M. Kroon, R. Smit and J. van Ham (Editors), Freight Transport and the Environment

THE PRESENT ENVIRONMENTAL CRISIS

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SUMMARY

Increasing environmental pollution poses a serious threat to the human environment, even on a global scale. It is realized too little that environmental problems have a time scale, so that the effects only become apparent after many years of environmental pollution.
Emissions must be cut by 50 to 80% to make sustainable development possible, as defined in the Brundtland report. Freight traffic plays a part in this pollution, also when viewed against the background of the strong growth which may be expected in this sector. The environment will have to be regarded as a production factor the use of which carries a price. Technological developments, including those in the field of new fuels and environmentally acceptable modes of transport, must be stimulated in order to cope with the growing environmental crisis with regard to freight traffic.

1. INTRODUCTION

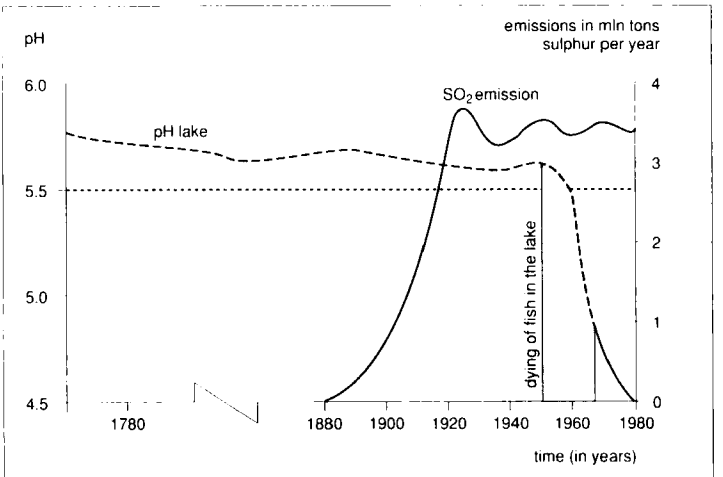
Our society has woken up to the fact that the increasing environmental pollution poses a threat to our environment. Visible effects in particular, such as damage to forests caused by acidification, contamination of drinking water, mass mortality of fish in rivers, and impairment of health by air pollution in Eastern Europe, demonstrate that acceptability limits have been widely exceeded.
"Have reports of the serious consequences of environmental pollution not reached us before now?" This would appear to be a legitimate question.
The answer to this is in the affirmative. I only need to draw attention to the report of the Club of Rome "The Limits to Growth", published in 1972. Certainly, the discussion on the predicted increasing environmental pollution did receive attention, but interest subsequently ebbed away. The same is true of the destruction of stratospheric ozone as a result of the sharp rise in the use of chlorofluorocarbons (CFCs), predicted by scientists in the early seventies. Measures have been announced after the depletion of the ozone layer recently became observable.

Society apparently reacts only after effects have occurred. Insufficient account is taken here of the time scale of the environmental problems.

2. TIME SCALES

The factor time plays a very important part in the development of these environmental problems. Our environment possesses, as it were, a buffer capacity, so that the consequences of many years of polluting the environment become noticeable only after this capacity has been exceeded. The problem of the time scales can best be illustrated by means of the following example: a study carried out by IIASA in Big Moose Lake in the United States has established the

relationship between the increase in SO_2 emission from the use of fossil fuels and its acidifying effect on the surface water.



Time scale of acidic emission and acidity of Big Moose Lake, supplied by groundwater. (Source: IIASA)

figure 1

The 70-year delay which can be observed in figure 1 between the increase in SO_2 emission and fish mortality can be explained by the delayed leaching of acid from the soil into Big Moose Lake by way of the groundwater. After the emissions have ceased, it will again take decades before the original situation in the lake has been restored.

This time scale problem makes it necessary to take preventive measures much earlier. Measures taken before the environmental effects become evident cost much less than cleanup measures taken after these effects have already occurred.

