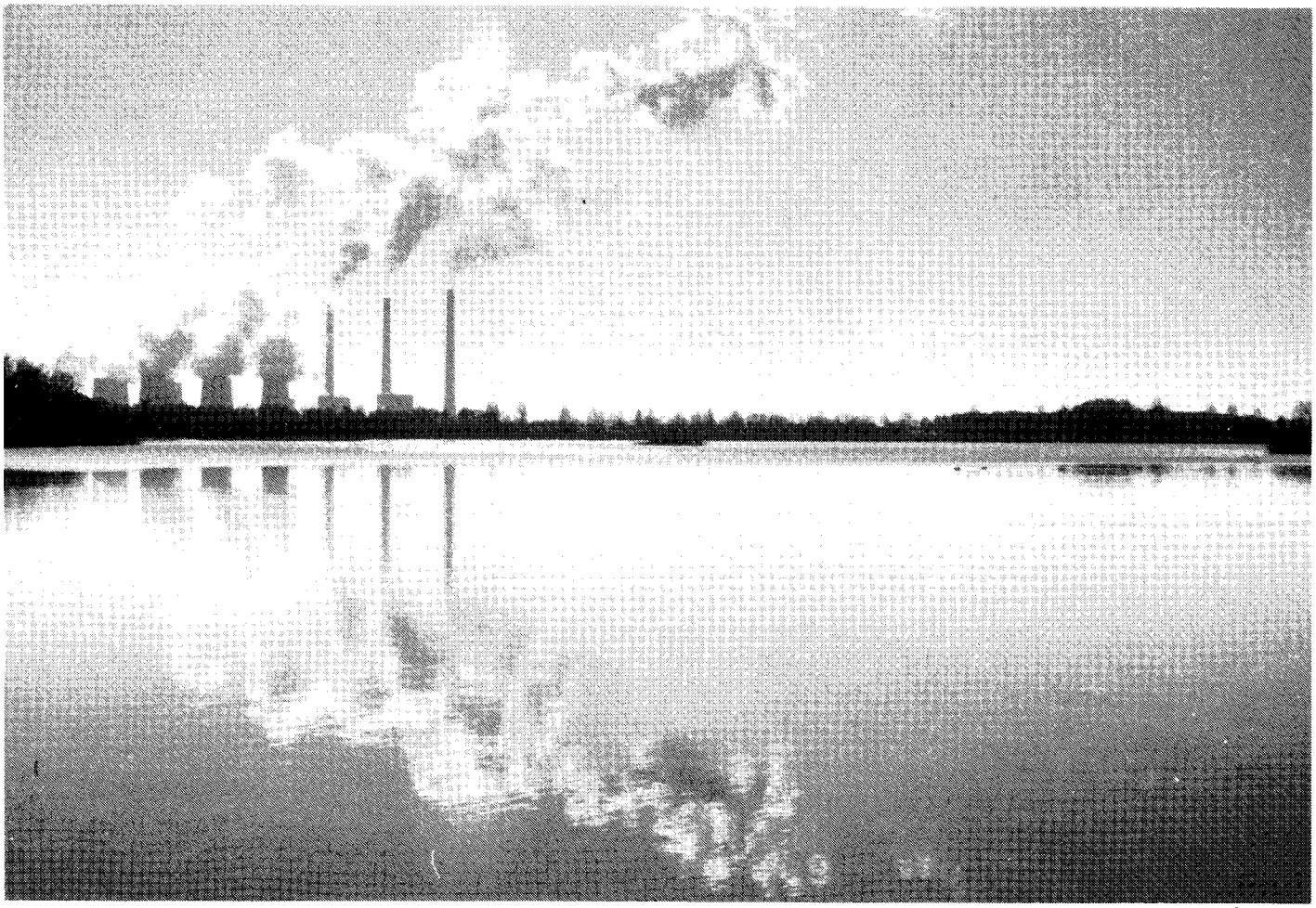
No.3, JULY 1989

Acid News

A Newsletter from the Swedish and Norwegian NGO Secretariats on Acid Rain



NEEDED REDUCTIONS

Photo: Christer Ågren ©

More than we thought

If we are to save our natural environment, European emissions of sulphur and nitrogen oxides to the atmosphere will have to be reduced by at least 90 per cent. The levels of ozone must be reduced by 75 per cent and, in some regions, the emissions of ammonia must be cut by at least 90 per cent.

This is what came out of an NGO Strategy Meeting that was held at Ede in the Netherlands on April 3-4 this year. The findings are based on the latest scientific data on critical loads.

Objectives for a reduction of emissions, in consideration of what ecosystems will tolerate, had previously been formulated by the European environmentalist organizations at a meeting in Sweden in the autumn of 1986. The meeting in the Netherlands was convened because it appeared from subsequent research that the original proposals needed updating.

Attending the Ede meeting were some thirty representatives from twenty-five environmentalist organizations based in fifteen countries, both in eastern and western Europe. It was organized by the Stichting Natuur en Milieu in cooperation with the WWF International, Greenpeace International, and the Swedish NGO Secretariat on Acid Rain.

The meeting opened with a presentation of the latest findings of research on critical loads by two Dutch scientists, Wim de Vries and Fred Tonnewijk. After Christer Ågren, Sweden, had explained the UN ECE Convention on Long Range Transboundary Air Pollution, the meeting went over to a discussion of joint objectives and strategies for the immediate future.

Agreement was quickly reached on the objectives set forth above

Continued on page 3

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Acid News

A newsletter from the Swedish and Norwegian Secretariats on acid rain.
ACID NEWS is a joint publication of the two secretariats, 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 secretariats at either of the addresses below. All requests for information or material will be dealt with to the best of our ability. 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:

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THE SECRETARIATS
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- The Environmental Federation (Miljöförbundet)
- The Swedish Anglers' National Association (Sportfiskarna)
- The Swedish Society for the Conservation of Nature (Naturskyddsföreningen)
- The Swedish Youth Association for Environmental Studies and Conservation (Fältbiologerna)

Address and telephone: see above.

The Norwegian secretariat,**"The Stop Acid Rain Campaign/Norway,"** is organized by five non-governmental organizations concerned with the environment:
- Nature and Youth (Natur og Ungdom)
- The Norwegian Forestry Society (Det Norske Skogselskap)
- The Norwegian Association of Anglers and Hunters (Norges Jeger- og Fiskeforbund)
- The Norwegian Mountain Touring Association (Den Norske Turistforening)

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EDITORIAL

Get on with it!

The new Working Group on Abatement Strategies, set up under the UN ECE Convention on Long Range Transboundary Air Pollution, has already had a first meeting, in February. Its main task is to develop abatement strategies based on the critical loads approach, for presentation in 1991. See Acid News 1/89, pages 8–9.

Proceeding from data on the critical loads for different areas, the group will be determining so-called target loads. These will indicate the loads of pollutants that should be kept within bounds through various emission-limiting measures. The target loads may be higher or lower than the critical loads, depending on the manner in which the situation is judged in different cases. They may be set lower in order, for instance, to leave a margin of safety, which may seem necessary because the data on which they are based is deemed uncertain. This would simply be following a practice that is standard in the medical field. The target loads may on the other hand be higher than the critical loads. This is perhaps more likely, and would mean in effect a deliberate acceptance of a certain degree of environmental damage.

For some years countries such as the Netherlands and Sweden have been employing the critical loads approach when deciding on the aim in limiting emissions. In every case however the target loads have been higher than the critical loads for more sensitive areas.

Of importance in the process of arriving at target loads and abatement strategies will be the development of critical-load maps, which will show the amount of pollutants that any area can take without suffering damage. Such maps will also make it possible to describe roughly, and to some extent to quantify, the likely environmental effects of various loads of pollutant.

The ways to get these maps made will be considered at an ECE workshop that is to be held in West Germany next November. If they are to reflect correctly the sensitivity of the various areas, critical-load maps must have a high geographical resolution. That of the EMEP maps on 150 x 150 km squares will not suffice for the new purpose. It will be extremely important, if the maps are to be ready within any reasonable time, for each country to start work on them without delay. They can then be revised and improved in the light of what comes out of this autumn's workshop.

As readers will have the gathered from previous articles in Acid News (latest in 2/89, p.2), a strict interpretation of the critical load concept, with its long-term aim of eliminating damage to the most sensitive ecosystems, would mean that in some areas the fallout of acidifying pollutants would have to be about nil. Last April the European environmentalist organizations agreed that the overall discharges of sulphur and nitrogen oxides should, in line with the latest scientific findings, both be reduced by at least 90 per cent (see p.1).

To diminish the concentrations of ozone, as required, by at least 75 per cent, the emissions of hydrocarbons would also have to be heavily reduced. It was noted, too, that in some parts of Europe reductions of up to 90 per cent would have to be made in the emissions of ammonia.

Seen in a human timescale, much of the damage caused by air pollution will be irreversible. Cases in point are the leaching of mineral plant nutrients from acidified soil, and the weathering away of buildings and other historical monuments. Nature's tolerance has long been exceeded, and for every year that passes the damage accelerates. The urgency of the need for a rapid, in fact very rapid, reduction of the emissions of pollutants cannot be overemphasized.

