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Briefing on the European Commission proposal for a regulation on certain greenhouse gases [COM (2003) 492]

Prepared for the European Parliament Committee on Environment, Public Health and Consumer Policy

INTRODUCTION

The Committee on Environment, Public Health and Consumer Policy of the European Parliament has made a contract with the European Academies' Science Advisory Council (EASAC) for the provision of technical-scientific advice in the area of Environment Public Health and Food Safety (project EP/IV/A/2003/09/02). As part of the contract, the Committee has commissioned a review of the European Commission's proposal for a Regulation on certain greenhouse gases, contained in the Commission document COM (2003) 492.

Four independent EASAC experts have reviewed the draft Directive, and their comments are summarised in this paper. The experts come from UK, Denmark and Greece. Their expertise covers the fields of atmospheric chemistry, and climate change. They include lead authors of the Intergovernmental Panel on Climate Change Third Assessment Report and the World Meteorological Organisation 2002 Stratospheric Ozone Assessment.

This review focuses on the scientific merits of the proposal and in particular on the likelihood that the measures proposed will deliver the improvements required. It does not deal with economic or industrial aspects of the proposal, which we have agreed are not within the competence of EASAC members. We do, however, comment on areas where it may not be scientifically appropriate to take a simple economics approach based on cost benefit analysis.

SUMMARY

In this document, the Commission sets out the case for action within the European Union on a number of important environmental pollutants that contribute to global warming. It contains proposals for reducing emissions through a number of specific prohibitions and a general provision for reducing uncontrolled release.

The opinion of reviewers was that the proposals address an important environmental issue but that they need strengthening before they can be guaranteed to be effective. More scientific analysis is required in the explanatory memorandum, and the measures need to be more sharply targeted.

BACKGROUND

During the 1990s, in response to the Montreal Protocol on the depletion of the stratospheric ozone layer, industry was encouraged to switch from using chlorofluorocarbons (CFCs), first to hydrochlorofluorocarbon (HCFCs), as a temporary expedient, and then to hydrofluorocarbons (HFCs) as a longer-term solution.
All of these materials, however, are greenhouse gases and contribute to global warming. They have therefore been the focus of attention within the Intergovernmental Panel on Climate Change (IPCC) and within the European Climate Change Programme (ECCP). The Commission has been considering appropriate action against this group of gases, since they are highly active as greenhouse gases, as indicated by their global warming potential (GWP). The GWP takes carbon dioxide (CO_2), the main anthropogenic greenhouse gas, as its reference. CO_2 has a GWP of one. Many of the gases in the group covered by this proposal have GWPs in excess of one thousand.

Deliberate release of CFCs into the atmosphere has been curtailed markedly as a result of policy responses to stratospheric ozone depletion taken under the Montreal Protocol. However, emissions of CFC-11 and –12 still arise from long-lived foams and refrigeration equipment, with the consequence that atmospheric concentrations of CFC-12 are still increasing in 2003. In addition, the CFC substitutes have not proved trouble-free. An unintended consequence of the increased usage of HCFC-22 as a major CFC replacement has been the release of HFC-23 to the atmosphere. HFC-23 is a long-lived fluorinated greenhouse gas with a high global warming potential and is an unwanted by-product of the industrial production of HCFC-22.

The phase-in and phase-out of HCFCs led to dramatic increases in the atmospheric levels of HCFC-22, HCFC-141b and HCFC-142b. Now the phase-in of HFCs has begun and atmospheric levels of HFC-152a and 134a have begun also to increase dramatically, starting in the late 1990s and early 2000s.

The focus within the UN FCCC (United Nations Framework Convention on Climate Change) has been on a basket of greenhouse gases that contains the HFCs, perfluorocarbons (PFCs) and sulphur hexafluoride, SF_6, in addition to carbon dioxide, methane and nitrous oxide. Concerns have been raised by policymakers that the global warming consequences of the release of HFCs in response to the measures agreed within the Montreal Protocol have not been adequately taken into account. There is also an issue concerning the global warming consequences of HFC by-product formation, for example in the industrial manufacture of HCFC-22.

