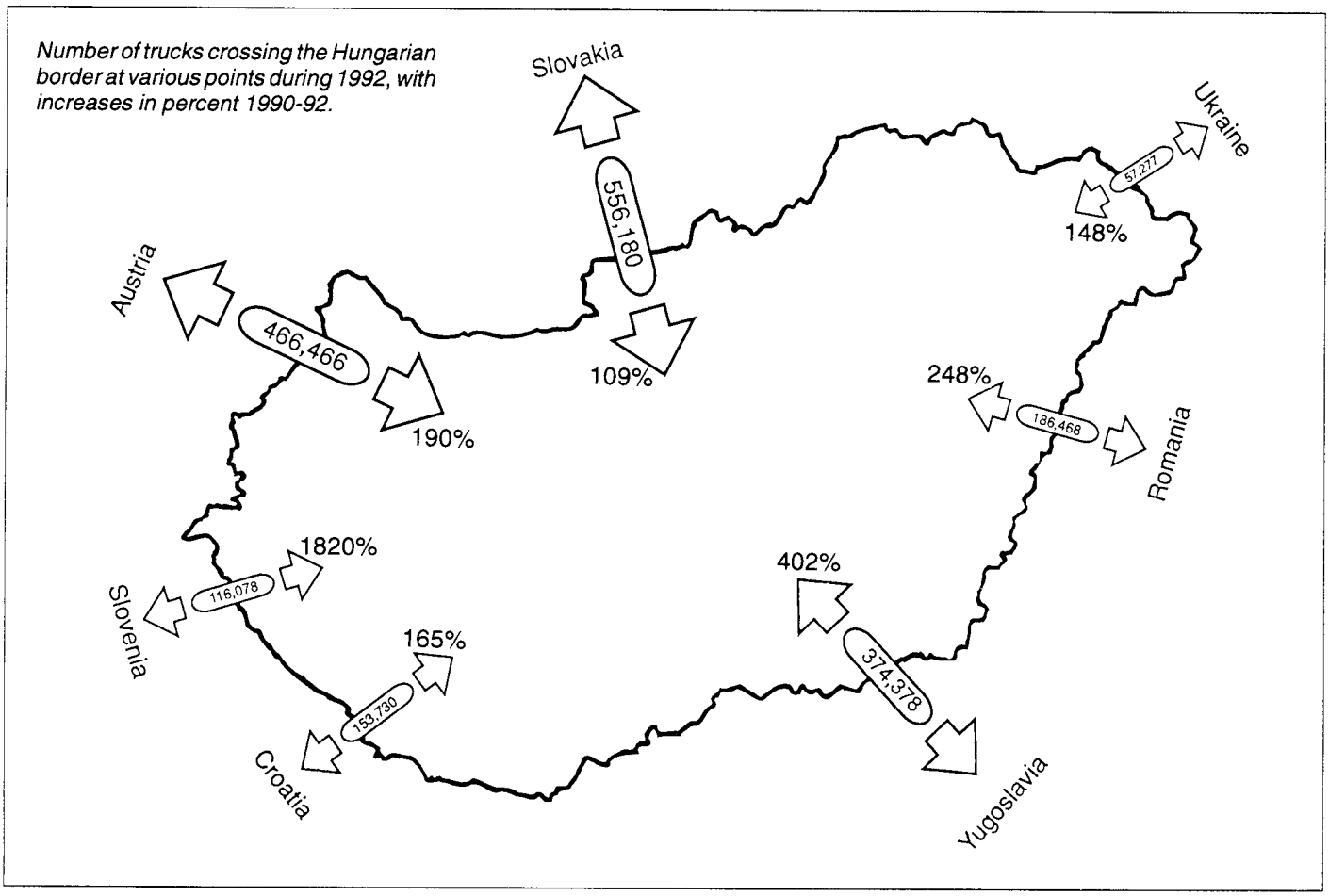
NO. 5, DECEMBER 1995

Acid News



Number of trucks crossing the Hungarian border at various points during 1992, with increases in percent 1990-92.

MAP: THOMAS ERIKSSON

TRANSIT TRAFFIC

Reasoning fails to prevail

BETWEEN 1980 and 1994 the volume of road freight in transit through Hungary grew almost tenfold. Now there is one foreign truck passing the Hungarian border every 40 seconds, and a great majority of the trips start or finish within the European Union.

In passage through Hungary these foreign vehicles add enormously to environmental damage, lead to increased traffic jams and damage to roads and buildings, and cause a great number of serious accidents. The problem is aggravated by the fact that many of the transit routes go through towns and cities, with direct effects on local health.

Up to 1992 this traffic had been untaxed, or almost so. At the end of 1991, however, energetic lobbying by environmentalist NGOs had led the Hungarian parliament to raise the transit charge tenfold, to 3 forint (about $0.03) per ton-kilometre, making it roughly the same as in Austria, although without many of the Austrian restrictions, such as the ban on night-time and weekend passage. Even so, the measure was challenged by truck drivers and haulage companies from EC countries, and especially Greece.

A delegation from the European Community then came to Budapest to negotiate with the Hungarian government on transit fees. The Clean Air Action Group – one of the leading environmentalist NGOs in Hungary – met the delegation and explained that raising the transit charge was in full accord with the associate membership agreement between Hungary and the EC, which was scheduled for approval within the next few months.

The agreement emphasizes the commitment on both sides to observe human rights, and the Action Group argued that the damage caused to the health of thousands of Hungarians by the transit traffic was a gross violation of human rights, and that raising the transit charge would both help to reduce traffic and provide finance for combating its harmful effects.

Even with the higher charge, the transit traffic would be paying only a fraction of its real costs – so that in effect the people of Hungary were subsidizing the movements of foreign

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Acid News

is a newsletter from the Swedish NGO Secretariat on Acid Rain, whose 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 fullfill 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:

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Published by: The Swedish Society for Nature Conservation

Printed by: Williamssons Offset, Solna, on paper not bleached with chlorine.

ISSN 0281-5087

THE SECRETARIAT

The Swedish NGO Secretariat on Acid Rain was formed in 1982 with a board now 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 and distributing information material.

☐ Supporting environmentalist bodies in other countries by various means, both financial and other, 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 bodies responsible for international conventions, such as the United Nations Convention on Long Range Transboundary Air Pollution.

☐ Acting as an observer at the proceedings involving international agreements for reducing the emissions of greenhouse gases.

EDITORIAL

Coordinated strategy

HITHERTO the problems of air pollution have been attacked in the European Union principally through separate directives, each stipulating different measures for reducing emissions. But there has been no coordinated strategy for dealing with the whole problem of acidification.

Following a Swedish proposal in the Council of Ministers in March, the Commission has undertaken however to present a report to the Council this autumn concerning the measures already decided upon or proposed, as well as those that may be expected, for controlling the emissions of acidifying pollutants, and the estimated effects of these measures.

The Commission's environmental directorate, DG XI, has subsequently been engaged in assembling such a report, for presentation to the council of EU environment ministers at its meeting in Brussels on December 18.

This report can be regarded as a first step towards a coordinated EU strategy for dealing with acidification. The conclusions that the Council of Ministers draws from it will therefore be of the highest importance.

The report will include – besides a general description of the effects and causes of acidification – a comparison of two scenarios with estimated emissions of sulphur, nitrogen oxides, and ammonia up to the year 2010. The environmental effects are being rated according to the extent by which the critical loads for acidification are exceeded.

It turns out, although hardly unexpectedly, that even under the stricter of the two scenarios, involving the most optimistic view of likely EU action, there would be no stopping of acidification.

The DG XI group has also been considering a genuine BAT scenario, in which the whole of Europe is assumed to apply to the best available technology to all emission sources, but not even that has been found to solve the problem. (There would perhaps be a 90-per-cent reduction of sulphur emissions, and 70 per cent for nitrogen oxides, between 1990 and 2010.)

The conclusions the environment ministers should draw from this report should therefore be, principally:

☐ The existing and proposed legislation is insufficient for attainment of the agreed aim, which according to the fifth EU action program for the environment is to ensure that the critical loads will never be exceeded.

☐ Since not even the best available technology will suffice, either, measures of a structural nature will also be required, such as fuel switching and moves toward greater efficiency in the use of energy.

☐ To make efforts for the protection of the environment more effective, the EU plans for treating transborder phenomena, such as acid deposition and low-level ozone, should be coordinated with the work of the Convention on Long Range Transboundary Air Pollution. This would also make the whole more cost-effective.

The Council of Ministers should without fail give the Commission an assignment to produce as soon as possible, or at most within a year, a strategy for dealing with acidification. This should take the form of a Communication from the Commission.

Here should be shown a carefully thought-out strategy, enjoying wide support within the Commission, which can indicate how the aim of not exceeding the critical loads is to be achieved. It should also include concrete proposals for new or revised directives. A reasonable expectation would be that the proposed measures should lead to the achievement of the environmental aims at latest by 2010.

The Commission already has before it a number of proposals for new and revised directives, which in themselves could help to reduce the emissions of acidifying air pollutants. These should in any case be adopted and implemented as soon as possible, without necessarily awaiting a general acidification strategy.

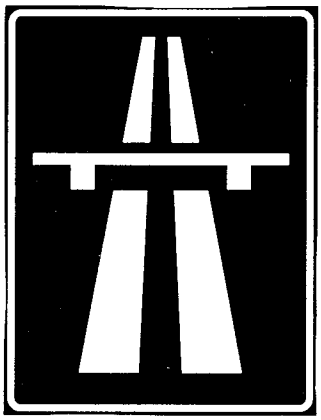
Measures to reduce emissions of acidifying air pollutants will not only solve acidification problems. They will also mitigate other serious environmental effects, such as eutrophication and damage from low-level ozone, not to mention the direct effects of air pollutants on people's health.

PER ELVINGSON

Continued from front page

trucks on their country's territory. One of the main aims of the associate membership agreement was for Hungary to move towards a market economy, and raising the transit charges was an important part of this process.

The agreement also underlined the importance of cooperation on matters of energy efficiency and the environment. The higher traffic charge would have stimulated the use of more environmentally benign and energy-efficient transportation.



It is said, moreover, that transporting freight by rail should be encouraged, and an increased transit charge would have the effect on reducing the subsidizing of road freight and making the rail mode – which is barely subsidized in Hungary – more competitive.

It turned out that the EC delegation was already aware that the Hungarian environment was in any case heavily polluted from sources other than transit road traffic. To those concerned this meant that no further pollution should be allowed, and that everything possible should be done to reduce pollution. Although it was pointed out, among other arguments, that the higher transit charge did not make Hungary any more expensive than other countries for foreign truckers, the EC delegation continued to exert tremendous pressure on the Hungarian government – even to the extent of threatening to veto the associate membership agreement. The environmentalists felt greatly disillusioned, especially as the delegation could produce no real arguments.

In the end the government had to make a big concession: although the transit charge remains in theory, so many free passes have been issued that more than 80 per cent of the trucks passing through Hungary (and an even larger percentage of trucks from EU countries) now pay nothing at all.

During their discussions with the delegation, the environmentalists suggested that the EC might provide finance to help the Hungarian Railways to develop combined road-rail transportation. It was said in the final communiqué that the EC would help Hungary to solve the problems associated with transit traffic, but from experience to date it would seem that this means building more new motorways rather than aiding railways.

Thus it seems that environmental reasoning has failed to prevail in this clash with the European Community. Hungary tried to protect its legitimate interests, only to be lectured by EC representatives.

The Clean Air Action Group is continuing to fight for a reduction of the damage arising from transit traffic, urging among other things that this traffic should pay its full costs. Whereas the total income from transit charges in 1993 only amounted to 1.3 billion forint, the damage from transit traffic in that year alone is estimated to have been equivalent to at least 50 billion forint. The Group is also agitating for a fuller development of rail transportation.

The problem is that Hungary is currently seeking membership in the European Union, and the government does not want to spoil the country's chances by taking measures affecting the transiting of freight. Union interests are also invoked if anyone asks why a country like Hungary, with a stagnating economy and a large foreign debt, should be obliged to spend large sums on new motorways.

