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the department for Enterprise

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The Rt. Hon. Lord Young of Graffham
Secretary of State for Trade and Industry

The Rt Hon Nicholas Ridley MP
Secretary of State for the Environment
Department of the Environment
2 Marsham Street
LONDON
SW1P 3EB

Department of
Trade and Industry

1-19 Victoria Street
London SW1H 0ET

Switchboard
01-215 7877

Telex 8811074/5 DTHQ G
Fax 01-222 2629

Direct line 215 5422
Our ref PS7AQZ
Your ref
Date 6 April 1989

Dominic
Do you want him
to at this?
CB

Nicholas

STRENGTHENING THE MONTREAL PROTOCOL ON PRODUCTION AND CONSUMPTION OF CHLOROFLUOROCARBONS (CFCs)

The Saving the Ozone Layer Conference successfully paved the way for the first meeting of the Parties to the Montreal Protocol at Helsinki from 2-5 May. We need to maintain the momentum of this initiative in a positive but realistic way for Helsinki. We and our Community partners are firmly committed to 85% cuts in production and consumption of CFCs as soon as possible with a view to complete elimination towards the end of the century. It is therefore important to examine the practical ways in which these cuts can be achieved by industry - and the implications of doing so.

... The attached paper has been prepared by my officials following extensive contacts with representatives of our producers and each of the main CFC and halon using sectors. Their views have been very carefully and critically examined and I should be surprised if any of our EC partners - taking an objective view - would arrive at any materially different conclusions. The paper examines the industrial and trade implications of strengthening the Protocol in three areas: accelerated production and consumption cuts (both in CFCs and halons); widening the range of chemicals covered; and the introduction of import prohibitions on products from non-parties.

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I believe that the line recommended for each of these areas is both positive and realistic:

- Accelerated cuts in production will make it all the more necessary (especially from the EC viewpoint) for the Protocol to provide for joint EC production controls, and to allow exemption for CFCs used as intermediates. Accelerated cuts in consumption depend on the pace of developing suitable alternatives to CFCs.
- The Protocol should not be extended to include existing substitutes such as methyl chloroform and HCFC 22. If it were, the achievement of the Protocol cuts and industry's ability to develop new substitutes for CFCs could be undermined.
- Although we shall not ourselves initiate discussion, we should continue to oppose the introduction of any import prohibition on products made with/or containing CFCs.

I agree with the paper's conclusion that efforts should be made to agree the above line with our Community partners prior to an EC coordination meeting on 21 April.

If you and colleagues are content I suggest that your officials discuss with mine how best to take them forward, bearing in mind also the possibility of a wider diplomatic effort (aimed at key non-EC countries) prior to Helsinki.

I am copying this to the Prime Minister, other members of E(A), as well as to Geoffrey Howe, Douglas Hurd, George Younger and Kenneth Clarke; and to Sir Robin Butler.

John G. ...
David

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INDUSTRIAL AND TRADE IMPLICATIONS OF STRENGTHENING THE MONTREAL
PROTOCOL ON PRODUCTION AND CONSUMPTION OF CHLOROFLUOROCARBONS
(CFCs) AND HALONS

Introduction

1. This paper explains the implications, for UK producers and users of chlorofluorocarbons (CFCs) and halons, of the probable strengthening of three aspects of the Montreal Protocol:

- the extent and pace of production and consumption cuts;
- the range of substances controlled;
- import prohibitions.

The paper considers what factors affect the prospects of more stringent requirements being met within a given timescale. In the light of this analysis, the paper considers what line HMG (and possibly the EC) should take. This paper does not examine the issue of confidentiality of data reporting. The UK position on this is well established, and unaffected by the Council of Ministers conclusions of 2 March when the Community agreed the need for the Protocol to be substantially strengthened. But it is important that our line is adhered to in discussions within the Community and at Helsinki: ie aggregation at Community level for all of the Group I substances (the CFCs) and, separately, all of the Group II substances (the halons). We can expect support on this from all other Member States, with the possible exception of Denmark.

Timetable

2. Urgent. A timetable for the amendment of the Protocol is at Annex A. The UK, and the European Community, need to have an established position in time for the meetings in Helsinki in 3-4 weeks time.

Summary of Conclusions

3. We recommend that UK representatives at the first meeting of the Parties to the Montreal Protocol (2-5 May) should take the following line:

(1) Cuts in production/consumption of CFCs/halons

- To enable accelerated cuts to be absorbed while retaining an EC production capacity, production controls should apply to the EC as a whole rather than to each Member State individually (paragraph 22).

- To avoid jeopardising the development of new substitutes for the CFCs and halons, the Protocol should be amended to permit the use of controlled CFCs as intermediates for producing those substitutes (paragraph 23).

(2) Cuts in consumption

- Without developing suitable alternatives, complete elimination of the use of CFCs/halons by 2000 would have severe implications for health, safety and for major electronics and precision engineering industries (eg in the defence field). The pace of cuts is therefore dependent on those technological developments (paragraph 32). For the foreseeable future, some (residual) use cannot be avoided.

- To retain flexibility, any proposal for 85% consumption cuts to be made as soon as possible needs to be applicable to consumption across the board rather than being sector- or substance-specific. (Paragraph 33).

(3) Widening the coverage of chemicals in the Protocol

- If existing substitutes such as methyl chloroform and HCFC 22 were to be covered in the Protocol, this would divert energy and resources away from finding substitutes for CFCs already controlled, and would jeopardise the development of new substitutes with low ozone-depleting potential (ODP) and the ability to meet the accelerated phaseout of CFCs (Paragraphs 35, 39).

