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Paris Minister<sup>2</sup>  
This suggests that although algae do emit a large amount of sulphur in season, this is not a significant contributor to acid rain.

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My ref:  
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Caroline Slocock  
Private Secretary to  
The Prime Minister  
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aps  
28/11

28 November 1989

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Dear Caroline

You sought comments on press reports of recent research work relating to acid rain and global warming. The advice of our experts is as follows.

Recent research carried out by the NERC in the North Sea suggests that emissions of dimethyl sulphide from algae blooms in spring and summer could be significant contributors to acid rain. The press article suggests that even with a full programme of desulphurisation on power stations, the problem of algae will have to be treated separately.

This source of sulphur is not a recent discovery. Arguments based on it have been deployed frequently over the years to counter the need to reduce power station sulphur emissions but have generally been discredited.

The recent work suggests that the peak average flux per unit area from the North Sea is about 25% of the average flux per unit area from Europe. Since the area of the North Sea is about one thirtieth of the European continental area the proportion of European sulphur emissions which arise from the North Sea is less than 1%, even at its peak. Additionally the sea emits very little sulphur in winter, so that averaged over the year, the anthropogenic component dominates overwhelmingly. <sup>1.2.</sup> man-made

This is borne out by scientific research carried out under EMEP (Environmental Monitoring and Evaluation Programme) of the UNECE to which the UK contributes.



On global warming the research has suggested that only 30% of man made carbon dioxide is absorbed by the oceans rather than 50% as has been assumed generally until recently. This result is based on a single study over a limited area and care should be taken in making extrapolations to a global scale. However, such a measurement is a British first and underlines the important contribution which British Scientists are making. It would not be surprising if this result turned out to be more generally true, since our knowledge of the carbon cycle is still limited. If true it implies that the missing 20% is taken up by the land biosphere. What is not in doubt, and which is important, is that about 50% of man made emissions of carbon dioxide remain in the atmosphere. This is confirmed by isotopic studies of carbon in the atmosphere.

It is not true to say that greenhouse warming will occur more rapidly since we have no reason to believe that the proportion of CO<sub>2</sub> emissions remaining in the atmosphere will change significantly, at least in the short term.

If it turns out that the land biosphere is a net sink of carbon dioxide then the impact of afforestation in ameliorating the rise in carbon dioxide would be greater than currently anticipated. We need to be generally cautious in this whole area however and await results of the research which is being done on the carbon cycle. In the meantime our policy of encouraging proper management of forests and afforestation is correct whatever the outcome.

CE J Bush

PP R BRIGHT  
Private Secretary



11-2-11-01

## Algae in North Sea 'causing acid rain'

NEW research shows that up to one quarter of Europe's acid rain is caused by emissions of dimethyl sulphide traced to algae in the North Sea, writes Mary Fagan.

Experiments carried out by the Natural Environment Research Council indicate that during spring and summer the algae are producing enough dimethyl sulphide to make it a significant problem.

The dimethyl sulphide produces sulphur dioxide in the atmosphere, which is as environmentally damaging as any coming from power stations. The Government is embarked on a programme costing hundreds of millions of pounds to clean up acid emissions from power stations but scientists say that even if Britain eliminates such emissions it will still need to tackle this separate problem. They say that at the worst time of the year 25 per cent of the acid pollution carried by wind from the Continent will be caused by the algae.

The main problem is a high

concentration of algae along the coasts of France, Germany, Belgium and The Netherlands, which produce most dimethyl sulphide in April and May.

John Woods, marine atmospheric science director at the NERC, said: "Before you spend hundreds of millions of pounds, you ought to consider nature as well as man."

The NERC's £12m North Sea project, which ended this week, is the first sustained work on the seasonal cycles in the North Sea, and is crucial to developing accurate computer models of water quality and to understanding what is happening to the global environment.

Dr Woods said that policy-makers had been trying to take decisions on pollution and water quality on the basis of data which scientists have believed do not adequately describe what is going on in the North Sea. Other results from the project will help scientists to gauge what happens to pollution from estuaries.

# Ocean tests show global warming is accelerating

By Mary Fagan  
Technology Correspondent

THE GREENHOUSE effect may be heating the earth much more quickly than previously thought, according to results from a major research project run by British scientists in the North Sea.

Previous theories that the world's oceans absorb half of man's production of carbon dioxide — a major cause of the greenhouse effect — appear to have been turned on their heads.

Without this ocean sink, the build-up of CO<sub>2</sub> in the atmosphere will greatly accelerate, but the experiments show the oceans absorb only 30 per cent instead of 50 per cent of the 5.5 gigatonnes emitted into the atmosphere by man every year. Most of this man-produced carbon dioxide comes from burning fossil fuels.

Dr Andy Watson, who worked on the project organised by the Natural Environment Research Council, said: "This is a major problem in terms of global warming. We appear to be missing a lot of carbon dioxide from the global budget. We have now got to come to grips with the fact that this has serious implications for our ability to predict changes in global climate."

He also warned that although there has been little time to work on the recent results, the carbon dioxide in the earth's atmosphere may increase 20 per cent faster than current models predict.

Dr Watson said that the extra CO<sub>2</sub> may be taken up by land vegetation instead, which has serious consequences as land is thought to be a less efficient "sink" and one which becomes saturated much more quickly.

Scientists are worried that within a short time more of the

carbon dioxide produced will stay in the atmosphere, thus accelerating the greenhouse effect.

Dr John Woods, director of marine atmospheric sciences at the council, said "the result is that we still do not have a handle on exactly where the carbon dioxide is going. If it is not the sea which is taking the carbon dioxide, then the back of the envelope calculation says that carbon dioxide in the atmosphere could double in 40 rather than 50 years and the planet will warm more rapidly".

The results come from a 15-month project, one of the most extensive undertaken, which measured physical, chemical and biological processes in the North Sea. But Dr Woods said the carbon dioxide uptake findings were fundamental and had serious implications for global climate change.

He said that it would be necessary to rethink research priorities for the future. The United Kingdom is currently involved in an international study to assess the impact of oceans and their plant and animal life on the greenhouse effect.

Dr Watson believes that tackling the problem of land instead of oceans could be much more difficult. "We do not know if, or why, the land vegetation takes the carbon dioxide up, or how long they might continue to do so. Scientists are being asked by the policy makers what they should do. It's rather embarrassing to admit we do not even know where the carbon dioxide is going."