3. DIVISION OF ENVIRONMENTAL PROBLEMS INTO SPATIAL SCALES

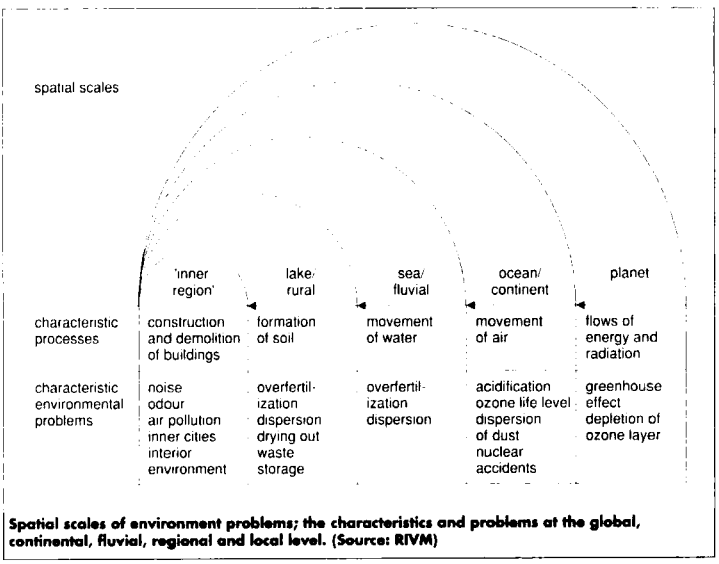
The report "Our Common Future", the Brundtland report of the World Commission on Environment and Development, published in 1987, has emphasized that sustainable development is essential to prevent further disruption of our society as a result of environmental pollution.

In the Netherlands the National Institute of Public Health and Environmental Protection (RIVM) has published in 1988 the report "Concern for Tomorrow", National Environmental Survey 1985-2010, which has served as a scientific background document for the National Environmental Policy Plan issued by the Dutch government in 1989.

In "Concern for Tomorrow", the environmental problems have been classified according to five spatial scales (see figure 2):

- global level : greenhouse effect and depletion of the ozone layer;
- continental level : acidification, ozone in the biosphere;
- fluvial level : eutrophication, dispersion;
- regional level : overfertilization, dispersion and waste disposal;

- local level : disturbance by noise, air pollution in inner cities.



Spatial scales of environment problems; the characteristics and problems at the global, continental, fluvial, regional and local level. (Source: RIVM)

figure 2

Environmental pollution caused by traffic has consequences especially for the global, continental and local scales.

The environmental pollution load will be greater in the Netherlands than in other countries using the same environmental technology. This is because energy consumption, density of population, number of vehicles, industrial production and number of farm animals in the Netherlands, calculated per square kilometre, are some of the highest in the world.

For road traffic, the transport performance per square kilometre in a number of OECD countries, for both passenger and freight traffic, is presented in figure 3. In this figure, too,

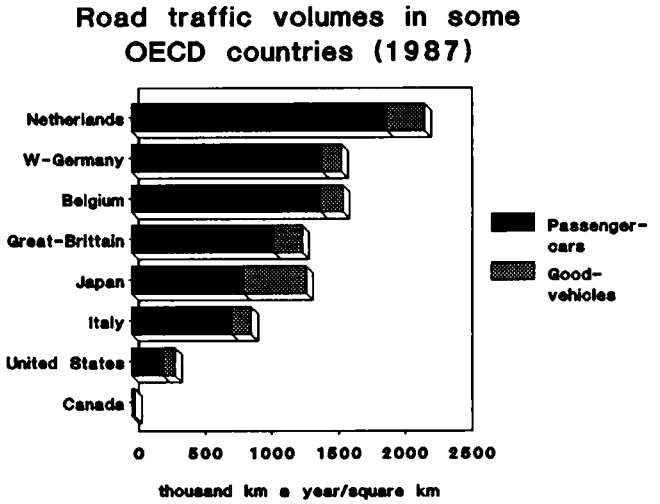


figure 3

it is obvious that the environmental situation in the Netherlands is critical. The report "Concern for Tomorrow" has demonstrated that serious disruptions can be expected if the current trends in production and consumption are extended into the future. For example, without taking stringent measures, the forests in the Netherlands will be lost as a result of acidification.