ANDRAS LUKACS
National secretary of the Clean Air Action Group and the Hungarian Traffic Club

The Clean Air Action Group is looking forward to increased collaboration with environmentalist organizations in other countries. It would be highly important, for instance, to try and persuade western financial institutions not to provide loans for the construction of new motorways in Hungary.

A report by the Hungarian Traffic Club on transit traffic is available in English from the European Federation for Transport and Environment (T&E), Rue de la Victoire 26, 1060 Brussels, Belgium. The documentary film, Road to Europe, can be obtained in an English version from the Hungarian Traffic Club, 2041 Budaörs, Pf 102, Hungary.

ON THE FOLLOWING PAGES

BRIEFS

Paying Bulgaria to halt reactors

The European Commission has offered Bulgaria a free supply of coal or electricity for three months, plus further safety checks at the Kozloduy nuclear power plant, if Bulgaria will again shut down the plant's No. 1 reactor which has just been restarted. Western donors have already spent 54 million ecus on improvments at Kozloduy.

The West's money could however be better used. Michael Scholand of the International Institute for Energy Conservation in London says the World Bank, the Commission, and private western companies have identified energy efficiency projects that could save Bulgaria about 9.3 terawatt-hours a year. The four oldest plants at Kozloduy produce 7 TWh a year. Most of the projects would pay for themselves within ten years through fuel savings.

New Scientist, November 4, 1995.

Household energy efficiency

The UK government has launched a mail and television advertising campaign to promote household energy conservation. Five million householders are being sent vouchers worth £300 offering discounts on energy-saving devices or services, such as home insulation and low-energy lightbulbs.

Environment Watch: Western Europe. October 16, 1995.

Less CO_2, more employment

If the Netherlands were to reduce its emissions of carbon dioxide by 20 per cent between 1990 and 2005, that would lead to the creation of 70,000 permanent new jobs, of which 50,000 would be in the country itself and 20,000 abroad, according to a study commissioned by the World Wide Fund for Nature. Since the reduction would be obtained by letting labour-intensive measures involving energy efficiency replace the more captital-intensive kind of energy supply, the yearly overall saving for the Dutch economy could amount to 9 billion guilders ($5.7 billion). The authors of the study also hold out the possibility of net savings from still furhter emission reductions.

Saving the Climate – that's my job! Case study: The Netherlands. By Marc D. Davidson and Gerrit de Wit, Centre for Energy Conservation and Environmental Technology. Available from WWF European Policy Office, 608 Chaussée de Waterloo, 1060 Brussels, Belgium.

ECE CONVENTION

Extent of compliance with the protocols

ALL THE COUNTRIES that signed the first sulphur protocol have fulfilled their commitment. It seems too, according to the latest information from EMEP, the European monitoring program for air quality, that most of the signatories to the nitrogen-oxides protocol will also be doing so.

The first sulphur protocol, which was signed in Helsinki in 1985, required the signatories to reduce their sulphur emissions by at least 30 per cent between 1980 and 1993. This they have done (Table 1). Even the really big emitters – Britain, Poland, and Spain, which had been so much criticized for their refusal to sign – have cleared the 30-per-cent hurdle. The countries that have made the greatest reduction of their emissions are Austria, Sweden, and Finland.

The second sulphur protocol, which was signed in 1994, will come into force when it has been ratified by sixteen nations. So far, however, only the Netherlands, Sweden, and Norway have done so. If all the countries were to meet the requirements of this protocol too (see AN 4/94, p.10), the sum of European emissions would, according to current estimates, be reduced by 51 per cent by 2000, and 58 per cent by 2010, as from the 1980 level.

The nitrogen-oxide protocol, signed in Sofia in 1988, required all countries to ensure that their emissions in 1994 did not exceed 1987 levels. Figures for 1994 are not yet available, but from those for the period ending 1993 it appears that with only a year still to go, five countries were far from fulfilling even the modest obligation to stabilize emissions (Belgium had however not ratified, which meant it had made no binding commitment. Table 2). Of all the signatories, the worst performer has been Spain, which by 1993 had increased its emissions by almost 41 per cent.

The outlook is still worse in regard to the special declaration signed by twelve countries at the time of the NOx protocol's adoption. This declaration came about because the twelve countries thought the requirement of the protocol had been set far too low. Instead they undertook to reduce their emissions of nitrogen oxides by about 30 per cent by 1998, reckoned from any one year between 1980 and 1986. Barring some drastic moves, however, several of them will have difficulty in meeting their commitment. As already reported (in

Table 1. Compliance with the 1985 Helsinki Protocol on the reduction of sulphur emissions, at its conclusion in 1993 (target -30 per cent).

	Change in emissions 1980-93 (%)
Signatories to the protocol	
Austria	-82.1
Sweden	-80.1
Finland	-79.3
Norway	-73.7
France	-66.0
Netherlands	-65.6
Denmark	-65.2
Belgium	-63.2
Slovakia	-58.3
Switzerland	-54.0
Russian Federation	-51.7
Hungary	-49.4
Germany	-48.0
Belarus	-41.5
Italy	-40.8
Czech Republic	-37.1
Luxembourg	-33.3
Former Soviet Union	-32.6
Bulgaria	-30.6
Ukraine	0.0*
Non-signatories	
Romania	-68.3
Turkey	-58.8
European Union	-45.6
United Kingdom	-34.9
Poland	-33.5
Spain	-30.2
Ireland	-29.3
Slovenia	-22.6
Yugoslavia fed.rep.	-1.2
Iceland	0.0
Latvia	0.0
Lithuania	0.0
Bosnia Hercegovina	0.0
Portugal	+9.0
Croatia	+20.0
Greece	+27.5

* Period 1980-1990. After the report had been printed, Ukraine produced data for 1993, showing that the country's emissions had diminished by 43 per cent between 1980 and 1993.

AN 3/94, p.5), only five of the twelve – Austria, Switzerland, the Netherlands, Germany, and Denmark – are in any position to attain the goal.

As a successor to the now outdated NOx protocol, a so-called multi-pollutant protocol is under way within the ECE convention. It is intended to cover, besides nitrogen oxides, also ammonia and volatile organic compounds. Adoption is expected some time around 1997-98.

PER ELVINGSON

Source: **European Transboundary Acidifying Air Pollution: Ten years calculated fields and budgets to the end of the first sulphur protocol.** EMEP/MSC-W Report 1/95.

Table 2. Progress towards compliance with the 1988 Sofia protocol concerning the control of NOx emissions, one year before completion (target 0 per cent).

	Change in emissions 1987-93 (%)
Signatories to the protocol	
Bulgaria	-42.8
Hungary	-30.9
Czech Republic	-29.7
Switzerland*	-25.1
Austria*	-22.2
Belarus	-22.2
Germany*	-15.9
Russian Fed.	-14.5
Denmark*	-12.6
United Kingdom	-10.5
Former Soviet Union	-10.4
Sweden*	-8.1
France*	-6.8
Slovakia	-6.7
Finland*	-6.3
Netherlands*	-6.1
Norway*	-5.1
European Union	-3.3
Luxembourg	0.0
Ukraine	+0.3
Ireland	+6.1
Italy*	+7.8
Spain	+40.9
Signed but not ratified	
Poland	-25.5
Greece	0.0
Belgium*	+9.0
Non-signatories to the protocol	
Yugoslavia fed rep.	-10.4
Bosnia-Herzegovina	0.0
Greece	0.0
Iceland	0.0
Latvia	0.0
Lithuania	0.0
Turkey	0.0
Slovenia	+7.5
Croatia	+9.1
Romania	+20.0
Portugal	+111.3

*=Signers of the NOx declaration, committing to a 30-per-cent reduction by 1998, compared with any one year 1980-86.

EUROPE

More west-east aid needed

THE ESSENTIAL MESSAGE of the final statement from the Pan-European environment meeting in the Bulgarian capital, Sofia, on October 23-25, was: West-to-east aid for the improvement of the environment must increase.

This was the third meeting of all Europe's ministers of the environment, the previous ones having taken place at Dobris, near Prague, in 1991 and at Lucerne, Switzerland, in 1993. It marked at least a few steps forward in the toilsome all-European march towards better cooperation in environmental matters. Enthusiasm for the process, which was greatest just after the fall of the iron curtain, has lately tended to be low.

Although the unsafeness of Bulgarian reactors and the French atom-bomb tests were subjects of intense debate at Sofia, west-to-east aid was really the prime issue. The fact is that the proportion of EU aid aimed at improving the environment has lately been falling off. The ministerial statement now says, albeit in vague terms, that it must increase.

At Sofia an all-embracing account of Europe's environmental problems was presented. Moreover the pan-European environmental program that was there put forward (Environmental Programme for Europe) was adopted by the meeting. Although this program is not especially demanding – the EU's environmental policy, for instance, goes further – its conception is reported to have caused great anguish among those involved. What perhaps can be said in its favour is that it at least has the verbal support of every European government.

Pan-European cooperation in environmental matters is in any case not confined to these ministerial conferences taking place at several years' intervals. At the Lucerne meeting in 1993, for instance, all the countries of central and eastern Europe undertook to develop national plans of action for the environment, and it came out at Sofia that thirteen of these seventeen countries now had plans ready or almost ready. Among them were Georgia, Moldavia, Kazakstan, and Ukraine.

The next pan-European meeting of environment ministers will take place at Copenhagen in 1998.

PER ELVINGSON

State of the environment

AMONG THE ITEMS presented at the meeting of Europe's environment ministers in Sofia was a 650-page survey of the continent's environment – an outcome of the Dobris meeting in 1991. The intention is that is shall be revised every third year by the European Environment Agency, an EU organ based in Copenhagen. This first issue contains an immense amount of information, the usefulness of which is however limited by the fact that most of it is at least five years old – a fault that it is hoped will be remedied in coming issues.

The survey, covering forty-six countries, comprises fifty-six sections dealing with different environmental problems. The following are some of its more outstanding revelations:

☐ Although improvements in air quality have been achieved through the introduction of cleaner fuels, desulphurization measures, and other controls in the past two decades, episodes of poor air quality, during which the World Health Organization's guidelines are exceeded, still occur regularly in most European cities. The main cause is road traffic.

☐ Road traffic is expected to have almost doubled in western Europe between 1990 and 2010. The conclusion is: "If transport does not pay its real social and environmental costs, then the benefits arising from technological improvements will be outweighed by disbenefits from increased transport growth."

Europe's Environment: The Dobris Assessment. 1995. 652 pp. 55.00 ecus. Available from the Office for Official Publications of the European Communities, 2 rue Mercier, 2985 Luxembourg. Fax +352 488573.

More trees than ever damaged

MORE DAMAGED TREES were found in Europe in 1994 than in any of the eight previous ECE surveys. To be counted as damaged, trees must show more than 25-per-cent defoliation, and of the 102,288 in the survey, 26.4 per cent fell into this class, as against 22.6 per cent in 1993. Needle trees were found to be somewhat more damaged than broadleaved species, with counts of 28.0 and 24.3 per cent respectively.

Defoliation is used as a measure of the trees' general health. Falling into Class 1, with 11 to 25-per-cent defoliation, is considered to be a warning rather than a sign of reduced vitality. Only when defoliation exceeds 25 per cent are trees classed as damaged.

The table shows the year-by-year trends for each country. The greatest proportion of damage is still found in the countries of central and eastern Europe, and particularly in forests on high ground, where there are several thousand hectares of the worst affected areas.

Some 170 million hectares, or about two-thirds of Europe's forested area, are covered by the national surveys. In 1994 figures were again forthcoming from thirty-two countries; but carried out concurrently with the national surveys is also a transnational one, involving the appraisement of a number of site parameters on sample plots in a 16x16-kilometre grid. Here twenty-nine countries participated last year.

Since the area covered by surveys may vary somewhat from year to year, direct comparisons are difficult to make. In the transnational plots there are however a number of common sample trees, 28,000 of which have been scrutinized every year from 1988 to 1994, and in respect of twelve species the number of trees is sufficient to make the sample statistically secure. As can be seen from the charts, the proportion of damaged trees has increased for almost every species.