Christer Ågren

Continued from page1
in the opening paragraph. The implementation dates, on the other hand, required rather longer debate. In view of the actual state of the environment, the required reductions should in fact take place immediately. As an attainable target date, however, the meeting put 1995 for a 75 per cent reduction both of SO2 and NOx – with the provision that the full 90 per cent reduction should be brought about as quickly as possible thereafter. In some parts of Europe it would be necessary to call for a similar reduction of ammonia (NH3). The reduction objectives are based on the 1980 level of emissions and refer to the whole of Europe.

The reduction schedules so far agreed upon within the UN ECE Convention were considered far from satisfactory.

What is needed

The methods and strategies that will be necessary to achieve the proposed objectives were discussed in working groups on the second day of the conference, and the outcome appeared in the series of measures set forth in the final statement issued by the meeting. It was for instance emphasized that the highest priority must be given to a more efficient use of energy as well as to energy conservation and an increased use of renewable energy sources. Since the effect of such measures will only be seen in the long term, however, they must be accompanied by a steady application of the best available technology for cleaning the emissions from road vehicles, power plants, and manufacturing processes.

In some cases, as for instance that of emissions from road traffic, not even the best available technology will suffice to bring about the desired results as quickly and effectively as is necessary. Along with the introduction of stricter exhaust standards and more fuel efficient vehicles, the volume of traffic itself will have to be controlled. Among the demands made in the statement from the meeting is one calling for a stop to all new major road projects and increased investment in public transport and freight by rail.

It was also said that measures should be taken to reduce emissions from aircraft and ships, as well as road traffic. As regards the last, one measure that would have immediate effect would be a lowering of the speed limits on all highways.

The matter of the east

With representatives of several environmental organizations from eastern Europe attending the meeting, East-West collaboration could also be profitably discussed. Clearly such collaboration needs to be greatly developed. Countries in the West were urged, either severally or alone, to assist those in the East to curb air pollution, by technical or financial aid or both. Joint-venture projects were named as a possible practical means of implementing such assistance, as was the training of technicians in environmental technology. The need for a widespread sharing of information was also emphasized.

Per Elvingson

A full report of the meeting, including addresses, minutes of the debate, and the concluding statement, is under preparation and is expected to become available in the cource of the summer. It will also be reviewed in the next number of Acid News.

On the following pages are four articles on issues concerning Eastern Europe

Andre Maslennikov©

Small cars

Last April the European Parliament voted against the emission standards for small cars that had previously been agreed by the Council of Environmental Ministers. The parliament wanted a limit of 20 grams per test for CO2 and 5 grams for HC and NOx combined, instead of 30 and 8 grams.

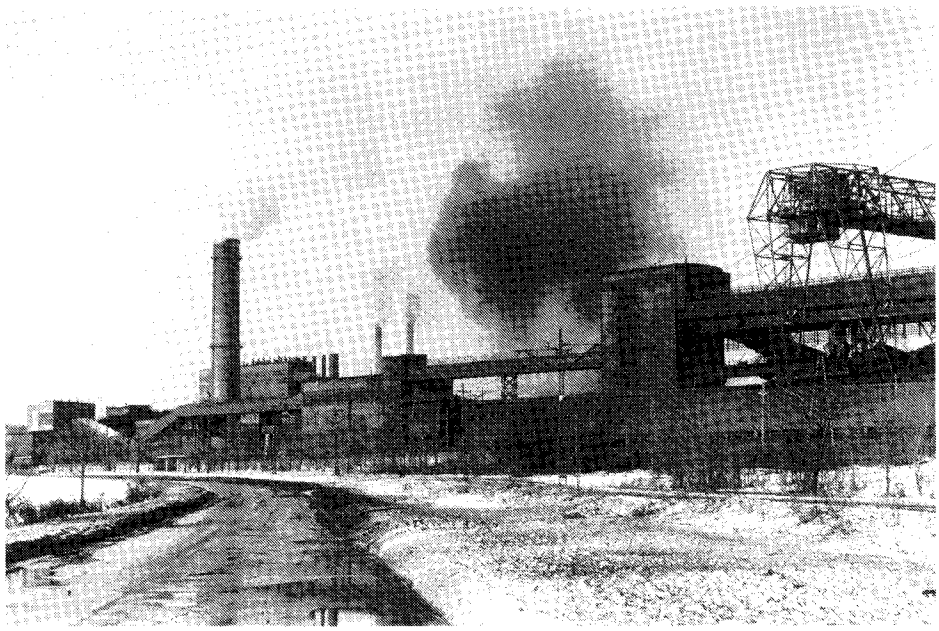
On June 6 the ministers agreed however on limits of 19 grams for carbon monoxide and 5 grams for the combination of hydrocarbons and nitrogen oxides. This means that all cars with engines under 1.4 litres will have to be fitted with catalytic converters by the end of 1992.

Picture on the front page shows the Jänschwalde power station near Cottbus, GDR. See article on page 9.

Advantage in modernizing

Environmental technology is much further advanced in western countries than it is in the socialist East. The introduction of western technologies in eastern European countries could therefore turn out to be a costly undertaking.

In the writer's view it makes little sense to provide the East with high tech environmental equipment. Apart from the fact that the socialist countries do not have the means to pay for such technology, they would probably run into difficulty later with its operation and maintenance. Then, too, it would not be sound economy to spend money, say, on western high tech FGD equipment for installation in a power plant from the 1930s. It is these obsolete industrial facilities that are causing the greatest problems in the East.



Among the plants in urgent need of modernization is the Nova Huta steelworks near Cracow. Photo: Andre Maslennikov©

The matter could be dealt with in two ways. One would be to help the socialist countries modernize their industrial plant, the other to assist them in manufacturing the kind of environmental equipment that is really applicable to their need. It might be sufficient as a first step, for instance, to develop filter systems that would reduce SO_2 emissions by 60 per cent instead of 90 per cent as in the West. This would not only mean a considerable reduction of the cost, but also that more units could be built, and the countries making them learn to master the technology. It could save them hard currency, and perhaps later enable them to export their low tech equipment to other East European countries.

The accruing improvement to the environment would also be of advantage to the West – since a greater overall reduction would result, for instance, from reducing the emissions of many power plants by 60 per cent than from reducing those of one or two by 90 per cent. Any overall reduction by more than 30 per cent should be considered a marked success.

The manufacture of suitable equipment could well be a matter for joint ventures between companies from East and West. Although there may be cases where the technology is not transferable, since the equipment is on the so-called COCOM list, this does not appear to be a general difficulty, and the problem may be even less in the future. If the West German/French airbus can be sold to East Germany, in other words really high technology, there should be no obstacle, say, to FGD equipment.

While the framework of East-West cooperation will have to be set up by the western governments, the filling-in will have to come from the activities of business interests and scientific and cultural groups as well as NGOs.

There are several reasons why East-West cooperation should be expanded, one of the most important being that the East's problems are of such a magnitude that other actors need to be involved besides the various governments. Lasting improvements can only be brought about through a broad mobilization of interests and the collaboration of western organizations with their counterparts in the East.

Since air pollution is, in general, caused by combustion processes, energy policy can be a crucial instrument for mitigation. Strategies for intensifying east-west collaboration in regard to the environment will therefore also have to aim at the energy sector. It may be more fruitful to modernize power plants or even whole sectors of industry than to make direct investment in such things as FGD equipment.

An advantage of such indirect environmental policy might be that western businessmen would be more interested in modernization, since it would be more profitable, than in selling purely environmental technology only. The socialist countries are in any case more interested in that kind of collaboration, since it will help to increase productivity, whereas environmental technology tends to be regarded as "unproductive."

Hungary, Poland, and Romania are deeply in debt to the West, and the creditors are often willing to sell their loans at a considerable discount. In the case of some countries, they can be bought for as little as 10 per cent of their face value.

Some American environmentalist groups bought $1 million of Bolivia's foreign debt for $100,000. The debt was then cancelled on cond-

tions that Bolivia would make the same sum available for environmental protection. The government enlarged a nature reserve and brought in legislation for the stricter protection of such areas. Similar agreements have been made with Costa Rica, Equador, and the Philippines.

A first Debt-for-Nature swap with a socialist country is now under way. The WWF U.S. is planning to by $1 million of Poland's foreign debt (also for $100,000) and invest it in local currency within the country. The money will go mainly to strengthening Polish environmental groups as well as setting up "green" libraries in a number of cities.

There is great official interest in this project in Poland. Hungary is also hoping for such an arrangement, and a swap is actually being prepared for Romania. The main problem now however is to find banks that are willing to sell a part of their claims. Although they were prominent in the deal with Poland, European banks are not so interested in this idea as the American ones.

If the political climate resulting from the improvement of relations between the superpowers, international collaboration in the field of the environment has also made substantial progress. Despite all efforts, however, the environmental situation in the four socialist countries of eastern Europe has undergone a drastic deterioration. It seems that the present forms of international collaboration are not effective enough to bring about any substantial improvement.

Central Europe constitutes a main environmental problem for this continent. As a conclusion to this and the previous article (Acid News 2/89) it is proposed that a working group should set up under the auspices of the ECE to formulate a program for solving the environmental problems of this part of Europe. This should comprise, besides the two German states, with Poland and Czechoslovakia, those countries that are most affected by the pollution from Central Europe or are willing to help combat it. These might be, besides the Scandinavian countries (in particular Sweden), the Netherlands, Hungary, and Austria.