Many emissions will have to be cut by more than 50%, often by 70-80%, to arrive at a situation in which development is sustainable, as defined in the Brundtland report.

4. ROAD TRAFFIC

The major environmental problems caused by road traffic relate to disturbance by noise and air pollution, and a substantial contribution to this is made by freight traffic.

One specific problem of road traffic is the great increase in volume which may be expected in the years to come. For example, in 1988 the Netherlands foresaw a growth of over 50% in road traffic and even of 80% in freight traffic by the year 2000. These growth expectations are meanwhile being revised downwards, under pressure of the anticipated increase in environmental pollution. However, it is not clear which measures can effectively reduce transport mobility.

As regards the technical development of quieter and cleaner trucks, I can only express disappointment about the slow pace at which truck producers have succeeded in developing cleaner and quieter vehicles. The very slow decision-making within the EEC on a tightening of the product specifications in particular, has hampered progress. More stringent environmental requirements outside the EEC, such as the recent ban in Austria on noisy freight traffic during the night, have often induced others to take similar action.

That the engineers have by no means yet reached the end of their technical capability can be deduced from figure 4, which

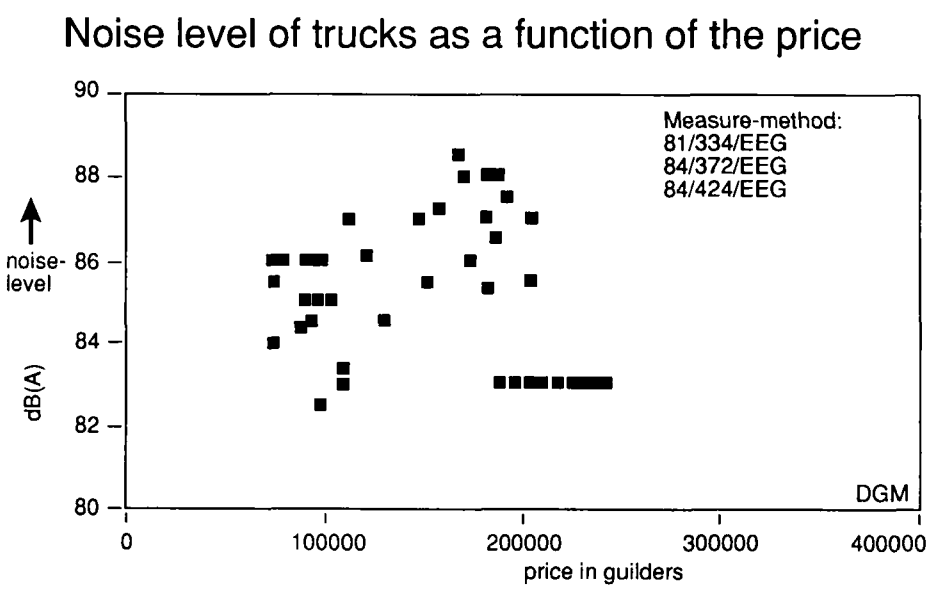


figure 4

shows the relationship between the purchase price of trucks and the measured sound levels in accordance with the current EEC type test requirements.

The same price range includes both noisy and quieter types. Considering the expenditure governments have to incur in order to reduce noise pollution by means of sound-proofing provisions such as screens and improved insulation of dwellings, it is not unreasonable to state that noisy trucks are underpriced compared with quieter ones.

Because of the anticipated strong growth in traffic, especially freight traffic, and also in the light of the slow pace of development of clean technologies, it may not come as a surprise that more stringent measures are being considered to curb the increasing environmental pollution caused by traffic.

The role of freight transport in the noise pollution from road traffic is significant. More and more international freight transport is taking place by night, so that the noise standards then in force are increasingly being exceeded along busy highways. This situation exists in busy urban areas too. Since noise pollution from freight traffic is expected to increase, it seems justified to ask whether in those areas where the noise standards are exceeded, freight traffic should be restricted to trucks which meet the most stringent noise criteria. The periodical tightening of these criteria will give industry an extra incentive to design quieter trucks. A market for quieter trucks can only develop if the government creates a demand for them. Industry will then certainly be able and willing to satisfy this demand.