By stressing the trees, air pollutants can intensify the effects of drought

With the present survey method, it is difficult to draw any safe conclusion as to the cause of the damage. Defoliation is of little help, since it can occur for several reasons, and in an attempt to remedy this, chemical analyses are now being made of the trees and soil, as well as the precipitation. It is urged, too, that this procedure should be extended.

Many of the country reports mention the warm, dry summer of 1994 as contributing to the increase in defoliation. By stressing the trees, however, air pollutants can intensify the effects of drought.

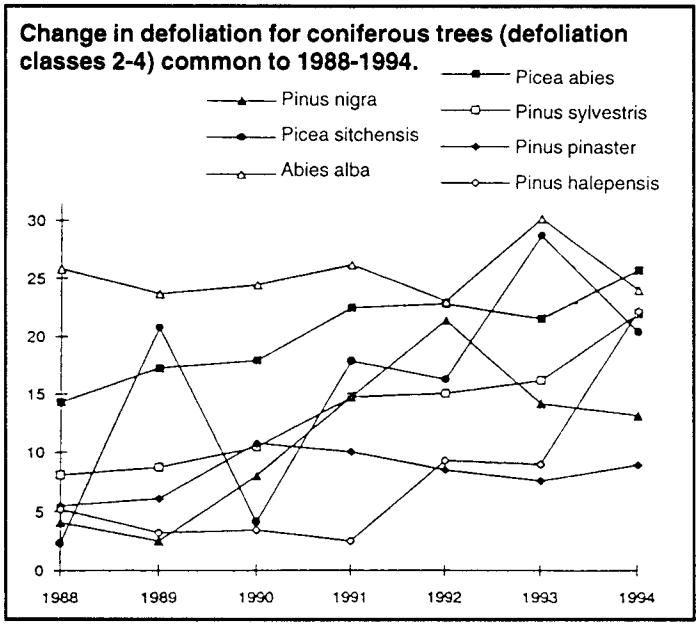
A conclusion that can be drawn from the national reports – and particularly from observations in the main damage areas of some countries as well as in some other regions – is that air pollution is a major cause of forest decline, because in those places the concentrations and depositions of several air pollutants are thought to exceed the critical levels and loads for forest ecosystems. In countries with a high level of air pollution, this factor is considered the main cause of forest damage. Elsewhere it is held for the most part to be a predisposing, accompanying, and locally triggering one, weakening forest ecosystems.

Since it is assumed that the recent dry summers and mild winters have had an effect on forest health, it is suggested in the report that especial attention should be given to climate factors in combination with air pollution.

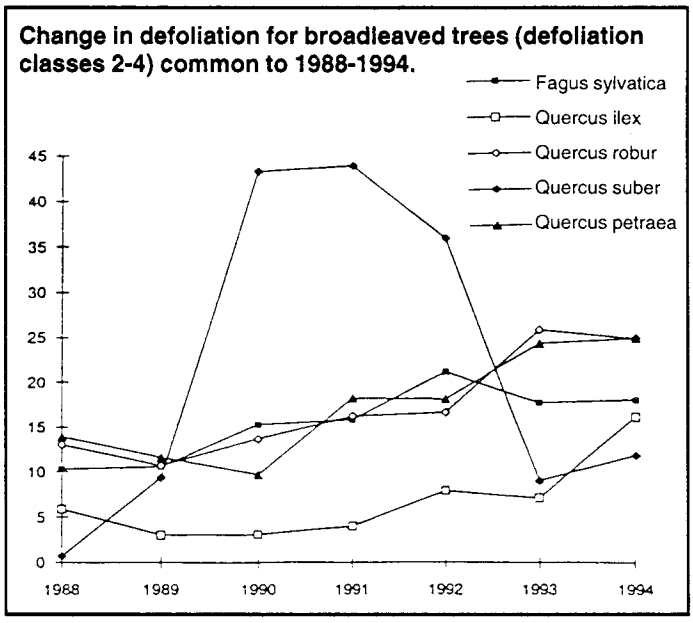
PER ELVINGSON

Forest Condition in Europe. Annual report of the forest-damage survey in Europe, prepared by the International Co-operative Programme on Assessment and Monitoring of Air Pollution Effects on Forests within the UN ECE Convention on Long Range Transboundary Air Pollution, in cooperation with the Commission of European Communities.

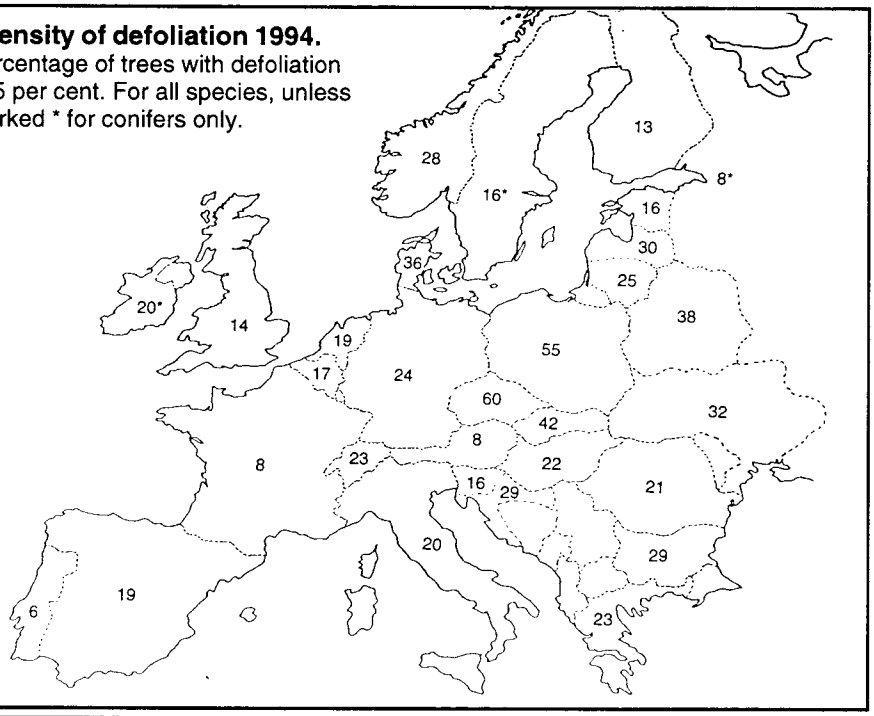
Change in defoliation for coniferous trees (defoliation classes 2-4) common to 1988-1994.



Change in defoliation for broadleaved trees (defoliation classes 2-4) common to 1988-1994.



Intensity of defoliation 1994.
Percentage of trees with defoliation >25 per cent. For all species, unless marked * for conifers only.



Results from forest-damage surveys 1986-1994. Percentage of trees in Classes 2-4 (defoliation >25 per cent). All species.

	1986	1987	1988	1989	1990	1991	1992	1993	1994
Austria	–	–	–	10.8	9.1	7.5	6.9	8.2	7.8
Belarus	–	–	–	67.2	54.0	–	19.2	29.3	37.4
Belgium	–	–	–	14.6	16.2	17.9	16.9	14.8	16.9
Bulgaria	8.1	3.6	7.4	24.9	29.1	21.8	23.1	23.2	28.9
Croatia	–	–	–	–	–	–	15.6	19.2	28.8
Czech Republic						–	56.4	53.0	59.7
Denmark	–	23.0	18.0	26.0	21.2	29.9	25.9	33.4	36.5
Estonia	–	–	9.0*	28.5*	20.0*	28.0*	28.5	20.3	15.7
Finland	–	12.1	16.1	18.0	17.3	16.0	14.5	15.2	13.0
France	8.3	9.7	6.9	5.6	7.3	7.1	8.0	8.3	8.4
Germany						25.2	26.0	24.2	24.4
- f. East	–	–	13.8	16.4	35.9				
- f. West	18.9	17.3	14.9	15.9	15.9				
Greece[1]	–	–	17.0	12.0	17.5	16.9	18.1	21.2	23.2
Hungary	–	–	7.5	12.7	21.7	19.6	21.5	21.0	21.7
Ireland	–	0.0*	4.8*	13.2*	5.4*	15.0*	15.7*	29.6*	19.7*
Italy	–	–	–	9.1	14.8	16.4	18.2	17.6	19.5
Latvia	–	–	–	–	36.0	–	37.0	35.0	30.0
Lithuania	–	–	3.0	21.5	20.4	23.9	17.5	27.4	25.4
Liechtenstein	19.0	19.0	17.0	11.8	–	–	16.0	–	–
Luxembourg	5.1	7.9	10.3	12.3	–	20.8	20.4	23.8	34.8
Moldova	–	–	–	–	–	–	–	50.8	–
Netherlands	23.3	21.4	18.3	16.1	17.8	17.2	33.4	25.0	19.4
Norway	–	–	20.8*	14.8*	18.2	19.7	26.2	24.9	27.5
Poland	–	–	20.4	31.9	38.4	45.0	48.8	50.0	54.9
Portugal	–	–	1.3	9.1	30.7	29.6	22.5	7.3	5.7
Romania	–	–	–	–	–	9.7	16.7	20.5	21.2
Russian Fed.	–	–	–	–	–	4.2*	5.2*	4.5*[2]	7.6*[2]
Slovak Republic			38.8	49.2	41.5	28.5	36.0	37.6	41.8
Slovenia	–	–	–	22.6	18.2	15.9	–	19.0	16.0
Spain	–	–	6.8	4.5	4.6	7.3	12.3	13.0	19.4
Sweden	–	5.6*	12.3*	12.9*	16.1*	12.3*	16.9*	10.6*	16.2*
Switzerland	12.0	15.0	12.0	12.0	17.0	19.0	16.0	18.0	22.6
Ukraine	–	–	–	–	–	6.4	16.3	21.5	32.4
United Kingdom[3]	–	22.0	25.0	28.0	39.0	56.7	58.3	16.9	13.9
Yugoslavia[4]	–	–	–	–	–	9.8	–	–	–

* Conifers only. [1]Excluding maquis. [2]Data only from Leningrad region. [3]Change of assessment method between 1992 and 1993, in line with that used in other states. [4]Former Yugoslavia; Croatia and Slovenia excluded.

FOREST DECLINE

What causes it?

Twenty years have now passed since the alarm was first raised for *Waldsterben* in Germany. Yet despite extensive research, the cause is still being debated. In view of this uncertainty, the World Wide Fund for Nature (WWF) has now issued a report in which the present situation is examined and the results assessed of research into the role of air pollution in forest decline.

Although it has been clearly shown that air pollution can damage trees directly and combine with other factors to reduce their general vitality, doubts remain about its role in forest decline as a whole. Monitoring of forest health has revealed marked year-to-year variations, which suggests the involvement of climatic factors and/or pest attacks. If pollution alone were responsible, the levels of damage would be expected to remain constant. But the concentrations of pollutants at places where decline is taking place are often well below those known to cause damage.

A new theory, the so-called eco-stress model, goes some way to providing an answer. This model suggests that it will depend on the characteristics of the site whether forests are more or less susceptible to air pollution. Even a poor site will normally allow healthy tree growth, but deteriorating environmental conditions will make trees on such a site more prone to damage. Hence the same stress will provoke different reactions, depending on the site. This would explain why similar declines can occur at places with quite different air-pollution loads, just as there may be differences in the degree of forest decline when the levels of pollution are similar.

The report also says that this theory can explain the confusing and often contradictory results of field studies and experiments. It suggests moreover that a more regional or even local approach will be needed in dealing with the problem of forest decline. The reduction of emissions in accordance with critical-load models will of course be necessary, but will not alone suffice to halt decline.

Tree health problems will also be exacerbated if there are drier summers in Europe, as predicted in climate-change models. Plantations with species at the edge of their native range may be particularly at risk from the dual effects of climate change and air pollution.

More research is called for in the WWF report, as well as reduction of the emissions of air pollutants, including greenhouse gases.

Air Pollution and Forest Decline in Europe. By Dr Katy Ling. WWF Research Report, June 1995. Available from WWF International, 1196 Gland, Switzerland.