The advantages of such a group would be

1. The number of countries involved being smaller than within the ECE, collaboration would be easier.
2. Only those countries would be involved that have an especial interest in seeing the problems solved. Other ECE countries are too far away from the problems of Central Europe.

As a model one might take the Arbeitsgemeinschaft Alpen, formed by West Germany, Austria, Switzerland, and Italy to improve the environmental situation in the alpine region.

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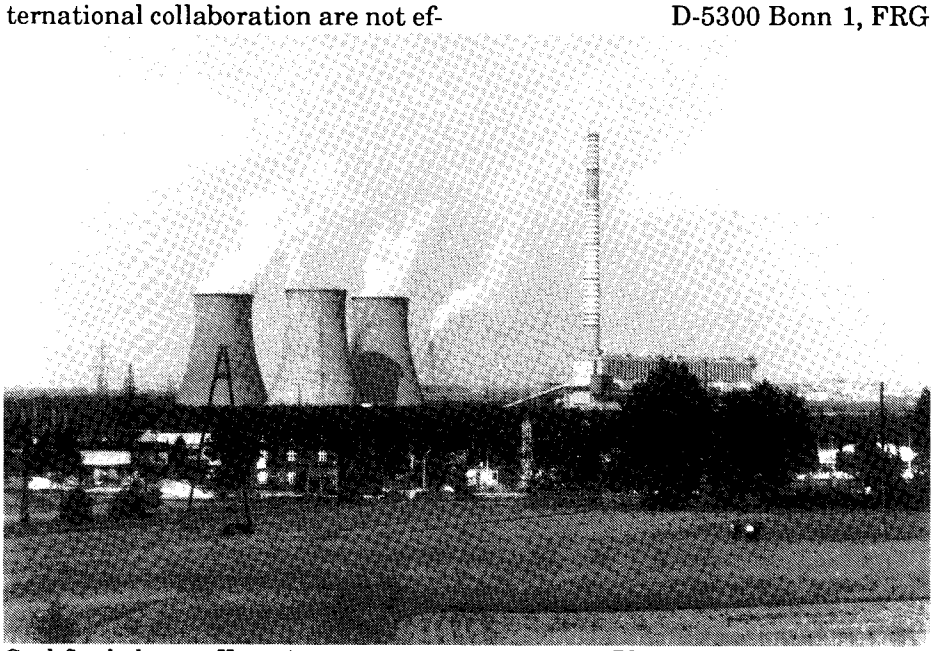

Coal-fired plant at Katowice. *Photo. Andre Maslennikov©*

Ecological catastrophe in Katowice

The Katowice region is the most heavily polluted area in Poland, and possibly in Europe. The emissions of sulphur dioxide from this small region, with only 2.1 per cent of the country's area, amount 1.2 million tons per annum, or 25 per cent more than the total from the whole of Scandinavia. The average fall-out of dust is 112 tons per square kilometre, which means of course that in some places it is very much more.

The most serious environmental problems in the Katowice region arise from the production of energy. Almost all the Polish coal comes from this region, being the source of 80 per cent of the energy consumed in the country. Nearly 30 per cent of Poland's electricity is also produced here.

The greatest effects on the environment are however caused by the dust and gases from coal burning. Air pollution invariably exceeds the legal limits, and is sometimes many times higher. This affects the water and the soil as well as the atmosphere.

The degradation is evident throughout the area, and the details justify declaring an ecological catastrophe. For example, the whole forest area (200,000 hectares) is affected and 14,000 hectares are either heavily damaged or dying.

In many areas the changes will be irreversible, and a return to nature impossible. It will rather be a question of creating a new balance. The highest priority should be given to increasing the efficiency of the energy flow, but raw materials will also have to be used more economically, and waste must be recycled.

Tadeusz Przybylski
Polish Ecological Club, Katowice

The Polish Ecological Club is setting up a secretariat in Katowice, initially with a staff of three, to deal mainly with air pollution. It will have financial support from the Swedish NGO Secretariat on Acid Rain.
Address: Information Center for Air Protection (ICAP), Upper Silesian Branch Board of the Polish Ecological Club, Pl 40-246 Katowice, Poland

Pooled Aid proposed

When a country has already disbursed a great amount of money on desulphurization, the marginal cost of a still further improvement will usually be very high. It might therefore be better to spend money on environmental investments in some neighbouring country from which much of the fallout of pollutants emanates.

In a memorandum to the parliamentary committee on environmental excise duties (see opposite) the vice chairman of the Swedish Society for the Conservation of Nature, Per Kågeson, has in consequence put forward a scheme for pooling part of the cost of installing flue-gas cleaning equipment at large coal-fired plants in East Germany and Poland.

Kågeson bases his proposal on the fact that something like nine-tenths of the sulphur deposited on southern Sweden comes from abroad. The marginal cost of reducing depositions through measures at Swedish plants would however be very high – amounting to 90 kronor per kilogram of sulphur eliminated (seeing that Sweden would also be paying for cleaning the two-thirds of its emissions that are exported to other places).

It is distinctly cheaper (per kg of reduction) to desulphurize in Poland and East Germany. On the other hand only 1.5 to 2 per cent of the sulphur emitted in those countries falls over Sweden. If Sweden were to pay the whole cost of limiting the Polish and East German emissions, the marginal cost of reducing the deposition over Sweden would amount to as much as 200-270 kronor per kilogram – or two or three times the cost of carrying out extra measures at home.

The interesting thing is that assuming current price levels, it would pay Sweden to bear 30-40 per cent of the cost of desulphrization in Poland and the GDR, if that would enable investments to be made that would otherwise not have been carried out in those countries.

The great problem, especially for Poland, is that a part of the total outlay would be for equipment which, because of better quality, would have to be bought in the West, and would therefore have to be paid for in convertible currency. In no case however is that part likely to be more than 30 per cent of the total.

The idea is that Sweden and other countries should bear the expense of such parts of any scheme. Four to five per cent of the sulphur from Poland and East Germany lands in the Federal Republic, about 2 per cent in Sweden and 0.5 per cent each in Finland, Norway, and Austria. If these five countries were to get together and each pay at the most the amount that it would be worth while economically for them to contribute, they could easily finance the hard-currency part of the outlay.

The average cost to the individual givers would probably be no more than a quarter to a third of the amount needed for an equivalent reduction of depositions over their own countries by domestic action. Kågeson's proposal is therefore that Sweden should start a move towards pooled financing for the installation of FGD equipment at large coal-fired plants in East Germany and Poland.

The recipients should be required to provide the money for the part of the project that can be paid in local currency. They should moreover allow the givers full access at all stages, from designing through construction to the operation of the plant.

Without such outside aid, the Polish emissions are likely to remain unchanged at the same high level as today. The partial financing of measures to reduce them should, it is thought, enable them to brought down by 30 per cent in the course of the nineties. That should lessen the annual fallout of sulphur over Sweden by 12,000 tons (the total from all sources is now about 275,000 per annum). Added to this would be a corresponding reduction of the sulphur coming from East Germany.

In the view of the writer of the memorandum, it would be unreasonable for Sweden and other countries in the West to undertake expensive projects themselves unless they can persuade others to take action where it can be done at a considerably lower marginal cost.

Transports of sulphur to and from Sweden in 1985, in thousands of tons per annum. Almost 90 per cent of that deposited over Sweden comes from abroad, while Sweden exports two-thirds of its own emissions. Total deposition: 317 000 tons

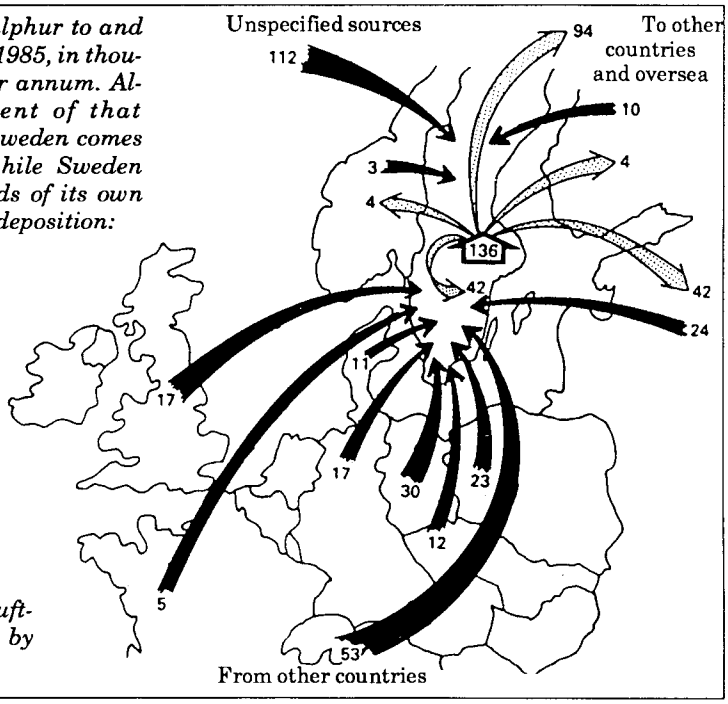

Diagram from Luftvård, published by Bokskogen 1989

Stone figure in Cracow illustrates ravages of polluted air.
Photo: Kay Romeyko-Hurko©

Taxing sulphur

A tax on sulphur in fuel oil is expected to be imposed in Sweden before the year is out. The parliamentary committee that has been examining the matter of environmental charges has proposed an excise duty of 30 kronor per kilogram of sulphur in the oil.