The principal air pollution constituents from road traffic, expressed as a percentage of the total emission in the Netherlands, are presented in figure 5.

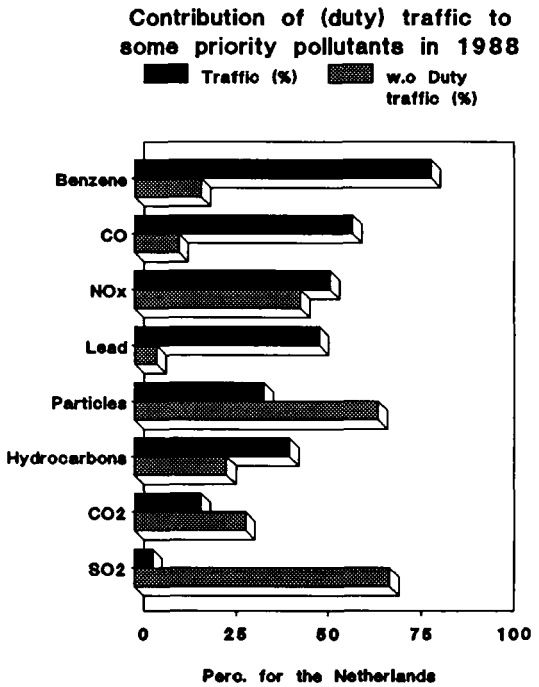


figure 5.

Traffic accounts for as much as about 50% of the total emission of nitrogen oxides. Of this, 4/10 comes from freight traffic. The proportion contributed by freight traffic to the sulphur dioxide and fine particles emitted by traffic is very high indeed.

Here follows a more detailed account of the consequences of a few atmospheric pollutant emissions, namely carbon dioxide, nitrogen oxides, sulphur dioxide and black smoke.

a. Carbon dioxide

The consumption of fossil fuels leads to a rise in the carbon dioxide (CO_2) concentration in the atmosphere. It has increased by 30% in the past century alone. If the current trends continue, the CO_2 concentration will have doubled by the middle of the next century. When the atmospheric concentrations of trace gases, which include CO_2, increase, less heat radiating from the surface of the earth can escape into space, as a result of which the lower layers of the atmosphere will warm up. The climate will change and the sea level rise. It is estimated that CO_2 is responsible for half of the greenhouse effect. Traffic accounts for about 20% of the CO_2 emission in the Netherlands, and approximately 1/3 of this stems from freight transport.

When the atmospheric concentration of CO_2 doubles, the global mean temperature can be expected to rise by 1.5 to 4.5 degrees Celsius. This will have far-reaching consequences for life on earth. It may be assumed that it is generally known that the greenhouse effect is not taken seriously everywhere.