It is therefore timely for policymakers to address controls on the emissions of HFCs, PFCs and SF_6. The proposal COM(2003) 492 for a regulation of fluorinated greenhouse gases is therefore to be welcomed. There are, however, a number of issues that need to be raised at this stage with the proposal and these are addressed below.

THE COMMISSION'S APPROACH

1. Scope of measures proposed: global warming potentials and atmospheric lifetimes

The fluorinated greenhouse gases certainly have large global warming potentials (GWPS) as can be seen from the table in Annex I of the Commission's proposals, reproduced in Annex 1 of this paper. There is no question that the GWP concept is the appropriate measure for policymakers to use when comparing greenhouse gas emissions and for setting policy for emission controls. However, the GWP concept takes into account a number of factors and it is worth highlighting one of them, atmospheric lifetime, because it is particularly important for greenhouse gas policy.

One of the reasons why greenhouse gases such as CF_4 and SF_6 have such large GWPs is that, in addition to their strong activity in the infrared region of the spectrum, they have extremely long lifetimes. This means that some fluorinated greenhouse gases essentially remain permanent constituents of the atmosphere once emitted. They are 'immortal molecules' and are generating a permanent greenhouse effect. Once these molecules are released to the atmosphere, there is no policy intervention that can influence their removal rates. Although GWPs characterise the magnitude of global warming impacts, atmospheric lifetimes control the dynamics of the response these materials make to policy interventions.

For example, CFC-12 has an atmospheric lifetime of 100 years and concentrations are still growing in the atmosphere despite measures taken under the Montreal Protocol. CFC-11, however, has a 45-year lifetime and concentrations are declining in response to the same policy actions.

This proposal focuses on fluorinated greenhouse gases with GWPs above and below 150. This is arbitrary but defensible. However, it also needs to focus on greenhouse gases with lifetimes significantly longer than 100 years, and particularly on those gases with no known sinks whose lifetimes are estimated to be 1000 years and beyond (see Annex 1 of this paper). Considerations of atmospheric lifetime would highlight HFC-23 (270 years), HFC-236fa (240 years), SF_6 (3200 years), CF_4 (50 000 years), C_2F_6 (10 000 years), PFCs (2600 – 4100 years).

In its approach, the Commission considers the nature of the legislative framework required to control these materials and points out that it needs to be comprehensive, flexible and adaptable. It should add that the framework needs to take account of the particular fluorinated greenhouse gas species, in order to deal with the dangers associated with extremely long-lived greenhouse gases. The Commission therefore needs to take a more differentiated approach taking account of atmospheric lifetimes.

2. Scale of measures proposed: does this proposal match the scale of the problem?

The proposal focuses particularly on cutting emissions of HFC-134a and SF6. These are forecast to be the most important fluorocarbon GHGs over the next 100 years, but our reviewers point out that global emissions of these gases, and, they suspect, European emissions, are currently low. The IPCC has a number of emissions scenarios in its analysis. In one of them, entitled SRES, HFC-134a emissions are shown increasing from 80 Kt/year in 2000 to over 1000 Kt/year by 2060. However, the Commission explanatory memorandum contains no breakdown of European emissions by gas, only by sector. It is hard to see, therefore, whether current EU emissions of these gases are in fact low.

Emission timelines of gases are difficult to predict. However, our reviewers estimate that very little of the quoted 1995 emission of 65Mt of carbon dioxide equivalent comes from either SF6 or HFC-134a. It probably comprises CFCs, HCFCs and those HFCs whose emissions are in very rapid decline or have gone to zero anyway. If, therefore, no new flurocarbons were introduced, this 65Mt would drop to almost zero anyway. In which case, the proposal would have the effect of stopping the projected growth in replacement gases, rather than "cutting emissions of flurocarbons by 65Mt equiv. CO_2" as it claims. The report needs to be clear about this and a breakdown of emissions by gas and future projections of emissions by gas is essential, at least in the supporting documents

3. Nature of action proposed

Given the complexity of these materials, their widespread use and the severe effects they have, our reviewers feel that regulation should be as effective and simple as possible. In particular, the Commission should use outright prohibition where the circumstances demand it. For example, in the case of long-lived gases, arguments of cost effectiveness should not be allowed to take precedence over the arguments of their culminative effect as a permanent addition to the greenhouse effect. Similarly, where there are viable alternatives, for example in the cases of footwear, windows and fire-protection systems, the use of these materials should be banned.