The US Acid Rain Program

SIR, The United States Acid Rain program, established under the 1990 Clean Air Act Amendments, represents a revolutionary approach to pollution control. As such, it is sometimes misunderstood by observers who are more familiar with traditional routes for controlling air pollution. Some of these misperceptions appeared in the article on emissions trading in Acid News No. 3, 1995 (p.6). Although there were numerous points made in the article, the overall theme can be summarized as follows: (1) there has been little allowance trading, so (2) the program may not be successful.

Let us first address the overall premise that the success of the acid rain program depends upon whether there is abundant allowance trading. An allowance is an authorization to emit one ton of sulphur dioxide. The most important aspect of the acid rain program is not the level of emissions trading, but the nearly 50-per-cent reduction in emissions of SO_2 which will occur with or without emissions trading. Beginning in 1995, SO_2 emissions from electric utilities are to be progressively reduced, so that by 2010 they may not be more than half of what they were in 1980. This is accomplished by issuing emission allowances equal to only about half of 1980 emissions. New utility sources receive no allowances and must obtain them from the fixed number frozen under a permanent cap. Future growth in electricity generation will require sources to get cleaner and cleaner to stay within the cap.

The integrity of emission reductions (and of the tradeable allowances) is ensured by the requirement for state-of-the-art continuous emissions-monitoring systems at all electric utility units. Utilities are required to collect hourly emissions data and to report this data electronically to the Environmental Protection Agency, where it is analyzed and stored in a computer data base called the Emissions Tracking System. Ultimately, emissions data will be made publicly available via the internet.

There are automatic penalties if annual emissions exceed the number of allowances held. The owners or operators of delinquent electric utility units must pay a penalty of $2000 (adjusted for inflation) per excess ton of SO_2 or NO_x emissions. In addition, violating utilities must offset the excess SO_2 emissions with allowances in an amount equivalent to the excess. A utility may either have allowances deducted immediately or submit an excess-emissions offset plan to the EPA that outlines how these cutbacks will be achieved. Finally, the Clean Air Act also provides for criminal penalties of $25,000 per violation.

The end result is that the emission reductions and environmental benefits of the Acid Rain Program will be achieved *even if there is no emissions trading.* If this is the case, why even bother with emissions trading? The purpose of allowance trading is to reduce the costs to society of compliance. Allowance trading ensures that the most cost-effective reductions are made, since it is often much cheaper for a dirty source to over-control for SO_2 and then sell its extra allowances to a relatively cleaner source.

Level of allowance trading is significantly higher than is generally known

Moreover because the allowance trading system provides for complete flexibility of compliance options, it encourages the use of pollution prevention technologies for air-pollution compliance. Energy efficiency and renewable energy technologies become even more cost effective because for every ton of pollution avoided, there is now a monetary reward.

Let us now move to the question of the volume of allowance trading that has taken place thus far. Is it really true that there has not been much allowance trading? Implicit in the question is the assumption that a certain amount of trading is "correct." Though some analysts expected more private allowance deals, the level of allowance trading is significantly higher than is generally known. As of November 1995, 23.4 million allowances had been transferred in nearly 700 private transactions registered in EPA's Allowance Tracking System. Approximately 3.5 million of these allowances appear to have been acquired by electric utility companies from other utility companies, brokers, or fuel companies. We expect that an even more significant portion of the total allowances transferred will become "intra-utility trades," i.e., allowances transferred between different plants within the same company. Finally, when examining the level of allowance trading it is important to note that 1995 is the first year of compliance and only 110 plants are affected. By the year 2000, more than 700 plants will be affected, thereby significantly increasing the size of the allowance market.

Although the volume of allowance trading is substantially more than most other trading programs, it should be remembered that trading is only a means to achieve cost savings, it is not an end in itself. The true goal is low compliance costs, and no one disputes that this goal is being met through the flexibility allowed by the program. The low allowance prices cited in the Acid News article simply reflect lower overall costs of the program and the early emission-reduction actions of some electric utility companies. The 1994 report of the Congressional General Accounting Office, also cited in the article, found that the market-based approach in the acid rain program could save as much as $3 billion a year compared to a more traditional approach. That is more than a 50-per-cent reduction in cost.

There is no argument with the need for a critical assessment of whether the U.S. Acid Rain Program achieves the environmental results for which it was intended. For example, there are legitimate concerns about whether the emission reductions required by the Clean Air Act Amendments are enough to protect sensitive ecosystems in the northeastern United States. Our recent Acid Deposition Standard Feasibility Study, for example, concluded that additional emission reductions of sulphur dioxide and nitrogen oxides may be necessary to fully protect these areas. The study did not conclude, however, that emissions trading will diminish the environmental benefits of the 10 million ton SO_2 reduction. This is because most of the cost effective reductions are being made at the highest emitting facilities in the mid-western US, the area most responsible for acid depositions in the sensitive northeastern part of the country.

Like all new approaches, allowance trading is sometimes misunderstood. However, there should be no confusion: a 10 million ton reduction in SO_2 emissions and the protection of the environment at less cost is good news.

BRIAN J. McLEAN

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The Acid Rain Program's home page on internet can be found at http://www.epa.gov/docs/acidrain/ardhome.html.

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DRAFT DIRECTIVE

Emissions from mobile equipment

ALTHOUGH SIZABLE, the emissions of air pollutants from diesel-powered mobile machinery – such as bulldozers, cranes, dumpers, tractors – have so far gone mostly unregulated. Now, however, if a directive proposed by the European Commission is accepted, they will be subject to limits.

The draft has been developed in close cooperation with the US Environmental Protection Agency (EPA), and its initial requirements conform on the whole with those published last year in the United States. But it also comprises a second stage, which will be imposing standards that are stricter than any likely American ones. It is intended that the rules should also apply in Norway, Iceland, and Liechtenstein, which together with the EU members form the European Economic Area.

Main aim to control the emissions of NOx and particles

The draft sets emission-limit values for the diesel engines in all types of mobile machinery except agricultural and forestry tractors, for which a separate directive is proposed. The possibility of standards for petrol-driven equipment is being considered.

Although the standard covers all four ordinary exhaust emissions, its principal aim is to control the emissions of nitrogen oxides and particulates. It is estimated that implementation of the second-stage will reduce particulates by 67 per cent and nitrogen oxides by 42 per cent, compared with what they would be if nothing was done.

The emissions of hydrocarbons should also be less, by 29 per cent, while those of carbon monoxide, which are in any case low, would hardly be changed. The added cost per vehicle is said to be marginal, which means the Commission's proposal should amount to a cost-effective way of lessening air pollution.

At present some 7 per cent of the total man-made emissions of nitrogen oxides in the Union are said to come from the kinds of equipment covered by the directive. The limits proposed for Stage 1 – which is intended to come into force by steps, according to engine power, between June 30, 1997 and December 31, 1998 – would correspond to the present ones for heavy road vehicles (Euro I), but be much above those for Euro II, which will apply already in 1996. Only in Stage 2, coming into force between December 31, 2000 and December 31, 2003, would the requirements equal those of Euro II, although they will probably have been still further tightened.

As regards particulates, the difference is even greater. The emissions accepted in Stage 1 would be 4-5 times greater than the concurrent Euro II standards.

Manufacturers will probably be permitted to sell off engines already produced during a period of at most two years following the deadlines, with the possibility of one year's extension in certain circumstances, and to encourage the purchase of machines that meet the emission standards before they become mandatory, governments would be allowed to grant tax breaks. As a means of keeping down administrative costs, it is proposed that the manufacturers themselves shall be responsible for ensuring that their engines comply with the new standards.

The draft was approved without debate or amendment by the European Parliament in November, but no word has yet been forthcoming from the Council of Ministers. By forgoing its power to amend the proposal at first reading the parliament has however largely closed off any opportunity to press for later changes in the text.

The Commission itself describes the proposed limits as "relatively lenient" and the timetable as "generous".

PER ELVINGSON

Source: **Environment Watch: Western Europe.** September 29, November 17, 1995.

Recent publications

Restoration and Recovery of an Industrial Region (1995)
Edited by J. M. Gunn. A case history of damage and restoration of the environment surrounding the giant metal smelters in Sudbury, Canada – once one of the world's largest sources of sulphur dioxide pollution.

372 pp. $79.00. Published by Springer-Verlag, 175 Fifth Avenue, New York 10010, USA.

Community Energy Workbook (1995)
By A. Hubbard and C. Fong. Outlines a simple framework for implementing sustainable energy practices in the local community. Based on lessons learned by evaluating what has enabled some communities to address energy issues successfully.

265 pp. $16.95. Published by Rocky Mountains Institute, 1739 Snowmass Creek Road, Snowmass, CO 81654-9199, USA.

Homemade Money (1995)
By R. Heede, Rocky Mountains Institute. A practical guide for householders seeking cost-effective ways to cut home energy bills, save energy and water, improve comfort and reduce environmental impacts. The Institute also offers a series of "Home energy briefs," highlighting different energy-consuming sectors in the household.

276 pp. $14.95. Available from RMI, address as above.

Effects of acid deposition and tropospheric ozone on forest ecosystems in Sweden (1995)
Edited by H. Staaf and G. Tyler. A scientific presentation of the latest results of Swedish research. Covers the effects on soils, trees, fauna and flora, and includes integrated studies and modelling.

369 pp. Ecological Bulletins No. 44. Can be ordered from Munksgaard International Publishers Ltd, 238 Main Street, Cambridge, MA 02142-9740, USA.

Mapping and Modelling of Critical Loads for Nitrogen: a Workshop Report (1995)
Report from a UN ECE expert workshop held in October 1994, with the aim of providing an updated scientific basis for the mapping and modelling of critical loads for use in the forthcoming discussion of a second nitrogen protocol.

207 pp. Obtainable from the Department of Environment, Technical Policy Branch, Air Quality Division, Room B356, Romney House, 43 Marsham Street, London, England SW1P 3PY.

Can improvements be maintained?

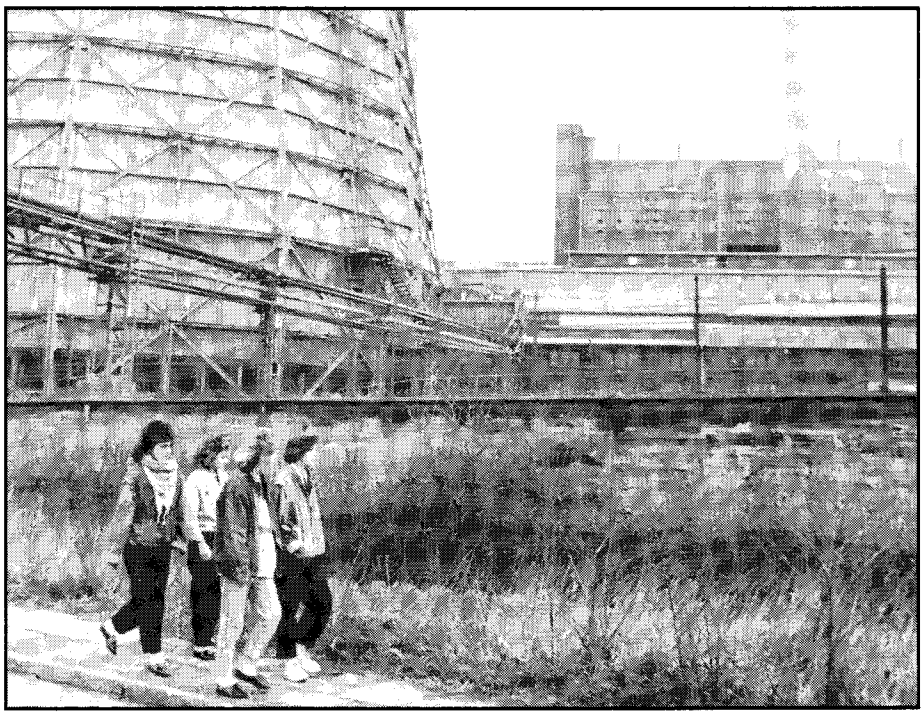
SINCE 1992 the Polish economy has been steadily on the way up, raising the question of whether the country's emissions of air pollutants – which had markedly fallen back during the previous recession – would now start to rise again. Not necessarily, says Z.M. Karaczun, who reported on a study of Poland's possibilities of reducing its emissions at *Acid Reign '95?* in June. But, he cautioned, the next few years will be decisive.