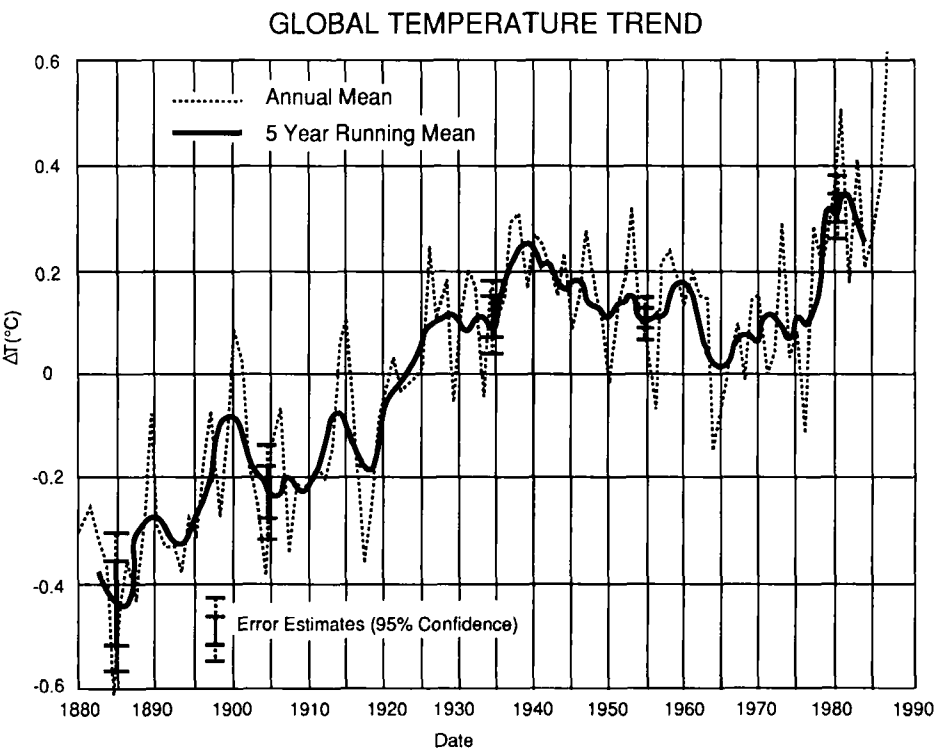


figure 6

Here, I merely want to direct attention to similar voices heard in the seventies concerning the damage to the ozone layer as a result of the use of CFCs, among other causes. At that time, too, some governments preferred to defer taking action until the effects became apparent. In the past few years, a rise in the global mean temperature has already been observed, as is shown in figure 6. Nevertheless, statistically, this cannot be interpreted as conclusive evidence that global warming has begun to occur. However, the postponement of further decision-making on a reduction of CO_2 emissions is not a realistic alternative because of the long recovery period following a drastic cut in these emissions. It can be deduced from figure 7

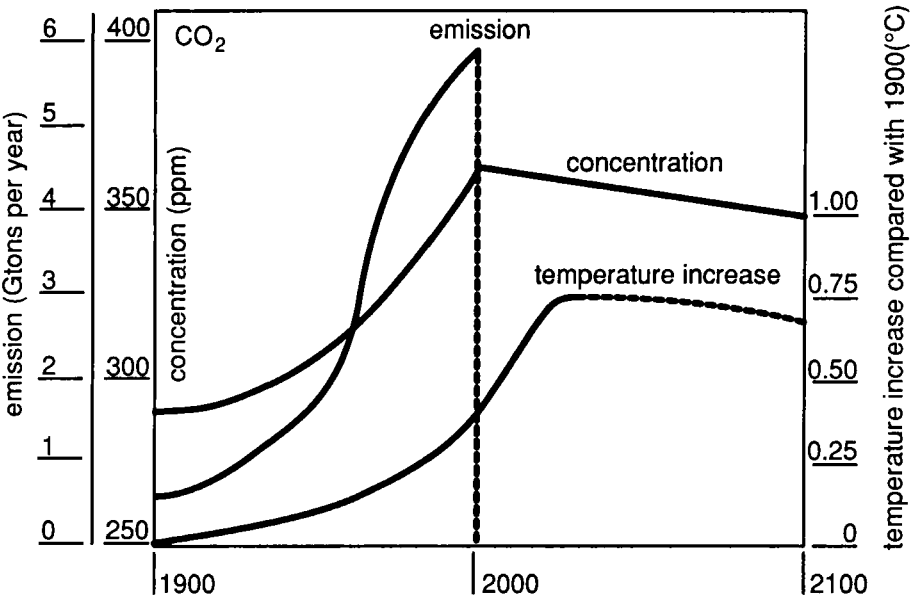


figure 7

that even after cessation of all CO_2 emissions, the temperature will still continue to rise and it will take a few hundred years before it has fallen again to the original level. This time-scale effect calls for stringent measures now. This applies especially to traffic because of the anticipated growth in this sector.

b. Nitrogen oxides

In the Netherlands, road traffic is responsible for over 50% of the emissions of nitrogen oxides (NO_x). Of this, approximately 4/10 is produced by freight traffic.