In the committee's estimate it will then be profitable to make capital investments for reducing emissions by 20,000 tons per annum. Of Swedens total emissions of 110,000 tons of sulphur, 40,000 tons come from the burning of fuel oil.

Later in the year the committee will be presenting proposals for taxes on sulphur in other fuels. It is also considering duties on emissions of carbon dioxide and nitrogen oxides, so as to enable the government to put forward a comprehensive bill during the spring session.

Air put first in Polish plan

An ambitious plan for cleaning up the environment, which was put forward by the Polish government last autumn and has since been circulating for comment, aims to reduce the country's emissions of sulphur dioxide by 60 per cent in the course of the next twenty years.

The increase in the emissions of other air pollutants – nitrogen oxides, hydrocarbons, and heavy metals – is also to be stopped, so that by 2010 the tolerable limits for air quality will in most cases not be exceeded. By 2010, too, the rivers are to be cleaned up, to enable at least 40 per cent of the water to be used as drinking water.

The essential aim, it is said, is first to stop the increase in the damage caused by pollution, and then to reverse the trend.

The Polish Ecological Club, whose opinion was also asked, in a move remarkable for Poland, has commented favourably on the plan, taking exception only to a certain reliance on nuclear power as a means of curbing air pollution.

A main issue is precisely the reduction of air pollution. Even according to official statistics, the country's emissions of sulphur dioxide amounted in 1985 to 4.3 million tons. The aim is to bring the emissions down by 30 per cent, from 1980 levels, by the year 2000, and then by another 30 per cent by 2010.

Although this timetable will not allow Poland to qualify for membership of the 30 Per Cent Club – the members of which have bound themselves to a 30-per-cent reduction by 1993 – it at least indicates a first step in that direction.

There are already fifteen installations for desulphurizing flue gases in operation in Poland, but they are only pilot plants. Full-scale operation is however foreseen for the 1990s, and according to the Ministry of the Environment, which is responsible for the plan, Poland in any case possesses the technical expertise for solving the problem of desulphurization.

The cost of installing FGD equipment is calculated, in terms of 1988 prices, to be 1,500 billion zloty, equivalent to about US$3.4 billion. The money will come from a special fund, built up from emission charges for sulphur.

The plan also takes in the twenty-seven areas of the country that are worst affected from the point of view of the environment – where in fact an ecological catastrophe is looming. A special program of measures, extending to 2010, is to be laid down for each area, and very few industries will be permitted to establish themselves in any of them.

By 1995 the laws concerning the environment will have to be revised. Environmental protection is to be decentralized, and air quality standards are to be brought into line with international agreements.

Poland intends to develop, as far as possible, its own technology for cleaning up the environment – with an eye, in part, to being able to export it later on. Collaboration between Polish and foreign interests will on the other hand be encouraged, and certain equipment will in any case have to be obtained from abroad, as will licenses to manufacture, technical services, and expertise generally.

It is proposed to set up a national fund both to aid existing enterprises in making environmentally favourable capital investments and to facilitate the creation of new undertakings for the manufacture of cleaning equipment.

The cost of the whole program, if carried out in its entirely, would be vast – no less than 23,000 billion zloty (more than US$50 billion) for the 20-year period. The state of the Polish economy will however make such an outlay impossible. Since the government intends to give priority to improving air quality – and especially to reducing emissions of sulphur and nitrogen oxides – part of the program for cleaning up the rivers will have to wait until after 2010.

Kerstin Österberg/Ny Teknik.
(Digest by permission.)

GDR's brown-coal problem

Because of its lack of natural resources and a shortage of foreign currency, the German Democratic Republic has to generate most of its electricity and heat from untreated brown coal – with enormous emissions of sulphur dioxide, soot, and ash in consequence. Since about the end of the seventies the problem has become worse, after the oil crisis had forced the conversion of any residential heating units and also power plants from oil, gas, or briquettes to brown coal. To obtain the same heat output, two-and-a-half times as much raw coal is needed, compared with briquettes.

More than 80 per cent of the brown coal mined in East Germany is burnt direct, without further treatment. The output in 1985 amounted to 321 million tons, putting the GDR far ahead of any other country in consumption of this type of fuel. The devastation of the landscape through opencast mining also brings tremendous problems.

In East Germany all the brown coal is mined in open pits, with some differences in quality between that extracted east of the Elbe and west of the river. Brown coal is classified as salty if there is more than 0.5 per cent of Na_2O in the dry substance or 4 per cent in the ash. The lower thermal values vary between 1500 and 2500 kcal/kg, but may in extreme cases be still lower.

The ash content runs, according to quality, from a minimum of 10 per cent to a maximum of 30 to 40 per cent. The coal contains 48 to 60 per cent water, while the sulphur content ranges from 1 to 3 per cent (the lower value applying mainly to the east-of-Elbe coal), although in some cases it will be considerably more.[1]

In many of the more highly industrialized countries, flue-gas desulphurization (FGD) is established technology. Several methods are being employed on a full scale, sometimes even in combination, to remove sulphur and nitrogen. When considering the various methods, the costs of the capital investment, as well as those of the raw materials needed for operation and the price obtainable for possible byproducts, all have to be calculated.

The following are the FGD methods that are now mainly in use.

Limestone-gypsum method. The flue gases are passed through a slurry of CaO or $CaCO_3$ in so-called scrubbers (towers up to 60 m high). The sulphur dioxide combines with the slurry to form gypsum. Gases are reheated before being emitted through the smokestack. (A)

Spray absorption method. Quicklime $Ca(OH)_2$ is sprayed into the flue gases form which dust particles have previously been filtered out. Anhydrite ($CaSO_4$ or CaSO) is formed through the combination of SO_3 with the $Ca(OH)_2$. Possibility of further processing to produce pure SO_2 and cement clinker. (B)

Walther method. Cleaning with ammonia (NH_3) and water. The resulting sulphate of ammonia solution can be spray dried for making fertilizer. (C)

The Wellman-Lord regenerative method. SO_2 in dust-free flue gas is absorbed into a solution of sodium sulphite, forming sodium bisulphate. This is heated to recover the sodium sulphite , and create liquid sulphur dioxide for turning into sulphuric acid and sulphur. (D)

There is also the so-called **BF/Uhde method,** which uses activated carbon, as well as dry methods for smaller combustors, including that by which up to 30 per cent limestone ($CaCO_3$) is added to the fuel, and also a dry absorption process.

From a count made by the West German environmental agency in 1985, it appeared that more than nine-tenths of the FGD installations in operation or on order had gypsum as the final byproduct. This can undoubtedly be laid both to the lower capital costs and to the simpler technology, as compared with the regenerative process. It has however brought its own problem, in the form of a saturated market for gypsum.

From Table 1 may be seen the quantities of byproduct resulting from the use of the various FGD methods in a coal-fired power plant with the capacity of 750 MW (sulphur content of the brown coal 1.3 per cent when operating for 4000 hours a year on full load).

Desulphurization scheme

In 1985 some 190 million tons of brown coal went to producing 82.4

Table 1. Quantities of byproduct from the various FGD methods

Method	Agent	Byproducts	Quantity t/h	Quantity t/4000 h
A.	Quicklime 5 t/h Limestone 9 t/h	Gypsum	15	60,000
B.	Quicklime 6 t/h	Sodium sulphite	13	52,000
		Anhydrite	13	52,000
C.	Ammonia 3 t/h	Sulphate of ammonia	11	44,000
D.	Sodium sulphite	Sulphur	2	8,000
		Sulphuric acid	8	32,000
		Liquid SO_2	5	20,000
BF/Udhe	Activated carbon	Sulphur	2	8,000
		Sulphuric acid	8	32,000
		Liquid SO_2	5	20,000

Source: F. Baumüller, Entschwefelungsüberblick über die Entschwefelungsverfahren. Brennstoff–Wärme–Kraft 1986/10. Pages 5–6.

Widespread damage to the forests may be seen in the Zittau mountains on East Germany's border with Czechoslovakia, where pollution comes from all sides. Photo: Christer Ågren©

per cent of East Germany's electricity. This was the main cause of SO_2 emissions amounting to about 6 million tons, making the GDR the highest per-capita emitter of sulphur dioxide of any industrialized country.[2] The emissions for the chief power plants burning brown coal are shown in Table 2.

The emissions of fifteen plants with the total capacity of about 13,300 MW thus amount to 1,980,000 tons of sulphur dioxide per annum. For flue-gas desulphurization at these plants, Schwilling[3] recommends the Wellman-Lord method – on account of its advantage in ability to handle high and greatly varying concentrations of SO_2 as well as eliminating 97 per cent of the sulphur dioxide.

The capital costs for this type of equipment come to about DM600 per installed electrical kilowatt. The total cost for the power plants in Table 2 would therefore be about DM8 billion. To this must be added the current outlay for operating and write-offs, estimated to be about DM2 billion. The emissions of SO_2 would be reduced by at least 590.000 tons per annum – which would lead to a drop of 33 per cent in the total of 6 million tons, bringing it down to 4 million tons. This is just about what the GDR had pledged at the Helsinki conference.