A crucial step, in Karaczun's view, was that taken by the Polish parliament in May 1991 when it decided that sustainable development was to be integral to environmental policy. According to a document from the ministry of environment the same year, this should mean that the emissions of sulphur dioxide and nitrogen oxides would be reduced by 80 per cent from 1980 to the year 2000, that individual coal-fired domestic furnaces would be entirely phased out in extensively built-up areas, and emissions of carbon dioxide would be reduced in accordance with international agreements.

Just now industrial output (and also GDP) is increasing faster than the consumption of energy – which would indicate that energy is being used ever more efficiently. The environment is also benefiting from the substitution of natural gas and oil for coal. During the period 1989-1993 there was a relatively sharp reduction in the emissions both of the acidifying sulphur and nitrogen oxides and of the main greenhouse gas, carbon dioxide. See Table 1.

The question is what these reductions can be ascribed to. Karaczun considers them to have been due to cutbacks and changes in industrial output, rather than to active environmental policy. Now however there are signs of the trend becoming reversed. A rapid increase of emissions is occurring for instance in the municipal sector and in transportation, among the reasons being the fact that more vehicles are coming onto the roads and cheap coal with a high sulphur content is being sold to private consumers.

Currently the most polluting sector is power generation, which accounts for 62 per cent of the emissions of sulphur dioxide, about 40 per cent of those of nitrogen oxides, and 65 per cent of the carbon dioxide. (As regard nitrogen oxides the traffic sector is however hardly better, contributing 37.5 per cent.) Only with the application of best available technology in new plant will it be possible for the power industry to appreciably reduce its emissions of sulphur and nitrogen oxides, according to a study released by the Ministry of Industry and Trade. Even then, no improvement is foreseen for carbon dioxide. See Table 2.



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Reductions due to cutbacks in output rather than to environmental policy

The legal instruments for the implementation of environmental policy are, according to Karaczun, outdated and inadequate in the present situation, where changes of ownership are taking place and there is a new attitude to private property and a division of authority, as regards environmental protection, between national, regional, and local government.

Under the present legislation it is impossible to employ certain types of economic instrument, such as emissions trading. A trial with emissions trading that nevertheless took place on a limited scale in Chorzow in 1991 showed however that great environmental benefits could be obtained without any increase in unemployment.

Other types of economic instruments have on the other hand been used for many years in Poland to limit the emissions of air pollutants. There have been charges on emissions, fines for exceeding the permitted levels, and subsidies. The income so obtained goes to a fund for the partial financing of environmental improvements. Collection has however not always been fully enforced, only 72 per cent of the charges for emissions, and 27 per cent of the fines having come in during 1992 for instance.

Following the political changeover in 1989, Poland has entered more actively into the international arena. It has signed both the global climate convention and the second sulphur protocol under the UN ECE Convention on Long Range Transboundary Air Pollution (undertaking to reduce

its emissions of sulphur dioxide by 66 per cent from 1980 to 2010). Foreign aid for environmental improvement has also increased, but still only accounts for 3-5 per cent of the total spending for such purposes.

The foreign aid has mostly sufficed for preliminary studies only, further finance having been lacking for carrying out the intended projects. An encouraging exception has been for the money going through the Ecofund, formed to administer funds granted to Poland under the debt-for-nature swap (see AN 3/95, pp.12-13).

Karaczun has put forward a number of concrete proposals for improving Polish environmental policy:

☐ Legislation should be brought up to date, and made to conform with EU rules. At present it shows considerable divergences, with regard for instance to the possibility of public participation, the action to be taken when the standards for ambient air quality are exceeded, as well as those for emissions from moving sources.

☐ The collection of environmental charges and fines should be improved. The present failings in this respect mean there is less money available for environmental improvements, and give the managements of polluting plants a feeling of impunity.

☐ Both commercial and investment banks should be brought to participate in the joint financing of large projects, for instance for the improvement of air quality, where high capital costs are involved and the difficulty of obtaining loans limits the possibilities of getting projects started.

☐ Take active steps to promote international programs for improving air quality, to acquire funds for the restructuring of industry in an environmentally friendly manner while it is in process of privatization, and to gain access to state-of-the-art technology for air quality.

PER ELVINGSON

Policy of Air Protection in Poland. By Z.M. Karaczun. Study presented at the Acid Reign '95? conference in Göteborg last June. Correspondence should be addressed Warsaw Agricultural University, Department of Environment Protection, Nowoursynowska 166, 02-766 Warsaw, Poland.

Table 1. Trends in emissions of air pollutants, 1980-1993.

	1989 kton	1993 kton	Change
SO_2	4,180	2,725	-35%
NO_x	1,400	1,130	-17%
CO_2	509,400	397,100	-22%

Source: **Ochrona srodowiska**. Main Statistical Office, 1994.

Table 2. Forcast reductions of emissions from power generation, assuming the application of best available technology. Changes in per cent compared with 1980.

	2000	2005	2010
SO_2	-30	-45	-70
NO_x	-10	-15	-20
Dust	-70	-70	-75
CO_2	-15	-10	0

Source: **The Energy Policy of Poland and an Outline of the Programme until 2010.** Ministry of Industry and Trade, 1993.

Wind-driven trains

NEXT SUMMER you will be able to travel a short distance by wind-driven train between Malmö and Ystad, in the southernmost corner of Sweden. Statens Järnvägar, the state railway company, has signed a contract with the power generator, Sydkraft, by which the latter will expand its wind-power capacity to provide the neccessary electricity for the project.

In this case a single wind turbine will suffice, but SJ has announced that it is in the process of re-negotiating its power supply, with the aim of converting to renewable sources within two years. "In view of the coming deregulation of the market for electricty, the producers' interest in supplying "green power" has markedly increased," says Lars Johansson, SJ environmental officer.

In preparation for the deregulation, the Swedish Society for Nature Conservation has published criteria for the environmental classification of electricity, as a means of making market forces influence the way it is generated – the idea being that if sufficient numbers of consumers demand power from renewable sources, it will soon become profitable for generating companies to swtich over to it.

For more information, please apply: The Swedish Society for Nature Conservation, Box 4625, 116 91 Stockholm, Sweden.

Recent publications

Global warming: Cooperation among OECD and non-OECD Countries can make the difference (1995)

Discloses among other things the gains that could result from the imposition of a common tax on greenhouse-gas emissions over a wide area. It is suggested that in order to avoid an all-too-complicated procedure, the first step should be taken by a restricted group of countries – members of the OECD, countries of the former Soviet Union and of eastern Europe, India, and China. In 1990 these countries were together responsible for 84 per cent of the global emissions. As some would be more hard hit than others, compensatory mechanisms are proposed.

Available from OECD Publications Service, 2 rue André-Pascal, 75775 Paris Cedex 16, France.

Global Warming: Economic Dimensions and Policy Responses (1995)

Addressing the policy follow-up of the Framework Convention on Climate Change, this report discusses current options for reducing emissions, explores future possibilities, examines the implications of a carbon tax for international trade and fiscal policies, and examines the scope for international cooperation and joint policy for implementation of the convention.

155 pp. Available from OECD, address as above.

Environmental Taxes in OECD Countries (1995)

Report providing a comprehensive survey of current environmental tax instruments in use in OECD countries. It covers not only taxes introduced explicitly for environmental reasons but also those that may significantly affect the environment, even if they were introduced for other reasons.

99 pp. Available from OECD, address as above.

Clear Air around the World (1995)

Ed. L. Murley. Third edition. Published by the International Union of Air Pollution Prevention and Environmental Protection Associations. A review of 27 countries' environmental legislation and programs for improving air quality, etc.

£49.00. 428 pp. Can be obtained from National Society for Clean Air and Environmental Protection, 136 North Street, Brighton, England BN1 1RG.

Latest monitoring

BETWEEN 1980 and 1993 the European emissions of sulphur fell by 40 per cent, while those of nitrogen oxides were still about the same in 1993 as they had been in 1980 – all according to the latest figures from EMEP, the European Monitoring and Evaluation Programme.

The trend for sulphur emissions was steadily downward over the whole period, from 28 or so million tons in 1980 to 17 million in 1993. Nitrogen oxides on the other hand rose from 21.7 million tons in 1980 to a peak of 24.5 million in 1989, after which they started to fall back again in a slow decline.

Figures for emissions supplied by each of the participating countries (Table 1) form, together with meteorological data, the basis of the calculations in the EMEP model, using advanced mathematical procedures to describe the transformation and deposition of pollutants as they move about over Europe, with field checks of concentrations and fallout to control the computer results.

The figures for sulphur are in general more reliable than those for nitrogen oxides. The report also includes data for ammonia, which are however uncertain, since reliable data for emissions have only been reported from relatively few countries.

Also included in the EMEP model are estimates of the natural emissions of sulphur from the seas (the production of dimethyl sulphide by phytoplankton). It may be noted that figures for the emissions from ships plying in international trade can only be given for the Baltic and the North Sea, and parts of the Atlantic. None can be presented for the Mediterranean and the Black Sea, although there is heavy traffic in those waters too. All the data concerning shipping is in any case said to be incomplete. Data that became available earlier this year shows figures for shipping that are three or four times higher than those used in the EMEP model (see AN 4/95, p.5).

Since a considerable part of the depositions in western Europe cannot be attributed to any specific country, they have to be ascribed to indeterminate sources (IND). Two-thirds of them are nevertheless thought to emanate from within Europe, the rest being carried by winds from North America and Asia. The depositions from sources in North America land mainly on territories bordering on the Atlantic, while those from Asia primarily affect northern Scandinavia. In each case however they only amount to 3-5 per cent of the total depositions in those parts.

The EMEP reports provide an important check on the way signatories to international agreements are fulfilling their obligations, as well as on

Continued on page 15

Table 1. Emissions of sulphur and nitrogen oxides (1000 tons a year).

		Sulphur		Nitrogen oxides (as NO_2)	
		1980	1993	1980	1993
Africa, north		[256]	[256]	[100]	[100]
Albania	AL	[60]	[60]	[30]	[30]
Austria	AT	198	36	246	182
Belarus	BY	370	216	234	207
Belgium	BE	414	152*	442	350*
Bosnia & Herzegovina	BA	240*	240*	[54]	[54]
Bulgaria	BG	1025	711	416*	238
Croatia	HR	75*	90*	60*	83*
Czech Republic	CS	1128	710	937	574
Denmark	DK	226	78	274	264
Estonia	EE	[120]	[120]	[66]	[66]
Finland	FI	292	60	264	253
France	FR	1669	568	1823	1519
Georgia		[81]	[81]	[188]	[188]
Germany[1]	DE	3743	1948	3440	2904
Greece	GR	200	255*	306*	306*
Hungary	HU	816	414*	273	183*
Iceland	IS	3	3*	13	12*
Ireland	IE	111	78	73	122
Italy	IT	1900	1126	1480	2053
Kazakstan		[70]	[70]	[76]	[76]
Latvia	LV	[41]	[41]	[54]	[54]
Lithuania	LT	[68]	[68]	[56]	[56]
Luxembourg	LU	12	8*	23	19*
Macedonia[2]	FYM	[5]	[5]	[2]	[2]
Moldova	MD	[46]	[46]	[35]	[35]
Netherlands	NL	244	84	582	561
Norway	NO	70	18	186	225
Poland	PL	2050	1362	1500	1140
Portugal	PT	133	145	166	245
Romania	RO	881*	280*	369*	443*
Russian Federation[3]	RU	3580	1728	1734	2269
Slovakia	SK	390	162	197*	184
Slovenia	SI	118	91	48	57
Spain	ES	1660	1158*	950	1257*
Sweden	SE	254	50	424	399
Switzerland	CH	63	29	196	150
Turkey[3]	TR	430	177*	[175]	[175]
Ukraine	UA	1925	1925*	1145	1097*
United Kingdom	GB	2454	1597	2395	2355
Yugoslavia[4]	YU	203	200	47	54
Int. trade, Baltic Sea	BAS	[36]	[36]	[80]	[80]
Int. trade, North Sea	NOS	[87]	[87]	[192]	[192]
Int. trade, rem. NE Atlantic	ATL	[158]	[158]	[349]	[349]
Int. trade, Mediter. Sea[5]	MED	[6]	[6]	[13]	[13]
Int. trade, Black Sea	BLS	n o d a t a			
Biogenic sea emissions	NAT	[360]	[360]	[0]	[0]
Sum		**28,270**	**17,093**	**21,709**	**21,117**

The table shows national official data received at the ECE secretariat. Data estimated by MSC-W/CCC are given in square brackets. * Interpolated data (no data have been officially submitted). [1] Incl. East Germany in 1980 figure. [2] Former Yugoslavian republic of Macedonia. [3] Part within the EMEP area of calculation. [4] Former Yugoslavia, excluding Slovenia, Croatia, Bosnia and Hercegovina, and Macedonia. [5] Data for the vicinity of Gibraltar only.