Excessive concentrations of nitrogen oxides damage human health, and for this reason a Directive came into force within the EEC in 1985 which requires the EEC member states to reduce the concentrations of nitrogen oxides to no more than 200 $\mu g/m^3$ by 1. January 1994 at the latest.

Figure 8 shows the NO_2 concentration for a number of European cities. The EEC limit is considerably exceeded in cities such as Cologne, London, Lyons and Milan. In view of the approaching date of 1 January 1994, compliance with this

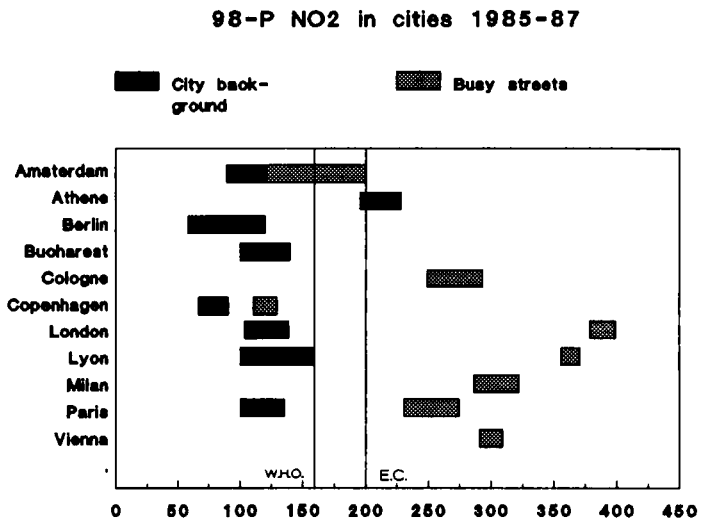


Figure 8

Directive will only be possible by taking measures designed to curb traffic.

In warm sunny weather, solar radiation acts on nitrogen oxides and volatile hydrocarbons to produce ozone, which leads to an increased health risk in risk groups such as persons with respiratory disorders and people engaged in heavy physical exertion outdoors.

A study carried out by the RIVM has shown that halting the traffic limited only to the Netherlands during this summer smog has only a small favourable effect on the ozone level. There is a better result in combination with measures in the surrounding countries.

The contribution made by traffic to the acidification problem in the Netherlands is increasing. It has risen from 19% to 21% since 1980. On the other hand, the proportion contributed by industry is falling as a result of the reduction in SO_2 emissions.

The acid deposition in the Netherlands consist of 40% sulphur compounds (particularly from industry), 32% nitrogen oxides (particularly from traffic) and 28% ammonia (from agriculture). Foreign sources account for over half of the acid deposition in the Netherlands. The Dutch contribution to acid deposition has risen from 37% in 1980 to 41% in 1985 as a result of the growth in intensive animal farming and traffic.

Actually, the Netherlands is a net exporter of acidifying air pollutants.

The average acid deposition rate in the Netherlands is currently about 5000 mol/ha/year, with a range of 3000 to 7000 mol/ha/year. In the medium-long term, forests and other natural areas can only be preserved when the average acid deposition does not exceed 800-1500 mol/ha/year. Figure 9 shows that only stringent measures, both in the Netherlands and in neighbouring countries, can reduce acid deposition. It is inevitable here that traffic will have to make a substantial contribution.

Acidification is not a typically Dutch problem. It also occurs in the rest of Europe as well as in the United States and Canada, and is potentially a risk to the other continents.

Acid depositions in the Netherlands compared to standards related to drinking water quality and the vitality of ecosystems