Since the resulting 950,000 tons or so of sulphur could be sold in the world market for about DM380 million, the annual cost need only be about DM1.6 instead of DM2 billion.

Abandonment of the enormous government subsidies for electricity in the GDR, together with financial and technical aid from the Federal Republic, would enable these proposals to be realized.

In the report by J. Krause,[4] the modernization of all obsolescent brown-coal power plants is put forward, alongside desulphurization, as an essential measure. Thus, in the next 10 to 15 years, old plants with a combined capacity of 11,700 MW would be shut down and replaced by about 9000 MW of new capacity. With an efficiency of 38 per cent instead of 20 per cent, the new plants would produce more electricity while using less brown coal.

The annual saving of 60 million tons of brown coal would suffice to offset the cost of DM18 billion for modernization, since it would eliminate DM6 billion needed for getting the coal to the users.

For reducing SO_2 emissions from power plants by 95 per cent, or more than 2.5 million tons per annum, a mixed bag of methods are proposed, comprising the Wellman-Lord for large combustors, limestone-gypsum for most others, and a modified process for the addition of limestone to the fuel (this last for immediate relief at small and old power plants). The capital costs are put at DM6 to 11 billion, and the operating costs at DM2 billion a year.

Vollrad Kuhn
Arche - Netzwerk

Table 2. Emissions from chief power plants in GDR burning brown coal (1985)

	Capacity MW	Emissions (SO_2 t/h)
Boxberg	3520	459,200
Espenhain	140	72,000
Hagenwerder	1500	232,000
Trattendorf	450	56,000
Hirschfelde	300	47,740
Jänschwalde[1]	1500	97,500
Lippendorf	600	105,000
Lübbenau	1800	175,140
Schwarze Pumpe	1050	315,000
Vetschau	1200	160,000
Wockerode	384	69,120
Zschornewitz	225	15,120
Thierbach	840	139,200
Harbke	140	23,760
Lauta	175	23,560

[1] In 1988, 208,000 tons

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[1] Köppe, H., Hossfeld, R., Barthmann, W. Rohbraunkohle in Rostfeuer-ung. Informationsbroschure des Institutes für Energetik une der Zentralstelle für rationelle Energieanwendung. Leipzig 1984.

[2] Statistisches Jahrbuch der DDR. Berlin 1986.

[3] Schwilling, T. Entschwefelungskonzept für Braunkohlekraftwerke in der DDR. Westberlin 1985.

[4] Krause, J. Rezension des Gutachtens "Alternative Energiepolitik in der DDR und Westberlin" vom Institut für Ökologische Wirtschaftsforschung. Umweltsbriefe des Kirchlichen Forschungsheimes Wittenberg 1988.

Photo:Christer Ågren©

Call of the wild

In a publication entitled Acid Rain and Wildlife, sixteen voluntary organizations in Britain have called on the government to take urgent action to reduce the emissions from vehicles and power stations that cause acid rain.

The publication explains how acid rain is affecting freshwater and terrestrial habitats, and what is happening to wildlife in consequence. It elucidates the concepts of critical loads, and on the basis of these calls for specific reductions of pollutants to stop acid rain and ensure protection of Britain's native wildlife.

Among the adverse effects of acid rain that are pointed out are for instance

- The poor health of native beech, oak, and yew trees in southern England.
- The loss of fish from lakes and rivers in Wales, northern England, and Scotland.
- Local decline of birds, such as dippers, in upland streams.
- The deterioration of peat bogs and losses of associated flowering plants such as sundew, bog rosemary, and bog myrtle.

In a series of resolutions the wildlife organizations call for

- Further measures to promote a more efficient use as well as the conservation of energy.
- More determined research concerning alternative energy sources such as wind and wave power.
- More action to reduce emissions from vehicles and power plants.
- Reduction of emissions as demanded by critical loads – that is to say, the amounts of pollution that habitats can take without becoming irreversibly damaged.

Although the wildlife organizations welcome recent government announcements concerning its measures for reducing acid emissions, they believe these measures go neither far enough nor fast enough. The British government is now committed to reducing emissions of sulphur dioxide and nitrogen oxides from power stations by 60 per cent by 2003, having first reduced them by 30 per cent by 1998. Using the principle of critical loads, scientists have however shown that reductions of both by 90 per cent will be necessary if the most sensitive habitats are to be safeguarded.

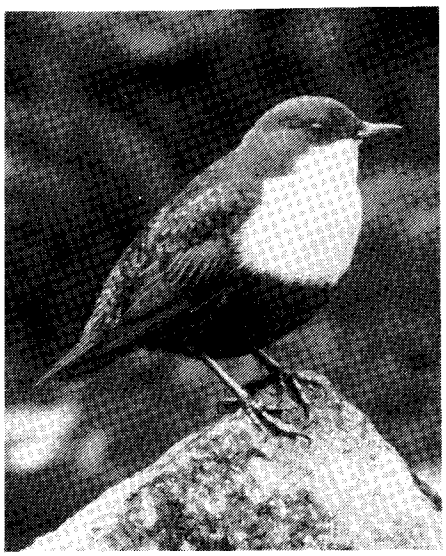
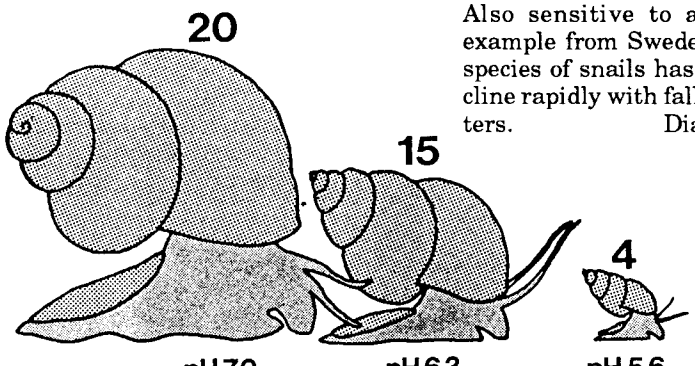


Photo: Axel von Arbin©

Speaking on the day of publication, the chairman of Wildlife Link, Lord Ross, said: "There is now overwhelming evidence that acid emissions are causing widespread damage to wildlife in Britain. In her speech to the Royal Society, the Prime Minister recognized that acid rain, together with the 'greenhouse effect' and depletion of the earth's ozone layer, is a global problem which Britain must address along with other countries."

Lord Ross continued: "The Government could demonstrate its genuine concern for our environment by considerably accelerating its program for reducing emissions from vehicles and power stations, and by aiming for much greater cuts than at present. It should place far greater emphasis on the promotion of energy conservation and the development of alternative energy sources such as geothermal, wind, and wave power. Unless such action is taken urgently, we shall continue to see further losses of Britain's wildlife."



Also sensitive to acidification - an example from Sweden. The number of species of snails has been found to decline rapidly with falling pH of lake waters. Diagram:Jan Veuger

About the publication

Acid Rain and Wildlife was produced by members of the Wildlife Link Air Pollution Group, with finance from the World Wide Fund for Nature UK and the Swedish NGO Secretariat on Acid Rain. It is available from Wildlife Link, 45 Shelton Street, London, England WC2H 9HJ at £3.00 inclusive of postage and packing.

Wildlife Link is the liaison body for the major voluntary organizations in the UK that are concerned with the protection of wildlife.

The following supported the publication of Acid Rain and Wildlife:

British Association of Nature Conservationists. British Herpetological Society. British Trust for Conservation Volunteers. Conservation Association of Botanical Societies. Environmental Investigation Agency. Friends of the Earth Ltd. Greenpeace UK. International Fund for Animal Welfare. Marine Conservation Society. Otter Trust. Peoples' Trust for Endangered Species. Royal Society for Nature Conservation. Royal Society for the Prevention of Cruelty to Animals. Royal Society for the Protection of Birds. Vincent Wildlife Trust. World Wide Fund for Nature UK.

UNITED STATES

Limits set for emissions near wilderness areas

Foresters and scientists in the United States are now agreed that the critical loads principle should be used when applications are being considered for new industries in the neighbourhood of the country's extensive Wilderness Areas.

Such was the outcome of a meeting in May between officials of the Forestry Service, regional managers of the various areas, and American scientists. New industries will only be allowed if their emissions of sulphur and nitrogen are in conformity with ecological tolerances.

Seeing that there had previously been some reluctance to accepting the idea of critical loads in the United States, this marks a breakthrough. The impetus for the change of attitude appears to have come mainly as a result of the work of the Scandinavian group of scietists who had studied the effects of sulphur and nitrogen on various types of soil with a view to calculating the critical loads.

The principles to be followed when dealing with applications to set up power plants and manufacturing facilities near Wilderness Areas have now been preliminarily set forth in a recent American study.

The amounts of pollutant that the soils in the various areas can take without suffering damage are to be first calculated. Then if the emissions from the proposed plant are estimated to fall below that limit, called the Green Line, the application will be granted without further ado. If on the other hand they should overstep a Red Line, above which depositions of sulphur and nitrogen would be certain to cause damage to the soil, a permit will equally certainly be refused

Only when the emission estimates fall between the Green and Red limits will the authorities have to make a special investigation before coming to a decision. Moreover, when the limits have been made public only those companies are estimated to fall in between will have to apply for permits.