Table 2. Provisional estimate of sulphur budget for Europe. Average for 1993-94. Total deposition of sulphur. 100 tons per year.

	AL	AT	BE	BG	DK	FI	FR	DE	GR	HU	IS	IE	IT	LU	NL	NO	PL	PT	RO	ES	SE	CH	TR	GB	BY	UA	MD	RU	EE	LV	LT	SI	HR	BA	YU	FYM	CS	SK	REM	BAS	NOS	ATL	MED	NAT	IND	SUM
AL	60	0	0	27	0	0	2	6	28	7	0	0	48	0	0	0	5	0	3	2	0	0	1	1	0	8	0	1	0	0	0	1	2	18	16	1	4	1	2	0	0	0	0	1	56	304
AT	1	50	12	9	2	0	65	208	2	58	0	1	105	1	4	0	73	0	9	18	0	14	0	26	1	14	0	1	0	0	1	50	12	12	12	0	132	26	2	0	3	2	0	2	180	1110
BE	0	0	188	0	0	0	108	102	0	2	0	2	4	2	27	0	6	0	0	13	0	0	0	88	0	2	0	0	0	0	0	0	0	0	0	0	12	0	0	0	14	2	0	2	41	620
BG	10	2	1	829	0	0	5	42	20	62	0	0	29	0	0	0	42	0	111	2	0	0	8	4	3	115	6	8	1	0	1	3	8	36	88	2	25	14	2	0	0	0	0	2	190	1674
DK	0	0	6	0	68	0	8	105	0	4	0	2	1	0	5	1	50	0	1	2	3	0	0	86	2	4	0	2	1	0	2	0	0	0	0	0	23	2	0	6	8	1	0	4	44	446
FI	0	0	4	2	9	124	6	70	0	8	0	1	2	0	2	4	82	0	2	1	20	0	0	40	20	36	1	216	70	11	10	1	0	0	2	0	24	4	0	12	3	1	0	6	260	1060
FR	0	4	130	4	2	0	1330	279	0	16	0	9	172	11	30	0	46	14	4	450	0	18	0	279	0	10	0	0	0	0	0	9	6	7	6	0	59	6	10	0	45	36	0	28	590	3618
DE	0	18	239	10	30	0	454	4478	2	54	0	10	84	18	114	0	344	4	12	94	3	22	0	504	4	42	2	6	2	1	3	12	7	8	10	0	767	27	2	8	60	12	0	15	550	8032
GR	34	1	1	322	0	0	4	22	208	22	0	0	66	0	0	0	19	0	24	4	0	0	18	2	2	51	2	4	0	0	0	2	5	25	37	2	12	5	4	0	0	0	0	3	200	1106
HU	2	16	5	26	1	0	21	136	4	676	0	0	59	0	2	0	123	0	56	8	0	2	1	14	2	42	2	2	0	0	1	23	34	34	50	0	109	108	1	0	1	0	0	1	152	1705
IS	0	0	0	0	0	0	2	3	0	0	2	1	0	0	0	0	1	0	0	0	0	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	22	52
IE	0	0	2	0	0	0	10	10	0	0	0	101	0	0	1	0	2	1	0	12	0	0	0	106	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	2	9	0	13	50	322
IT	5	10	7	27	1	0	140	106	11	52	0	1	1632	1	2	0	56	2	8	64	0	24	1	22	1	17	1	2	0	0	0	48	44	56	26	0	52	14	22	0	2	2	0	9	518	2987
LU	0	0	3	0	0	0	15	9	0	0	0	0	0	4	0	0	1	0	0	2	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	5	46
NL	0	0	69	0	2	0	52	169	0	3	0	2	2	1	106	0	14	0	0	7	0	0	0	180	0	4	0	0	0	0	0	0	0	0	0	0	22	2	0	0	22	2	0	3	46	713
NO	0	0	8	2	20	6	14	144	0	7	0	4	1	0	6	32	60	0	2	4	17	0	0	150	6	8	0	53	6	3	4	0	0	2	1	0	33	3	0	6	12	4	0	24	298	938
PL	2	10	44	21	32	2	86	2270	2	149	0	4	40	2	24	1	3482	2	32	24	8	4	1	201	28	188	4	35	5	4	20	12	10	19	22	0	800	102	1	16	18	4	0	8	485	8223
PT	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	162	0	117	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	20	0	6	55	371
RO	6	6	5	192	2	0	18	152	11	306	0	0	62	0	2	0	178	0	574	6	0	2	6	16	10	316	22	18	2	1	3	12	24	56	128	1	106	76	2	1	2	0	0	2	356	2682
ES	0	0	6	2	0	0	74	26	1	1	0	2	28	0	2	0	3	110	0	2044	0	1	0	32	0	0	0	0	0	0	0	1	2	2	1	0	6	0	18	0	2	34	2	16	316	2736
SE	0	1	15	3	71	23	24	266	0	15	0	4	2	0	10	18	178	0	5	4	104	0	0	166	20	35	1	64	26	10	14	2	1	2	4	0	64	8	0	24	16	4	0	18	388	1608
CH	0	2	5	1	0	0	70	35	0	4	0	0	92	0	2	0	6	1	1	22	0	48	0	11	0	2	0	0	0	0	0	3	2	2	2	0	8	1	1	0	1	1	0	1	94	420
TR	6	2	2	236	1	0	8	50	77	35	0	0	42	0	0	0	51	0	43	3	0	0	421	6	6	228	7	24	1	1	2	2	4	14	26	0	29	10	12	0	0	0	0	7	808	2170
GB	0	0	37	0	4	0	96	146	0	5	0	55	5	1	23	0	30	2	1	40	1	0	0	3489	1	6	0	1	0	0	0	1	0	0	1	0	33	2	0	1	46	25	0	35	206	4298
BY	0	2	8	22	9	4	16	236	1	46	0	1	12	1	4	1	426	0	20	8	4	1	2	42	393	280	6	84	14	15	47	4	4	6	8	0	92	22	1	6	3	1	0	2	286	2143
UA	3	8	14	155	8	4	36	492	9	270	0	2	60	0	8	1	862	0	176	12	4	2	17	71	133	4876	74	224	12	8	20	14	20	32	50	0	244	119	10	4	6	1	0	5	894	8960
MD	0	0	1	12	0	0	2	24	0	16	0	0	5	1	0	0	36	0	25	0	0	0	2	2	2	116	38	4	0	0	0	1	2	2	4	0	12	6	0	0	0	0	0	0	45	363
RU	4	7	22	157	37	114	45	623	16	168	0	5	51	0	14	8	882	0	119	16	38	2	49	195	550	3428	38	6552	367	82	110	11	16	32	44	0	230	70	168	34	16	4	0	26	5238	19592
EE	0	0	1	1	3	10	2	31	0	3	0	0	2	1	1	0	34	0	1	1	4	0	0	12	10	14	0	22	112	12	8	0	0	0	0	0	10	2	0	6	1	0	0	1	55	362
LV	0	0	2	4	6	4	4	58	0	5	0	0	2	0	2	0	78	0	2	1	5	0	0	20	28	30	1	22	15	54	32	0	0	1	2	0	20	3	0	6	2	0	0	2	79	490
LT	0	0	3	5	6	1	6	88	0	8	0	0	3	1	2	0	136	0	4	2	4	0	0	23	30	43	1	24	5	13	110	1	1	2	2	0	28	4	0	5	2	0	0	2	85	652
SI	0	6	1	2	0	0	8	22	1	14	0	0	55	0	0	0	12	0	2	4	0	1	0	3	0	4	0	0	0	0	0	94	12	7	5	0	13	4	1	0	0	0	0	0	42	318
HR	2	6	2	13	0	0	13	55	4	66	0	0	112	0	1	0	40	0	8	7	0	1	0	5	1	14	0	1	0	0	0	24	96	70	26	0	38	14	2	0	0	0	0	1	102	726
BA	4	2	1	18	0	0	8	39	5	48	0	0	70	0	1	0	31	0	6	4	0	0	0	4	0	15	0	1	0	0	0	6	30	300	34	0	26	11	2	0	0	0	0	1	100	770
YU	18	4	2	78	0	0	9	58	18	122	0	0	84	0	1	0	46	0	35	4	0	1	2	7	1	36	2	2	0	0	0	6	25	198	386	2	39	20	3	0	1	0	0	2	172	1386
FYM	15	0	0	46	0	0	1	6	16	8	0	0	16	0	0	0	6	0	4	1	0	0	2	1	0	8	0	1	0	0	0	1	2	15	22	4	4	2	0	0	0	0	0	0	40	224
CS	0	10	18	7	2	0	50	883	2	48	0	1	21	2	7	0	270	0	8	14	0	3	0	40	2	18	0	1	0	0	1	8	4	5	8	0	984	36	0	1	4	2	0	2	136	2602
SK	1	8	4	8	1	0	14	140	2	152	0	0	20	0	2	0	192	0	14	5	0	2	0	12	2	30	1	2	0	0	1	8	6	8	12	0	136	196	0	0	1	0	0	1	83	1066
REM	2	1	4	38	2	2	43	58	16	20	0	0	173	0	2	0	57	6	14	105	0	2	17	18	20	422	4	354	5	2	4	3	4	10	9	0	21	6	594	0	2	3	1	14	1707	3764
BAS	0	2	28	10	144	65	44	680	1	36	0	6	10	1	20	8	580	0	12	10	86	1	0	263	43	93	2	104	86	42	46	3	3	4	7	0	155	20	1	104	25	3	0	22	448	3220
NOS	0	4	175	2	88	3	334	980	0	26	0	58	20	4	180	18	276	4	6	81	17	2	0	3716	10	35	1	16	9	4	8	4	3	4	5	0	218	14	1	16	287	42	0	138	709	7518
ATL	0	2	78	2	36	34	358	521	0	21	10	282	25	3	43	28	204	150	8	1630	27	2	0	1937	25	68	2	702	42	10	12	4	2	2	4	0	128	10	4	12	74	638	0	1410	4194	12774
MED	89	16	22	556	4	0	470	302	596	184	0	2	2918	2	10	0	188	30	88	785	2	16	188	77	8	232	10	22	2	1	3	62	179	242	146	3	150	50	322	2	8	15	3	114	2354	10471
BLS	6	2	4	517	2	2	12	116	32	78	0	0	36	0	2	0	152	0	128	4	1	1	114	14	22	958	32	101	4	2	5	5	10	28	43	0	63	24	28	1	2	0	0	15	765	3382

Table 3. Estimate of oxidized nitrogen budget for Europe. Average for 1993-94. Total deposition of nitrogen. 100 tons per year.