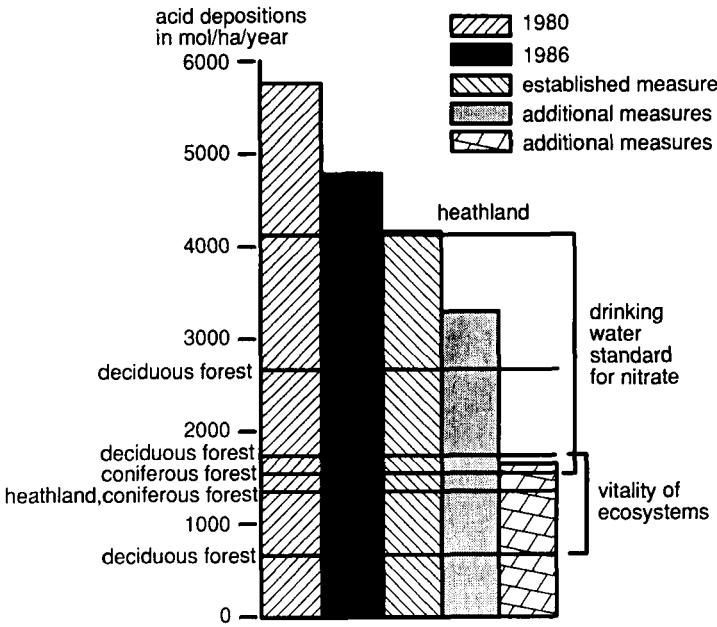


Figure 9

c. Sulphur dioxide and fine particles

During a winter smog-period, excessive concentrations of sulphur dioxide (SO_2) and black smoke have serious effects on health. Unlike the summer smog situation, where the largest risk group consists of mostly healthy persons doing heavy physical exercise outdoors, the group at risk during winter smog comprises persons who are especially susceptible to the acid winter smog mixture and stay mainly indoors. These include cardiac patients, persons with chronic lung diseases and elderly people in very poor physical condition. Winter smog can result in hospitalization, and possibly even increases the risk of death. In the Netherlands, winter smog occurs during cold spells in conjunction with a strong high-pressure area over Central Europe, so that more fuel is used.

A study carried out by the RIVM has shown that measures designed to curb traffic on very busy streets during these periods may reduce the health risk by approximately 30%.

5. AIR TRAFFIC

The environmental effects of air traffic cannot be passed over at this symposium because of the vigorous growth foreseen for freight transport by air. For example, Schiphol Airport, Amsterdam, expects the total number of arrivals and departures to increase by about 75% between 1987 and 2000, whereas the growth in freight transport by air is calculated at about 300%.

Consequently, the noise near airports, especially during the night, will become more and more a dominant factor. The people in the neighbourhood increasingly appeal to the courts for better protection of the environment around airports.

Recently, a judicial decision in the German Federal Republic imposed a ban on nighttime flying at the new Munich airport. In the Netherlands, the court has already decided upon a noise standard to be met at the North-South runway of Maastricht airport in the south of the Netherlands. The relaxation of this standard proposed by the government for a new East-West runway to be built there will certainly give rise to further discussion. This proposal was influenced by the fact that no agreement could be reached with the neighbouring countries on optimization of the prescribed flying routes, especially over Belgian territory. In this context, I should merely like to mention the obvious damage to public health caused by aircraft noise.

Air pollution near airports too, poses a growing problem, which incidentally is caused chiefly by the road traffic they attract. The air pollution around Schiphol, and the associated cancer incidence, are comparable with the situation in densely populated areas.

The emissions from aircraft in the troposphere and, in the near future, also the stratosphere will cause a growing problem in aviation. This is because these airplanes inject their exhaust gases directly into the air at higher altitudes. These emissions therefore have a relatively large effect.
Figure 10 shows that the NO_2 emissions from air traffic are

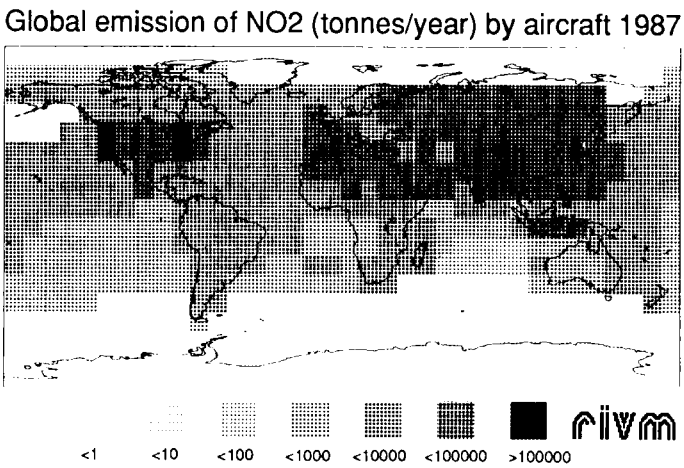


Figure 10

highest over Europe and the United States.