In the first areas that have been studied the critical loads have turned out to be about the same as in Europe. For sulphur the Green Line is drawn at 3-5 kilograms per hectare per annum and the Red Line at 20 kilograms. The corresponding limits for nitrogen are 3-7 and 10-15 kilograms.

Source: Miljöaktuellt 4/89

UNITED KINGDOM

Cleaner Air needed to save waters

The latest assessment of the state of surface waters in Britain underlines the need for drastic reductions in atmospheric pollution if streams and lakes are to recover from acidification. That is the clear message from the British government's Acid Water Research Group in a recent report.* It concludes that Britain should restrict emissions of sulphur dioxide to half their 1984 levels, in order to reduce the acidity of stream water.

Reductions of around 30 per cent in the overall discharges of atmospheric pollution will hold acidity at present levels. Only a reduction of 90 per cent in emissions of sulphur dioxides and nitrogen oxides would neutralize surface waters almost completely. The report warns, however, that even with the major curbs "the response to any reductions will be delayed by up to several decades, and some waters may never recover."

New Scientist 22 April 1989
* Acidity in UK Fresh Waters, HMSO, £5.50

Recent Publications

Health Effects of Diesel Exhaust Emissions (1988).
With a steady increase in the proportion of air pollutants coming from diesel exhausts, more attention needs to be given to their effects on health. This report by scientists at the Swedish Institute of Environmental Medicine summarizes the current knowledge of the subject. In English. 26 pp. Report No. 1988:8. Obtainable from the Nordic Council of Ministers, Store Strandstraede 18, DK-1255 Köbenhavn, Denmark.

Use of the Ames Test for Investigating the Mutagenicity of Air Pollutants (1988).
The ability of the Ames Salmonella bacterial assay to predict cancer risks is discussed in this report by K. Victorin. Literature surveys on mutagenicity studies of air pollution from different combustion sources are also presented. 182 pp. Report No. 3519. Obtainable from the National Environmental Protection Board, Information Section, Box 1302, S-171 25 Solna, Sweden.

Environmental Policy Benefits: Monetary Valuation (1989).
Because the beneficial effects of investments for the protection of the environment often cannot be assessed in terms of money, such investments may either be delayed or not made at all. Besides scrutinizing the various cost-benefit studies that have been made in Europe and the United States, this report tries to summarize the methods used for assessing the benefits in monetary terms. 85 pp. Obtainable from OECD Publications, 2, rue Andre' Pascal, F-75775 Paris Cedex 16, France

Verdsetting av kollektive goder som påvirkes av sur nedbör i de nordiske land (1988).
A review of the theoretical aspects and empirical studies of the economic valuation of marginal changes in the quality and quantity of public assets when affected by transboundary pollutants. In Norwegian. 110 pp. Report No. 1988:4. Obtainable from the Nordic Council of Ministers, Store Strandstraede 18, DK-1255 Köbenhavn, Denmark.

Air Pollution in Europe (1988).
An assemblage country-by-country reports on air pollution and the national policies for dealing with it. In two volumes, both edited by B. Rhode. 1. Western Europe (194 pp.), 2. Socialist Countries (132 pp.). Both reports are edited by B. Rhode. Obtainable from the Vienna Centre, P.O. Box 974, A-1011 Vienna, Austria.

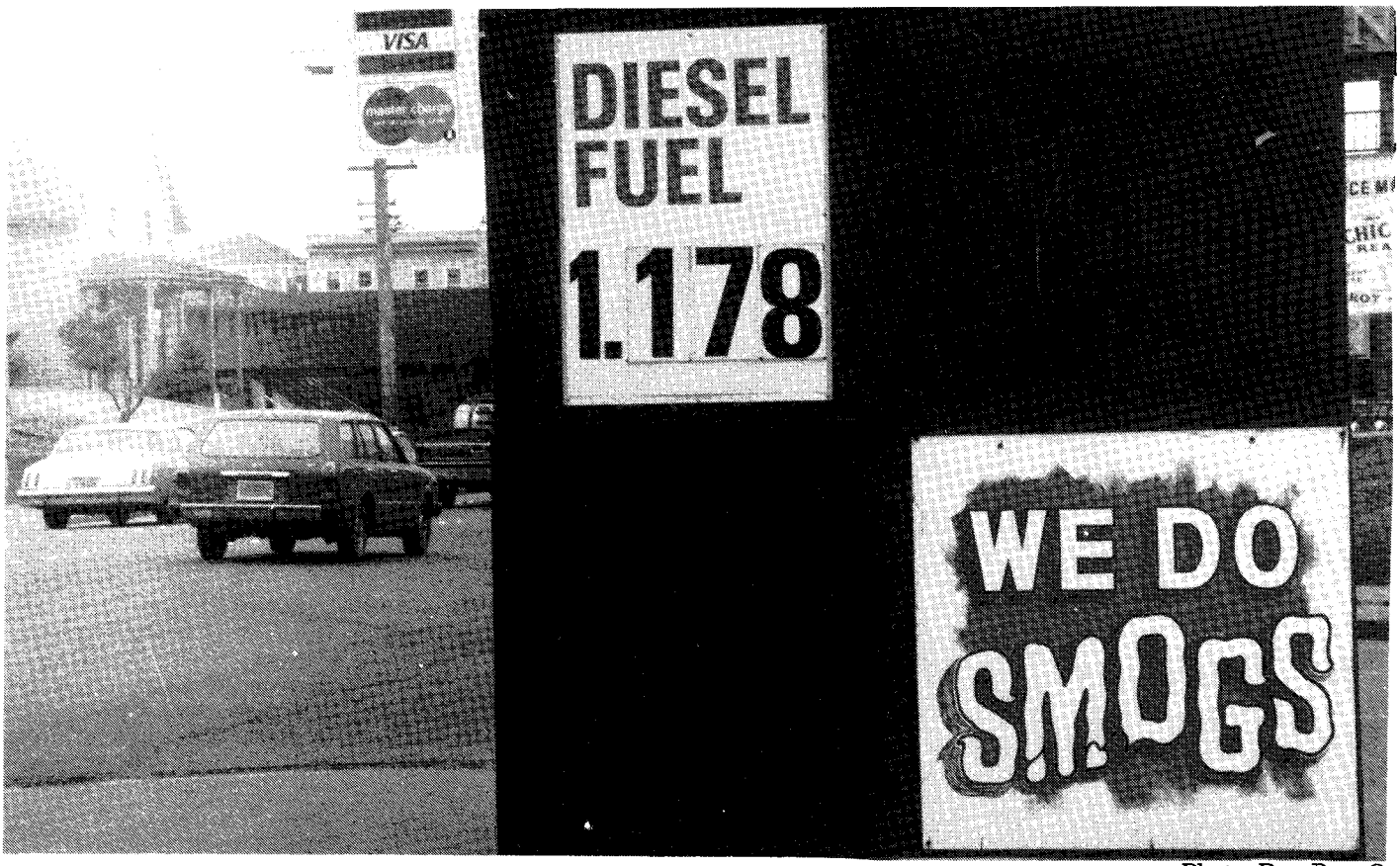


Photo. Dan Rapp©

Curbing diesel exhausts

Diesel vehicles are major contributors to the emissions both of nitrogen oxides and particles. In the Federal Republic of Germany for example, it has been estimated that approximately 32 per cent of the NO_x emissions from mobile sources and 60 per cent of particulate emissions emanate from such vehicles. Fortunately control is possible and has already started.

In the United States emission control requirements for smoke from engines in heavy-duty trucks and buses were first implemented for the 1970 model year. The opacity standards were specified in terms of per cent of light allowed to be blocked by the smoke in the diesel exhaust (as determined by a light extinction meter). As from the 1974 model year a light extinction of 20 per cent during acceleration, 15 per cent during lugging, and 50 per cent at maximum power is allowed.

The world's first particulate standards for diesel exhausts in the world were established for cars and light trucks by the US Environment Protection Agency (EPA) in 1980. Standards of 0.6 grams per mile (0.37 g/km) were set, starting with the 1982 model year. Since 1987 model year the standards are 0.2 and 0.26 grams per mile for cars and light trucks respectively. In the mid 1980s California decided to adopt its own diesel particulate standards – 0.4 grams per mile in 1985, 0.2 in 1986 and 1987, and 0.08 g/mile (0.05 g/km) in 1989.

Particulate and NO_x standards for heavy duty diesel engines were also promulgated by EPA in March 1985. Standards for particulate of 0.60 grams per brake-horsepower-hour, g/bhph (0.80 grams per kilowatt-hour), were adopted for 1988 through 1990 model years, 0.25 for 1991 through 1993 model years and 0.10 for 1994 and later model years. Because of the special need for bus control in urban areas, the 0.10 standard for these vehicles will go into effect already in 1991. As regards NO_x, heavy trucks and buses will be required to meet a level of 5.0 g/bhph starting 1991, more than a 50 per cent reduction from uncontrolled levels.

Smoke limits similar to those in the US have been in effect in Europe for many years. Exhaust-smoke levels are currently regulated by ECE Regulation 24 (equivalent to EEC Directive 72/306). But recognizing that the requirements where then inadequate, the EEC environmental ministers decided in December 1987 to adopt a particulate standard for light-duty diesels of 1.1 grams per test (1.4 for conformity of production, COP). In addition, the ministers ordered the Commission to develop a proposal for a second step by the end of 1989, which will lower particulate to 0.8 (1.0 for COP) unless it is determined that such levels are technically or economically infeasible.