	AL	AT	BE	BG	DK	FI	FR	DE	GR	HU	IS	IE	IT	LU	NL	NO	PL	PT	RO	ES	SE	CH	TR	GB	BY	UA	MD	RU	EE	LV	LT	SI	HR	BA	YU	FYM	CS	SK	REM	BAS	NOS	ATL	MED	BLS	NAT	IND	SUM
AL	4	1	0	3	0	0	2	4	8	1	0	0	28	0	0	0	2	0	2	1	0	0	0	1	0	2	0	1	0	0	0	0	1	2	1	0	2	1	0	0	0	0	0	0	0	18	86
AT	0	30	12	2	2	0	72	178	2	8	0	0	106	1	12	0	21	0	6	6	2	20	0	22	1	4	0	1	0	0	0	6	4	1	1	0	30	8	0	0	3	2	0	0	0	70	633
BE	0	0	36	0	0	0	48	66	0	0	0	1	2	1	26	0	2	0	0	5	0	1	0	52	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	7	2	0	0	0	18	275
BG	2	4	2	44	1	0	5	22	10	10	0	0	21	0	2	0	13	0	50	1	0	1	2	4	1	26	1	6	0	0	0	1	2	2	6	0	9	6	0	0	0	0	0	0	0	56	313
DK	0	1	4	0	21	0	8	44	0	0	0	2	1	0	13	2	15	0	0	1	6	0	0	52	1	2	0	0	0	0	0	0	0	0	0	0	6	1	0	2	5	1	0	0	0	19	212
FI	0	1	6	0	16	84	8	54	0	2	0	1	2	0	11	18	36	0	2	0	56	0	0	38	8	10	0	40	12	6	4	0	0	0	0	0	11	2	0	10	4	1	0	0	0	100	548
FR	0	8	80	1	4	0	724	268	0	3	0	6	134	6	60	0	14	16	3	185	2	23	0	204	0	2	0	0	0	0	0	2	2	1	0	0	18	3	2	0	30	36	0	0	0	258	2100
DE	0	26	154	1	25	1	368	1398	0	10	0	8	91	10	215	4	91	4	8	36	11	34	0	341	2	9	0	2	0	0	1	3	3	0	0	0	138	12	0	5	42	13	0	0	0	243	3316
GR	4	2	1	24	0	0	5	11	48	3	0	0	34	0	1	0	6	0	13	2	0	0	6	2	0	12	0	4	0	0	0	0	2	2	3	0	4	2	1	0	0	0	0	0	0	63	261
HU	0	20	6	4	1	0	24	86	2	42	0	0	56	0	7	0	36	0	22	3	1	4	0	12	1	10	0	2	0	0	0	4	8	3	4	0	32	29	0	0	2	1	0	0	0	56	480
IS	0	0	1	0	0	0	2	3	0	0	1	1	0	0	1	0	0	0	0	0	0	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	18	39
IE	0	0	3	0	0	0	12	10	0	0	0	18	0	0	4	0	0	1	0	4	0	0	0	54	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	8	0	0	0	26	146
IT	1	16	8	4	2	0	147	93	6	9	0	0	747	1	8	0	18	2	6	34	1	25	0	18	0	4	0	2	0	0	0	8	12	6	3	0	17	6	4	0	2	3	0	0	0	192	1405
LU	0	0	2	0	0	0	8	6	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	27
NL	0	0	24	0	2	0	28	90	0	0	0	2	2	0	60	0	4	0	0	3	0	0	0	90	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	10	2	0	0	0	21	350
NO	0	1	9	0	26	10	15	90	0	1	0	4	1	0	22	63	23	0	2	1	44	0	0	114	3	4	0	8	2	2	2	0	0	0	0	0	11	2	0	6	11	4	0	0	0	127	608
PL	0	18	46	4	37	2	94	593	2	22	0	4	42	2	78	6	470	0	18	8	24	8	0	156	15	40	2	15	2	2	4	2	4	2	2	0	174	33	0	10	18	4	0	0	0	196	2161
PT	0	0	0	0	0	0	3	1	0	0	0	0	0	0	0	0	0	55	0	46	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14	0	0	0	38	160
RO	1	12	6	22	2	0	19	81	6	42	0	0	50	0	8	1	56	0	141	2	2	3	2	14	4	58	5	13	0	0	1	3	8	4	10	0	36	30	0	1	2	1	0	0	0	112	756
ES	0	1	7	0	1	0	72	26	0	0	0	2	18	0	8	0	2	84	0	574	0	2	0	26	0	0	0	0	0	0	0	0	0	0	0	0	2	0	3	0	4	30	2	0	0	160	1027
SE	0	2	16	1	62	35	26	157	0	3	0	4	2	0	38	57	60	0	4	2	132	1	0	128	10	12	0	21	8	6	5	0	0	0	0	0	21	4	0	16	16	4	0	0	0	154	1011
CH	0	2	4	0	0	0	68	36	1	0	0	0	70	0	4	0	2	1	1	9	0	24	0	9	0	0	0	0	0	0	0	1	0	0	0	0	2	0	0	0	1	1	0	0	0	32	272
TR	1	3	2	23	2	1	9	30	33	6	0	0	20	0	2	0	18	0	27	2	2	1	84	6	3	56	2	32	0	0	1	0	2	1	2	0	12	4	7	0	1	0	0	0	0	281	678
GB	0	2	26	0	6	0	78	115	0	0	0	25	4	1	50	2	10	2	1	12	3	2	0	668	0	3	0	0	0	0	0	0	0	0	0	0	10	1	0	1	26	18	0	0	0	98	1166
BY	0	4	8	3	14	6	20	107	1	8	0	1	12	0	15	4	114	0	11	2	16	2	0	34	48	58	2	40	3	6	8	1	2	0	1	0	29	8	1	4	4	1	0	0	0	92	696
UA	1	16	16	20	14	6	44	222	6	40	0	2	56	1	28	4	242	0	82	4	16	6	6	62	42	484	14	143	3	4	6	4	8	2	5	0	79	44	8	5	7	2	0	0	0	302	2054
MD	0	1	1	1	0	0	2	10	0	2	0	0	4	0	1	0	10	0	8	0	1	0	0	2	1	18	2	4	0	0	0	0	0	0	0	0	4	3	0	0	0	0	0	0	0	14	94
RU	1	17	27	22	76	178	66	373	8	33	0	6	44	1	61	48	342	0	84	6	148	6	18	186	160	708	12	2116	54	39	36	3	8	3	4	0	95	36	96	36	21	6	0	0	0	1716	6904
EE	0	0	1	0	4	8	2	17	0	0	0	0	1	0	4	3	11	0	1	0	11	0	0	10	3	4	0	8	5	3	2	0	0	0	0	0	4	0	0	3	1	0	0	0	0	19	127
LV	0	1	2	0	7	5	4	28	0	1	0	0	2	0	6	3	22	0	2	0	12	0	0	15	6	7	0	9	3	6	4	0	0	0	0	0	6	1	0	3	2	0	0	0	0	28	186
LT	0	1	4	1	8	2	7	40	0	2	0	1	3	0	8	2	35	0	2	1	12	1	0	18	9	9	0	8	1	3	8	0	0	0	0	0	8	2	0	3	2	0	0	0	0	28	231
SI	0	6	1	0	0	0	9	20	0	2	0	0	46	0	2	0	4	0	2	1	0	2	0	2	0	1	0	0	0	0	0	5	2	1	0	0	4	2	0	0	0	0	0	0	0	16	130
HR	0	8	2	2	0	0	14	36	2	8	0	0	91	0	2	0	12	0	5	3	0	2	0	4	0	4	0	1	0	0	0	4	12	5	2	0	12	6	0	0	1	0	0	0	0	36	278
BA	1	4	2	3	0	0	8	24	2	7	0	0	66	0	2	0	11	0	4	2	0	1	0	4	0	4	0	1	0	0	0	2	8	8	3	0	8	4	0	0	0	0	0	0	0	34	217
YU	2	6	2	10	1	0	10	46	8	17	0	0	66	0	4	0	16	0	19	2	0	1	1	6	1	8	0	2	0	0	0	2	8	8	15	0	14	8	0	0	1	0	0	0	0	58	336
FYM	2	0	0	4	0	0	1	4	6	1	0	0	10	0	0	0	2	0	2	0	0	0	1	0	0	2	0	1	0	0	0	0	1	1	2	0	1	1	0	0	0	0	0	0	0	12	56
CS	0	14	19	1	4	0	52	251	1	7	0	1	24	1	23	1	50	0	5	4	2	6	0	38	1	4	0	1	0	0	0	2	2	0	0	0	109	11	0	1	5	2	0	0	0	60	701
SK	0	10	4	2	1	0	16	66	1	14	0	0	20	0	6	0	42	0	8	2	1	3	0	11	1	7	0	1	0	0	0	2	2	1	1	0	34	22	0	0	1	0	0	0	0	32	313
REM	1	3	4	6	3	2	62	46	8	4	0	0	98	0	7	2	22	6	11	64	4	5	6	17	8	97	2	214	2	2	2	1	2	1	1	0	8	4	116	2	2	3	1	0	0	880	1728
BAS	0	4	26	2	82	42	46	285	0	6	0	6	9	1	59	26	137	0	8	3	110	2	0	176	16	22	0	35	12	10	10	1	1	0	0	0	40	8	0	26	20	4	0	0	0	158	1396
NOS	0	8	96	0	65	4	222	512	0	4	1	34	17	2	112	27	76	3	4	27	40	4	0	1126	6	9	0	6	2	2	3	1	1	0	0	0	52	6	0	10	84	34	0	0	0	300	3004
ATL	0	7	88	1	63	56	342	450	0	4	10	111	18	3	152	95	84	60	6	259	80	6	0	1196	14	20	0	108	10	6	6	1	1	0	0	0	46	6	1	14	78	302	0	0	0	2286	5990
MED	12	28	22	50	5	0	385	214	150	28	0	2	1114	2	27	2	56	20	52	321	4	26	46	58	4	54	2	18	0	0	1	12	32	18	14	0	46	21	36	2	7	14	2	0	0	934	3848
BLS	1	4	5	32	4	2	14	58	14	12	0	0	22	0	6	1	49	0	58	2	4	2	32	12	8	170	6	100	1	1	2	1	4	2	3	0	22	10	18	1	2	0	0	0	0	231	919

Explanation of the tables

For two-letter country codes, see opposite table. To find the contribution from other countries to a certain country, follow the horizontal row starting from the relevant country code on the far left. To find the contributions from a certain country to other countries, follow the vertical column starting from the relevant country code at the top. REM signifies contribution to and from the part of the domain for deposition calculations which is not covered by European countries. IND signifies the part of the calculated depositions which cannot be attributed to any known emission sources by the present models.

Controversy over "dirtiest fuel"

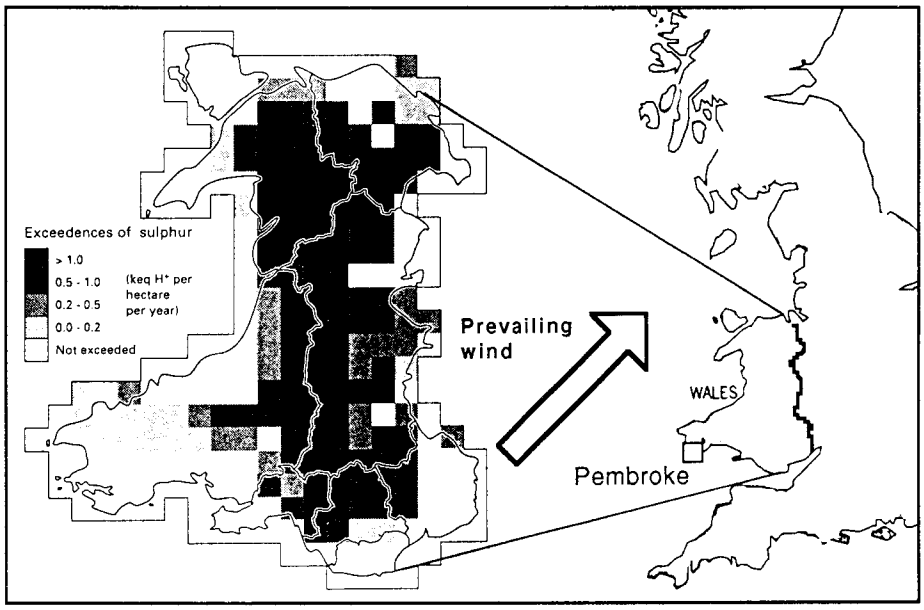
FROM THE VERY START, the plan of the British electricity generator National Power to burn orimulsion in its Pembroke power station in southwest Wales has been beset by controversy on account of the health and environmental effects.