The emissions from subsonic planes (altitude up to 12 kilometres) increase the ozone concentration in the troposphere, resulting in an enhancement of the greenhouse effect. A study carried out by the RIVM in collaboration with the University of East Anglia (GB) expects that with a doubling of the volume of traffic, the tropospheric ozone level will rise by approximately 20%.

The aircraft industry is currently discussing the development of a new generation of super- and hypersonic planes with altitudes of more than 15 kilometres, which will spend a large part of the flying time in the stratosphere. This development is likely to contribute significantly to the depletion of the ozone layer. The resulting increase in ultraviolet radiation could raise the incidence of skin cancer. The question of whether it is advisable to develop such

airplanes, seems justified. When the Concorde I was developed some time ago, insufficient attention was paid to social aspects such as disturbance by noise and energy consumption. The proposed Concorde II will likewise carry a great risk.

In view of the public-health and environmental aspects related to aviation, one recommendation would be a shift from continental air traffic to high-speed train connections, thus counterbalancing in particular the growth in intercontinental air traffic.

6. ENVIRONMENT AND ECONOMICS

To date, too much emphasis has been placed on a contradiction between Economics and Environment. It is gradually being realized that developing an environmental policy too late places a great financial burden on our society. The Dutch National Environmental Policy Plan has calculated that an estimated 150 billion guilders will have to be spent to clean up the already existing serious contamination of the environment. The significance of this sum can be judged from the current Dutch national debt of about 320 billion guilders. If these cleanup costs were related back to the periods in which these expenses have been incurred, then the calculated economic growth would have been considerably lower.

The scarce production factor environment has not been priced at all, or underpriced for too long. This has led, from a national economic point of view, to ineffective decision-making, so that the cleanup expenses have to be defrayed by future generations.

In my opinion, instruments in conformity with the market in particular, such as subsidies, and levies related to environmental pollution, should accelerate the development of clean and quiet technologies. The purchase and use of clean products will have to be encouraged, creating a market demand of which the producers can take advantage.

Physical regulation is only useful if it has a stimulating effect on technological developments, which is certainly not the case in the EEC today.

In my opinion, the establishment of phased requirements should be considered, with the standards to be met in, for example, 15 years' time, already being set now. These should be based on assumptions regarding technologies not yet developed. This promotes and rewards technological research.

Returning to the environmental pollution which has already occurred, I dare to put forward the proposition that future economic growth will only be possible if stringent environmental measures are taken. Economic models have thus far taken no, or insufficient, account of the consumption of our natural environment. It is already becoming evident in the agricultural sector that air pollution causes damage to agricultural production.

Because of the international nature of environmental pollution, especially air pollution, a more stringent environmental policy must be drawn up within the EEC in particular. Until this has been accomplished, countries such as the Netherlands with a high density of activities per square kilometre, will have to choose between a more seriously damaged environment than other EEC countries, or a more area-oriented approach, for example by favouring environmentally acceptable vehicles.

7. CONCLUSIONS

More intensive environmental research, using advanced

measurement techniques and mathematical models, has convincingly demonstrated that a potential environmental crisis exists. Only by taking stringent measures, and especially by thinking differently about the consumption of the production factor environment, will an inevitable environmental crisis be averted. Waiting any longer, referring to further research, means choosing the inevitable. This is because of the time scale within which environmental problems arise and can be remedied. Freight transport plays an important role in this discussion, also in the light of the growing demand for it. In addition to technological developments, including those in the field of new fuels and those encouraging the use of the most environmentally acceptable trucks, stimulation of freight transport by rail and inland waterways will become more attractive because of the associated environmental benefits. This can be done especially by placing a cash value on the services provided by natural environments. The environment is no longer primarily a collective property for recreation and relaxation, but a condition for human life and for a sustainable economic growth.