Approximate conversion rates between the US and ECE tests are as follows: 0.08 grams per mile US test procedure equals 1.8 grams per test and 0.45 grams per kilometer using ECE test procedure.

With regard to heavy duty vehicles, the EEC has decided to adopt initial requirements tighter than those of ECE R 49, by 20 per cent for

NO_x and 30 per cent for HC, to be introduced on all vehicles by October 1990. The suggested UN ECE levels for trucks, contained in R 49, requires max emissions of 14.0 g CO, 3.5 g HC and 18.0 g NO_x per kWh, when using the ECE 13 mode cycle test procedure on an engine test stand. The EEC requirements for commercial vehicles are quite modest when compared to the US standards that will go into effect within the same time frame. In addition, as with cars, the Directive is permissive and will probably not be implemented by all countries.

At present there is no legislation in force in the Common Market for particulate emissions from heavy duty engines. Several non-Common Market countries have however been cooperatively moving toward more significant diesel particulate requirements. Sweden has already adopted the US passenger-car standard and Switzerland and Austria are likely to do so .

These countries are also looking hard at more stringent requirements for trucks and buses. In June 1988 the Swedish parliament decided to adopt requirements that will bring about the same degree of control as the US by 1994. Specifically, standards equivalent to US 1990 requirements will be in force in Sweden on a voluntary basis for 1990 light-duty trucks, and will be mandatory by 1992. As regards heavy trucks, Sweden will also be introducing the equivalent of US 1990 requirements, first on a voluntary basis from 1992 and mandatory starting in 1994.A decision on the particulate test is likely to be made during 1989.

In May 1988 the Swiss government decided to introduce new emission standards for heavy-duty vehicles to go into effect on October 1, 1991. The standards, based on the European regulation ECE R 49, are 4.9 g CO, 1.23 g HC, 9.0 g NO_x and 0.7 g particulate per kWh. Switzerland intends to tighten these standards again in the early nineties in order to achieve reductions equivalent to those resulting from the US 1994 standards. The entire Stockholm Group of eight countries is moving in the same direction.

Michael Walsh

UNITES STATES

Drastic recipe for Los Angeles smog

Cars fueled by petrol could be banned from much of southern California by the year 2007, according to new proposals for cleaning up the notorious Los Angeles smog. The measures, which stand a good chance of beeing implemented, will replace petrol with methanol. They are likely to become a blueprint for other American cities that suffer from smogs.

The measures come after a five-year investigation by pollution authorities in southern California. These groups have the power to implement some of the proposals, but others will require further approval from state and federal government.

Both state authorities and the Federal Environmental Protection Agency want Los Angeles to clean its air. But they may face a fight from industrialists and trades unionists who fear a loss of business and jobs.

The measures will affect the 12 million residents in four counties – Los Angeles, Orange, San Bernardino and Riverside – which together cover 20,000 square kilometres. Last year, air pollution in this area exceeded federal standards on 176 days.

The smog in Los Angeles consists largely of oxides of nitrogen and hydrocarbons, plus ozone created when these chemicals react in sunlight. The pollutants come from some 6 million cars and 40,000 industrial sources.

Ozone high in the atmosphere protects the planet from ultraviolet radiation, but at lower altitudes it is harmful to life. It triggers breathing problems in mammals, damages trees and crops and attacks materials such as rubber and textiles. It also promotes the formation of acid droplets. Smogs in the region have been recorded with a pH of less than 2, making them as corrosive as the notorious London smogs of the 1950s. Frequent temperature inversions over the Los Angeles basin prevent the smog from escaping.

In the first phase of the cleanup, lasting from 1989 to 1993, there will be strict controls on the content of paints, solvents, degreasers and other solutions which emit hydrocarbons. One measure will ban lighter fluid for barbecues and petrol for lawn movers. But the prime purpose is to reduce the 6,000 tons of pollutants that vehicles spew into the air every day.

There will be stiff fines for companies that do not introduce compulsory car-sharing among their employees, a limit on the number of cars that each family can own, and an end to free parking. Cars will be required to have radial tires because these throw less dust into the air.

By 1993, all fleet vehicles, included rented cars, should run on fuels, such as methanol, that burn cleanly. The two big American car makers, Ford and General Motors, are expected to be producing up to 100,000 cars that run on methanol by that date.

The cost of the measures during the first five years will be about US$ 2.8 billion a year. Air pollution is estimated to cost southern California 13 billion a year in sickness expenses and damage to crops and property.

By 1998, 40 per cent of all cars, 70 per cent of freight vehicles and all buses must have converted to cleaner fuels. By 2007, all cars are to be converted to run on clean-burning fuels or electric power.

Ian Anderson

New Scientist April 1, 1989
By permission.

Control needed for ships

Shipping accounts for a tenth of the global emissions of sulphur to the atmosphere that are a result of human activities. About a million tons of sulphur dioxide are emitted annually in European waters alone. From rough estimates it appears that the emissions of nitrogen oxides are equally large. In the case of a great ship-owning nation like Norway, shipping actually constitutes the largest single source of such emissions. Whereas little more than 30 per cent of the emissions of nitrogen oxides in that country emanate from road traffic, ships are responsible for 45 per cent, according to official figures.

A main reason for the large emissions of sulphur dioxide is that the ships are run on a relatively cheap type of oil that is high in sulphur. Stricter requirements on land have led to steadily worse types of oil being burnt at sea. Nearly all big ships are run on heavy oil, which usually has a sulphur content of 2.5 to 3.5 per cent. The fuel may also be mixed with oil waste as well as combustible hazardous waste, which is unlawful but difficult to uncover without thorough analysis.

It is not only the natural environment that is endangered through the use of inferior fuel. It also affects the working environment of the crew, bringing an increased risk of cancer.

A number of measures will be required to bring about an abatement of atmospheric pollution from shipping. The emissions of sulphur dioxide could be heavily reduced, for instance, by going over to low-sulphur oil. As things are at present, a ship carrying coal from Australia to a northwest European port emits just about as much sulphur and nitrogen oxide as its whole cargo would in a combustion plant meeting current Swedish emission requirements.

According to the National Board of Shipping the sulphur content of fuel oil would have to be at most 0.4 per cent if emissions are to be brought down to the level prescribed in Sweden for oil-burning power plants on shore. Better quality oil would also reduce the emissions of nitrogen oxides and particulates from ships.

Strong measures – such as regular sampling of the bunker oils and heavy fines for offences – will be needed for dealing with the practice of mixing oil waste and hazardous waste in the fuel oil. An alternative method to bring down sulphur emissions might be to equip ships with scrubbers as on power plants ashore.

The emissions of nitrogen oxides were recently investigated in a project commissioned by the State Pollution Control Authority (SFT) in Norway.* With diesel engines running at full speed they were found to average 70 grams of NO_2 (+-30) per kilogram of fuel. Ships propelled by steam turbines only emitted 4-10 per cent of the quantity from diesel-driven vessels. Since steam turbines are however expensive to install, require a lot of space, and are relatively less efficient, their use has lately been in marked decline.

New ships can be fitted with equipment for selective catalytic cleaning, which reduces the emissions of nitrogen oxides from diesel engines by something like 90 per cent. This again requires a lot of space, however, and so is difficult to install on existing vessels. Five new ships that are about to be delivered in the United States will have such equipment, costing $300-800,000 per installation. This will be the only way for shipping to meet the requirements that are now being imposed in Sweden and other countries for large combustion plants on land.

Another method, which has so far only reached the development stage in Sweden, is estimated to reduce nitrogen oxide emissions by 25-30 per cent, while at the same time lessening fuel consumption. This involves the injection of an emulsion of water and fuel oil into the combustion chamber. Heat causes the microscopic drops of water to explode the larger drops of oil, thus resulting in better combustion at a lower temperature.

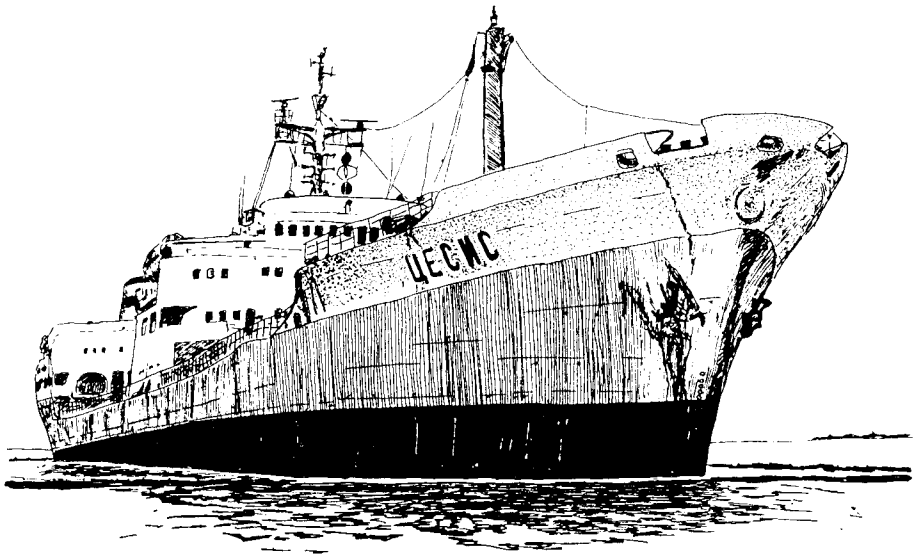
This equipment costs only about $60,000 to install, and the operating and maintenance costs are negligible. The disadvantage of the method, even if it should prove capable of practical application, is that it will only reduce the emissions by at most 30 per cent. The advantages are however its relatively cheapness, and the fact that it could be employed on existing vessels.