In other cases, for example in automotive air-conditioning, there should be a uniform maximum leakage rate, documented and guaranteed by the manufacturer over the lifetime of the vehicle. At the end of its life, remaining fluorinated gases should be removed from the vehicle and reused or substituted by a gas of lower activity.

4. Indirect effects

There are several indirect consequences of the proposed regulations on climate, local environment and health, and these should be considered in the Commission's proposal. The IPCC is currently preparing a special report on halocarbons and climate, which is expected to examine these issues. However, it is due out at the end of next year and work may be required within the EU to address these indirect effects and other climate interactions. Some of these indirect effects are summarised below.

<u>Tropospheric ozone</u>
One of the recommended replacements to the HFCs is the hydrocarbons (HCs). Whilst the direct effect of hydrocarbons on climate is minimal, they may have larger indirect GWP through the effects they have on tropospheric ozone levels (see the IPCC, Third Assessment Report 2001 and the WMO Ozone 2002 report). Therefore the net carbon dioxide equivalent emission reduction due to substitution of HCs for HFCs could be much less than quoted in the proposal if indirect effects are included. There is very limited data on these indirect GWPs at present, but the explanatory memorandum should at least explain why they are not used. There should be a cross-reference to the IPCC report to be produced next year, which ought to quantify the indirect GWPs. One of our reviewers believes that there is an argument for waiting for this report to ensure that the indirect effects are properly taken into account. Tropospheric ozone increase would also have negative impacts on human health and the environment. It would make it harder to control episodes of photochemical smog.

Health

The replacements suggested for the fluorinated greenhouse gases may also have health effects that should be taken into account. For example, ammonia is toxic. There are also safety issues. Some hydrocarbons, for example, are explosive and high pressure hoses needed in some CO_2 applications can also split and cause damage.

These are not objections to the use of substitutes but should be a reminder that reputation is an important consideration. If hydrocarbon-filled fridges started exploding and killing people there would be a serious threat to the policy as a whole. Our reviewers would like to see replacements assessed in their wider context in the proposal. Again, the IPCC will address these issues.

Energy efficiency

The proposal as it stands makes no mention of energy issues in the whole. This is important if, for example, equipment that uses substitutes turns out to be less energy efficient.

5. Compliance regime: monitoring

Article 11: Review: Monitoring, page 13

An important feature of the Proposal is the compliance regime that is envisaged. The proposal is heavily based on emissions and emission factors. These are both uncertain and difficult to validate. Monitoring compliance is crucial to the success of the measures contained in this proposal. If the emissions are highly uncertain then the policy may not deliver the expected outcomes even if it is fully implemented.

It is therefore essential to check the emission inventories with an independent method. Atmospheric measurements at baseline observing stations have been used to great effect to monitor the compliance with the provisions of the Montreal Protocol in Europe. Work has begun to establish observation programmes for the fluorinated greenhouse gases. These will in time become a vital means of checking whether the emission inventories are giving a reliable guide to current atmospheric releases and of monitoring compliance with the provisions of the Proposal. The Commission of the European Communities should strongly support the atmospheric measurement programmes for the fluorinated greenhouse gases within Europe. There should be provision for this in the proposal.

DETAIL

The Joint IPCC/TEAP Special Report on HFCs

The introduction to the policy finishes with the 1999 report of the HFC and PFC Task Force of the UNEP Technology and Economic Assessment Panel. Subsequently the UN FCCC and the Montreal Protocol have agreed to pool their resources and information and to produce a joint IPCC/TEAP Special Report on HFCs and their replacements. At the very least, this should be referred to in the introduction.