Orimulsion originates from the huge bitumen reserves of Venezuela and is an emulsion of water and bitumen products. It is a comparatively cheap fuel compared to coal, but has been labelled by environmentalists "the dirtiest fuel" on account of its high sulphur content and high levels of vanadium and nickel.

The average sulphur content is 2.7 per cent, which is similar to that of the heavy fuel oil now being burnt at the station, but higher than the 1.6 per cent average for British coal. Since orimulsion has a lower heat value than oil, in terms of emissions per energy unit it would be the same as oil with a sulphur content close to 4 per cent. The low cost of orimulsion – compared to that of the fuel oil now being used – will mean that the station will switch from peak-load use to baseload, with the potential for significant increases in gaseous emissions.

Concern initially concentrated on the huge increases in emissions of sulphur dioxide and nitrogen oxides, with resulting acidification, which could be expected from a switch to orimulsion. The predominantly southwesterly rain-bearing winds mean that emissions from the station could lead to significant increases in acid deposition on parts of Wales that are already receiving more than the nature can withstand in the long term (i.e. above the critical load).

The Countryside Council for Wales has estimated that thirty-one Sites of Special Scientific Interest (SSSIs) "have or probably have" been damaged by acidification, and that a further eleven sites may be at risk, which amounts to 80,000 hectares of land and water. Even after the implementation of the 1994 sulphur protocol, requiring reductions of 80 per cent in UK sulphur emissions by 2010 compared with 1980, there will still be 46,000 hectares with sulphur depositions above their critical load.



Pembroke, and areas in Wales where the critical loads are already being exceeded.

The company's decision on financial grounds to fit flue-gas desulphurization (FGD) rather than the more advanced Integrated Gasification and Combined Cycle (IGCC) technology as the best practicable environmental option (BPEO) has been criticized by the government's own pollution regulator.

Flue-gas desulphurization could reduce emissions of sulphur dioxide by 94 per cent, but require thousands of tons of limestone to be quarried and transported to Pembroke and result in the production of large amounts of metal-rich waste gypsum with a limited economic potential. It will most probably have to be landfilled, presenting the possibility of groundwater pollution.

Concern for huge increases in emissions of sulphur and nitrogen oxides

Local acid deposition may increase when FGD by-pass occurs during start-up, affecting sensitive lichen communities that are recognized to be of European importance. The so-called low-NOx burner technology that is to be applied will only slightly reduce emissions of nitrogen oxides from the plant. Overall, therefore, there will be substantial increases in the plant's NOx emissions when the orimulsion comes on stream, exacerbating and compounding the existing problems caused by sulphur dioxide deposition.

But IGCC would produce the saleable by-products sulphur and hydrogen, and greatly reduce NOx emissions, as well as having a higher thermal efficiency with correspondingly lower emissions of carbon dioxide.

Dust emitted from the burning of orimulsion is to be removed by fitting electrostatic precipitators. Due to the precipitators' lack of effectiveness and the detrimental effects on health locally – in particular from the escaping ultrafine particles, affecting people suffering from respiratory illnesses – as highlighted by Friends of the Earth Cymru, the overall emissions are nevertheless going to increase.

The dust will have a very high metal content, and pressure is growing to tighten the emission standards to bring them into line with those for the burning of hazardous waste.

Uncertainties remain as to the effect of the power station on local sea-water quality and the aquatic ecosystem in general. Discharge waters are expected to have a ten-de-

gree higher temperature, which could have a significant effect on certain fish species, in particular migratory salmanoids, and on the spawning ground for the waterway's unique population of herring.

Clearly the concerns expressed by environmentalist groups and government agencies are giving rise to a number of serious questions which National Power will have to answer before getting the green light for burning orimulsion at Pembroke.

The environmentalist organizations argue that there is no need for the plant at all, pointing out that electrical generating capacity is already in surplus and that the capital would be better invested in insulating buildings, improving the efficiency of appliances, and promoting renewable energy schemes. Such projects would create jobs that are sustainable in the long term.

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Key to sales

The British power company PowerGen has announced that it is to close its 360 MW orimulsion-fired power station at Ricborough in Kent. The company insists that commercial rather than environmental concerns have influenced its decision to shut the thirty-three-year old station. PowerGen will continue to burn orimulsion at its Ince station on Merseyside at least until 1997, when its fuel-supply contract with Bitor Europe expires. Bitor's hopes of increasing UK sales to 10 million tons per year by the end of the decade now rely on National Power's plans to convert the Pembroke plant to orimulsion.

ENDS Report 249, October 1995.

Being pushed elsewhere

Bitor Europe, a subsidiary of Petroleum Venezuela, is doing all it can to spread the use of orimulsion. A contract has recently been signed with the Lithuanian government, giving highly advantageous terms which include a reduced price for the first three years and the possibility for Lithuania of breaking the contract at any time. After a trial firing with orimulsion at the Elektrenai power station, the results will be evaluated as regards both the economy and and the effects on the environment. Seeing that the plant entirely lacks flue-gas cleaning, greatly increased enissions of pollutants can be expected.

Energy News of Lithuania No.2, 1995

Global emissions increasing

ESTIMATES HAVE recently been made of the global emissions of several air pollutants, including compounds of sulphur and nitrogen. Scenarios have also been constructed for likely future trends. It appears that the annual man-made emissions of sulphur amount to about 65 million tons S, and the natural emissions to about 25 million tons. Some studies suggest however that the anthropogenic emissions of sulphur may be higher, of the order of 70-80 million tons S.

The anthropogenic emissions of sulphur dioxide emanate almost exclusively from the burning of fossil fuels and the smelting of sulphide ores. The natural sources are primarily the oxidation of dimethyl sulphide from the sea and emissions from volcanoes. It is well to note that the anthropogenic emissions are about three times as great as the natural ones, but that in the industrialized parts of the northern hemisphere they are twenty times larger.

As regards nitrogen oxides, the annual emissions from human activity, with the exception of aviation, are estimated to be 21 million tons N a year. Aircraft add further 1.5 million tons. As in the case of sulphur, the emissions come mainly from the combustion of fossil fuels. Those from natural sources probably amount to 15-20 million tons N a year, the chief sources being biomass burning, lightning, and biogenic emissions from soils.

Although the figures for ammonia are uncertain, the total, both from natural and anthropogenic sources, seems to be about 45 million tons N per year, distributed according to one study as follows: animals (domestic and wild) 25 million tons; the seas 7 million tons; vegetation 5 million; biomass burning 2 million tons.

Among the scenarios used for tracking future trends have been those for energy use developed by the Intergovernmental Panel on Climate Change. From one of these the emissions of sulphur and nitrogen oxides have been projected up to the year 2100, showing a dramatic increase. The anthropogenic emissions of sulphur would double from 73 million tons in 1990 to 151 million tons in 2050, later falling back to 144 million tons by 2100. The most marked increases are expected in eastern and southern Asia.

The man-made emissions of nitrogen oxides are likely to increase still more, from 25 million tons N in 1990 to 53 million in 2050, and then on to 72 million tons by 2100.

In terms of the acidifying potential, i.e. as hydrogen-ion equivalents, the increase would be from 4.6 tera-equivalents (Teq) in 1990 to 6.6 Teq in 2050, and then 9.1 Teq by 2100, if both anthropogenic and natural emissions are included. The global acidifying potential due to sulphur and nitrogen oxides would thus double over the next hundred years.

CHRISTER ÅGREN

Sources: **Global scale transport of acidifying air pollutants,** by H. Rodhe et.al., and **Global emissions inventories of acid-related compounds,** by T.E. Graedel et.al. Papers presented at the Acid Reign '95? conference in Göteborg last June.

Continued from page 12.

the general effect of such agreements (see article, p.5). The data is moreover needed when agreements are being negotiated for further reductions of emissions under the UN ECE Convention on Long Range Transboundary Air Pollution.

The latest figures for exports and imports of sulphur and oxidized nitrogen compounds are shown in Tables 2 and 3. Since relatively large differences in the transports of air pollutants may occur on account of weather and air currents, the values in the tables are averages for 1993 and 1994.

PER ELVINGSON

European Transboundary Acidifying Air Pollution: Ten years calculated fields and budgets to the end of the first sulphur protocol. EMEP/MSC-W Report 1/95. Available from the Norwegian Meteorological Institute, P.O. Box 43-Blindern, N-0313 Oslo 3, Norway.

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P 28

The extra number of deaths and cases of disease per million of population that might be expected as a result of a three-day pollution episode.

	Concentration of PM_{10} in the air (micrograms/m^3)		
	50	100	200
Deaths	4	8	16
Hospital admissions for respiratory problems	6	12	24
Asthmatics needing their inhalers	1400	2800	5600
Asthmatics with aggravated sympthoms	1000	2000	4000

Source: WHO

Health effects of particles

THE World Health Organization, now working on new guidelines for air quality, has found small airborne particles, known as PM_{10}, to be a serious health risk for thousands of people.

The panel that has come to this conclusion, composed of experts from eleven countries, is however unwilling to propose any safe limit for PM_{10} because "there is no evident threshold for effects" as regards morbidity and mortality. The group has also abandoned the practice of lumping particles together with sulphur dioxide, and has estimated how many people are likely to be harmed by PM_{10}s alone (see table).

The EU Commission's technical working group on particles, which has to propose a directive as subsidiary to the main one on air quality, got started in October. It is reported to be studying limits between 30 and 100 micrograms of PM_{10} per cubic metre of air. Representatives of the oil and transportation industries who were present at the meeting of the working group expressed strong opposition however to any tightening of the regulations. Several of the measures needed to reduce particle emissions are said to require relatively costly investments.

A draft EU directive has to be ready at latest by December 1996, but there is no official deadline for the WHO panel.

Source: **New Scientist**, November 4, 1995.

UK SO_2 standards

The goverment of the United Kingdom has indicated it will follow the recommendation of an independent panel of scientists to set an air quality standard for sulphur dioxide of 100 parts per billion (ppb) over a fifteen-minute period. Such a standard would go beyond the existing WHO guidelines. If it is incorporated in the forthcoming national air quality strategy it will create problems in parts of the UK where pollution levels currently exceed it. These include Belfast as well as London.

Environment Watch: Western Europe. September 29, 1995.

Environmentally friendly city

A thousand shiny bicycles made their appearance this summer on the streets of the Danish capital – to be borrowed by anyone who wanted to get about. They can be unlocked by inserting a 20-krone piece, the charge being returned when the bike is put back into any one of the 120 racks that are spread around the city. Next year, when Copenhagen is to be the EU culture capital, still more bicycles will be put out, showing how environmentally friendly the city is. The scheme is financed both by the government and private sponsors. The special design and a built-in radio sender are intended to discourage thievery.

Dagens Nyheter, June 1, 1995.

OZONE

Threshold values exceeded

THE THRESHOLD VALUES for ozone, which have been set for the protection of human health and vegetation, were substantially overstepped in all or almost all EU member states in 1994, according to figures from the European Commission. From a preliminary report that was presented at the meeting of the European environment ministers in October, it appears that the thresholds had frequently been crossed in 1995 too.

According to a directive from 1992, all member countries are obliged to measure the concentrations of ozone and report when certain threshold values have been exceeded. Nine of the countries have still not given the directive legislative force. A majority have however submitted required data.

In its comment to the report from 1995, the Commission observes that the extent of the exceeding "is of concern and represents an important challenge for the Community and the Commission in the months and years to come."

The Commission notes that although a number of measures have already been taken to reduce emissions of the ozone precursors, nitrogen oxides and volatile organic compounds, further legislation will be needed to bring down concentrations to levels below the threshold values. For the time being discussion is said to be centring on a framework directive on fuel qualities, new emission limits for cars, emission limits for mobile and non-mobile machinery, control of the losses from evaporation during refuelling, revision of the directive for large combustion plants, and measures to limit emissions of solvents from industrial processes.

Source: **European Commission DGXI**, October 10, 1995.