Another way to reduce the emissions of pollutants, apart from a return to the steam turbine instead of the diesel engine for propulsion, would be to let wind power serve as a complement to the combustion machinery on ocean-going vessels.

Large amounts of hydrocarbons are released while oil is being transported by sea. In the course of a trip, say, from the Persian Gulf to northwestern Europe, as much as 10 per cent of a tanker's cargo will have to be vented in order to relieve the pressure in the holds when the deck gets heated in the daytime. The very size of the emissions as well as the losses they entail should in themselves be enough to stimulate the development of some kind of recovery system.

A great escape of hydrocarbons also occurs during the loading and discharge of crude oil. Equipment for their recovery can be very efficient, and it is financially attractive as well. There are already such installations both in the Netherlands and the United Kingdom, and in both cases it is the oil companies that are forcing the process.

Local air pollution can be kept down by controlling the emissions from auxiliary machinery while ships are lying in port. If a ship's own diesel-driven generators are used while loading and unloading,



Drawing: Fältbiologerna©

the emissions will be comparable to those of a small factory. Provided the stayover is not too short, this can be avoided by taking power from the local supply. The method is used for the big passenger ferries in Sweden as means of mitigating air pollution around their terminals.

Shipping is a highly international industry, where stiff competition rules. It may therefore be taken as unlikely that any nation will adopt strict environmental requirements for its own merchant fleet only. There is however already an international agreement for the control of discharges to water. The convention brought about for this purpose through the International Maritime Organization (IMO) could well serve as a model for one to combat air pollution. The matter has in fact already been brought up within the Helsinki Commission (for the Baltic) as well as at the North Sea Conference in London 1987.

The Scandinavian countries are striving for an international convention on air pollution within the IMO. The aim is to have regulations set forth by 1994, which does not suggest any high degree of ambition. Nor, pending the acceptance of a convention, are these countries prepared to adopt any special controls themselves.

The proposals put to the IMO must have the support of a large number of countries if they are to be effective. The problem with international agreements is that it takes a long time before they have any noticeable effect. In the case of shipping it may also be difficult to get owners to comply with the regulations. It is felt they are not doing so with regard to discharges to water. It is all to easy to register under another flag – today more than a third of the world's merchant tonnage is in fact sailing under flags of convenience.

Nevertheless it will probably be necessary, as in the case of emissions from land, for a few nations to lead the way. A start may for instance be made by controls on ferries plying from home ports. There is no reason why the same emission limits should not apply at sea as on shore.

As carriers of freight, ships are very energy-efficient. To carry a ton of freight over one kilometre in coastal trade requires no more than 3 grams of oil – as against 13-14 grams from a heavy truck. Allowing road haulage to replace coastal shipping, as is now being done in so many places, is highly wasteful.

If low-sulphur fuel were to be used, and ships have more efficient propulsion machinery and to be equipped with catalyzers to reduce emissions of nitrogen oxides, there would be a great environmental advantage in transferring long-distance freight from the highways to shipping. In most cases however railways constitute the most environmentally favourable and the most energy-efficient method of moving freight.

Per Elvingson

* Exhaust emissions from ships. SFT Report 89/88.

Further publications

Acid Rain: The View from the States (1988).
Proceedings of a conference held in December 1987 in Washington, D.C., including the papers presented by 21 diverse organizations and agencies. Edited by James C. White. 180 pp. Obtainable from Government Institutes, Inc., 966 Hungerford Drive, #24, Rockville, MD 20850, USA.

Miljöets energi (1989).
A compendium presenting present and future energy systems in Denmark, with emphasis on the environmental effects of the various sources of energy, as well as alternative solutions. 112 pp. Price 40 kroner. Published by Danmarks Naturfredningsforening, Nörregade 2, DK-1165 Köbenhavn K, Denmark.

Försurningsläget i enskilda vattentäkter i Sverige (1989).
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Report from the Swedish Transport Research Board presenting the results of a study of N_2O emissions from various types of motor vehicles. In Swedish. 28 pp. Obtainable from Transportforskningsberedningen, Birger Jarls torg 5, S-111 28 Stockholm, Sweden.

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The ability of the Ames salmonella bacterial assay to predict cancer risks is discussed in this report by K. Victorin. Literature surveys on mutagenicity studies of air pollution from different combustion sources are also presented. 182 pp. Report No. 3519. Obtainable from the National Environmental Protection Board, Information Section, Box 1302, S-171 25 Solna, Sweden.

Flue Gas and Fly Ash (1989).
Proceedings of a meeting of contractors, organized by the Commission of the European Community and held in Belgium in June 1988. Includes nine scientific papers on flue gas treatment and six on the properties, re-use and disposal of fly ash. Edited by P.F. Sens and J.K. Wilkinson. In English. 173 pp. Published by Elsevier Applied Science Publishers Ltd.

International Air Pollution Week

During the week of May 27–June 5 environmentalist organizations all over Europe carried out demonstrations and other activities to hammer home the theme of air pollution and acidification. Since its inception in 1983 this week of simultaneous actions has involved many thousands of people in a drive for better air quality.

In this way the European organizations are demonstrating both their alarm at the disastrous effects of air pollution on our environment and their displeasure at the failure of governments to take the necessary measures for a drastic reduction of the emissions of pollutants.

Previously, in April, the European environmentalists had issued a joint statement to make clear how great a reduction of the various polluting substances was needed if long-lasting damage to the environment was to be avoided. This call was based on the most recent scientific findings concerning the natural levels of tolerance to different pollutants. Thus

- The emissions of sulphur and nitrogen oxides must each be reduced by at least 90 per cent.
- A decrease of at least 75 per cent is needed for ozone concentrations. This requires a marked diminution of the amounts of hydrocarbons released to the atmosphere, as well as a reduction of nitrogen oxides to the extent indicated.
- The emissions of ammonia must also be reduced, in some areas by as much as 90 per cent.

These demands were put forward with great emphasis during Air Pollution Week,in which environmentalist organizations from fifteen countries, both in East and West Europe, were engaged.

What they did

- The fifteen worst emitters of sulphur dioxide were exposed . The European Youth Forest Action group also demanded publication of all the relevant data on emissions. In Spain Greenpeace arranged demonstrations against the coal-fired power station at Andorra.
- Environmentalist groups in Poland, Estonia, Czechoslovakia, and Hungary issued calls for a car-free day on June 5, World Environment Day.
- Road traffic campaigns involving bicycle cavalcades, distribution of leaflets, and so forth, were mounted in Sweden, Denmark, Holland, Switzerland, France, Spain, and West Germany – with demands for a cutting down of motor traffic and the development of public transport systems as a means of saving the environment.
- Conferences and exhibitions to illustrate and protest against forest decline were staged in Cracow (Poland), Schwarzwald (West Germany), Ljubljana (Yugoslavia), Trento (Italy), and in Paris.
- The Czechoslovakian youth organization Brontosaurus was the arranger of a camp for 500 young people from East and West Europe, at which global environmental problems and the possibilities of international cooperation for their solution were intensively discussed.

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Harder rules for freons environmentalists demand

At the United Nations conference on ozone in Helsinki in May, some eighty countries agreed on a program for phasing out CFCs. Represented at the meeting were all the great industrialized nations and many of the larger developing countries, including India and China. There was a unanimous vote for a complete stop for the five worst types of freon – CFCs 11, 12, 113, 114, and 115 – by the year 2000. The use of halons, which are employed primarily in fire extinguishers, was to cease "as soon as possible."

This declaration from Helsinki does not invalidate the Montreal Protocol, but simply indicates an inevitable tightening up of the protocol when it comes up for revision in London in the spring of 1990.

At the last London conference, in March this year, China put forward a proposal for an international fund to enable the developing countries to "skip" the CFCs and go over directly to using the alternatives that are now being developed in the industrialized countries. It was also intended to facilitate the transfer of the technology for production of the alternative chemicals and know-how concerning their use to the poorer countries.

At Helsinki Norway proposed a global fund, financed by the industrialized countries, for saving the stratospheric ozone layer and counteracting the much feared-greenhouse effect on the world's climate.The Norwegian minister of the environment made an offer of 0.1 per cent of her country's gross national product – or 600 million kroner a year – as a start to such a fund. A number of countries, headed by West Germany, Britain, and France, were however adamant in their opposition to a centrally managed fund, preferring to support the ozone campaign through separate bilateral agreements with each developing country.

The environmentalist organizations are far from content with the Helsinki declaration. Greenpeace wants an immediate stop for all freons. A hundred or so other organizations, acting together, think there should be a complete stop by 1992, but could, in an extremity, admit an extension of the use of freons until 1995.

Environmentalists also take a very critical view of the new, supposedly more harmless chemicals that are now being developed – maintaining that even though the substitutes may decompose more rapidly, and are much less destructive to ozone, they will still be a threat to the environment. Therefore, the environmentalists say, they should only be allowed during a transitional period.

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