The Commission may wish to say that they will review this Proposal in the light of the outcome and conclusions of the Joint IPCC/TEAP Special Report.

GWPs and atmospheric lifetimes

In the 'Approach to Reach the Objectives' p. 5, the Commission should add the need to take a species-specific approach to the reduction of effects of fluorinated greenhouse gases within the legislative framework. It needs to be species-differentiated to take into account the dangers associated with the extremely long-lived greenhouse gases.

The Commission proposes a staged approach on p6. There needs to be a third stage addressing the particular problems of the extremely long-lived greenhouse gases.

Under leakage inspections on p.7, the Commission proposes that the frequency of inspections should vary depending on the quantity of the fluorinated greenhouse gas contained in the equipment. Again, there is no consideration of the leakage requirements for any extremely long-lived greenhouse gas.

In para 4.2, Article 4: recovery on p. 8, there is an issue as to whether cost-effectiveness is appropriate for extremely long-lived greenhouse gases.

In para 4.6, Article 7: Control of Use on p. 8, there is an argument that there should be a duty on any premises using SF_6 to prevent and minimise leakage under all circumstances whether cost-effective or not because it is an extremely long-lived greenhouse gas.

In the 'Business Impact Assessment' Table 1 on p.15, it would be helpful to have a split by atmospheric lifetime into short and extremely long lifetimes to see whether the focus is balanced in the strategy.

The table in the back uses outdated GWPs and is not clear about the time over which the GWP was assessed. Our reviewers believe it to be 100 years, but this should be stated. Updated GWPs are in WMO, 2002, and these will change again for the IPCC report next year. Some gases are borderline GWP~150 – near the critical cut off GWP. The report needs to be clear about which set of GWPs it uses and to give full references.

CONCLUSIONS

This proposal addresses an important topic and has therefore been welcomed by reviewers.

However, there are several matters that should be addressed if the proposal is to be fully effective. In particular:

- The proposal should deal specifically with the question of atmospheric lifetime of these materials
- There should be a differentiated approach, with emission and projections made for each species
- The monitoring regime must include measurements of atmospheric levels of the gases
- Where necessary, the Commission should use prohibition regardless of economic arguments
- Indirect effects of these materials and of their substitutes should be considered in deciding action

20 November 2003

ANNEX 1 Global warming potentials and atmospheric lifetimes

This is the Table in Annex 1 Page 33 of the Commission's proposals with an extra column showing the atmospheric lifetimes taken from Ozone 2002, the WMO's assessment of stratospheric ozone depletion.

Fluorinated gas	Chemical Formula	Global Warming Potential	Atmospheric Lifetime (yr)
Sulphur hexafluoride	SF_6	23 900	3 200
Hydrofluorocarbons	(HFCs)		
HFC-23	CHF_3	11 700	270
HFC-32	CH_2F_2	650	4.9
HFC-41	CH_3F	150	2.4
HFC-43-10mee	$C_5H_2F_{10}$	1 300	
HFC-125	C_2HF_5	2 800	29
HFC-134	$C_2H_2F_4$	1 000	9.6
HFC-134a	CH_2FCF_3	1 300	14
HFC-152a	$C_2H_4F_2$	140	1.4
HFC-143	$C_2H_3F_3$	300	3.5
HFC-143a	$C_2H_3F_3$	3 800	52
HFC-227ea	C_3HF_7	2 900	34.2
HFC-236fa	$C_3H_2F_6$	6 300	240
HFC-245ca	$C_3H_3F_5$	560	6.2
HFC-365mfc	$CF_3CH_2CF_2CH_3$	890	8.6
Perfluorocarbons	(PFCs)		
Perfluoromethane	CF_4	6 500	50 000
Perfluoroethane	C_2F_6	9 200	10 000
Perfluoropropane	C_3F_8	7 000	2 600
Perfluorobutane	C_4F_{10}	7 000	2 600
Perfluoropentane	C_5F_{12}	7 500	4 100
Perfluorohexane	C_6F_{14}	7 400	3 200
Perfluorocyclobutane	$c\text{-}C_4F_8$	8 700	3 200