(4) Import prohibitions

- Import prohibitions on products made with and/or containing CFCs would be damaging to trade policy and too costly, impractical and easy to evade. (Paragraphs 40, 41).

(5) Tactical considerations

- It is also recommended that efforts should be made to coordinate with our Community partners prior to the EC Management Committee meeting on 21 April in Brussels (paragraph 47) and of any meetings within the Council machinery. A wider - but relatively low-key - diplomatic effort should also be considered ahead of Helsinki discussions. In essence, this would involve a briefing telegram to all Posts to alert them to the significant practical difficulties outlined above (paragraph 48).

Production, consumption and application of the controlled CFCs and halons

4. There are four main sectors of CFC use: in aerosols (as propellants); in refrigeration and airconditioning (as coolant

and insulation); in the manufacture of flexible foam (as blowing agents) and in rigid foam (as blowing agent and insulation); and as solvents for cleaning electronic components, engineering parts and in dry-cleaning. There are also other more minor uses as Annex B shows, eg as sterilants for medical use; as fast-food freezants; in laboratory testing, leak detection; wind tunnels; and in the nuclear industry. Consumption of CFCs by application sector as a percentage of the 1986 total is shown in Annex C. In 1986, the aerosol industry was the predominant user in the UK; but since then, the industry has announced that 90% of aerosols will be CFC-free by the end of 1989.

5. Halons are used mainly in fire extinguishers as the extinguishing agent, especially in populated enclosed spaces, computer installations, aircraft and ships.

6. Production statistics for 1986 (the reference year adopted under the Montreal Protocol) for the five controlled CFCs and three halons (together with their estimated ozone-depleting potential - ODP) are at Annex D. Two points are of particular significance. First, the most common CFCs (11 and 12) have the highest ODPs among this group. Secondly, although halons are more damaging than CFCs, their volume is much lower (less than 18,000 tonnes compared with more than one billion tonnes of CFCs). The two UK producers of CFCs are ICI (Runcorn) and RTZ-ISC (Avonmouth). ICI also produces halon 1211.

7. Consumption statistics for 1986 are at Annex E. Production and consumption roughly balance for USA, Japan and the Eastern Bloc, whereas the EC produces about half as much again as it consumes - the remainder going mainly to developing countries.

8. The UK and EC ratified the Montreal Protocol on substances that deplete the ozone layer on 16 December 1988 and the Protocol came into effect on 1 January 1989 (implemented by a European Community Regulation. The Protocol provides for the reduction, in stages, of the production and consumption of the CFCs and halons indicated in Annex D. In the light of scientific evidence on the rate and extent of ozone depletion (particularly the September 1988 Report of the Stratospheric Ozone Review Group), political pressure has been growing for the Protocol requirements to be strengthened in two areas:

I. the extent and pace of production and consumption cuts;

II. the range of substances controlled;

Pressure might also be expected in the area of:

III. import prohibitions.

The next part of this paper examines each of these areas and considers in detail the existing commitments and the pressures on those commitments.

I. EXTENT AND PACE OF CUTS IN CFC PRODUCTION AND CONSUMPTION

9. CFC production is defined as amounts produced minus amounts destroyed (by "approved technologies") and CFC consumption as production plus imports minus exports.

Existing commitments

10. A freeze at 1986 levels from July 1989; a 20% cut from July 1993 and a further 30% cut from July 1998 (achieving in total a 50% cut on 1986 levels).

For production, an extra 10% is allowed at stages one and two and an extra 15% at stage three to supply developing countries and/or permit industrial rationalisation.

Pressures on existing commitments

11. On 2 March, the EC Environment Council agreed unanimously on:

- An 85% cut "as soon as possible" in production and consumption of CFCs with a view to complete elimination towards the end of the century, and for the Protocol to be strengthened accordingly.

At the London Conference on Saving the Ozone Layer, the EC Environment Commissioner interpreted "as soon as possible" as 1995; and "towards the end of the century" as 1996/97. It is highly likely that there will be pressure at the Helsinki meeting for corresponding proposals to amend the Montreal Protocol to be circulated by October.

Extent and pace of cuts in halons production and consumption

Existing commitments

12. Production and consumption to be frozen at 1986 levels, from 1 January 1992.

Pressures on existing commitments

13. There are no specific proposals as yet (the EC Environment Council statement did not refer to halons). But pressure is likely to grow as the CFC cuts bite, because of the need to take action generally and because halons will account for proportionately increased ozone damage. It would not therefore be unrealistic to expect proposals to impose more stringent controls on halons to be discussed at Helsinki.

II. RANGE OF SUBSTANCES CONTROLLED

Existing commitments

14. The five CFCs and three halons covered are shown in Annex D. They each have a relatively high ozone-depleting potential (ODP), from 0.6 to 10.0.

Pressures on existing commitments

15. There have been calls from various Protocol countries for three further substances (two with relatively low ODP) to be controlled. These are methyl chloroform (ODP = 0.1-0.15), HCFC 22 (ODP = 0.05) and carbon tetrachloride (ODP = 1.06). It is likely that these calls will be taken up again in Helsinki, given the evidence of further ozone depletion.

III. IMPORT PROHIBITIONS

Existing commitments

16. The Protocol requires a list of products containing controlled CFCs to be drawn up by 31 December 1991; imports of those products from non-Parties would be banned by non-objecting Parties within one year of the list becoming effective. By 31 December 1993, the Parties are to decide on the feasibility of a further list being drawn up of products made with but not containing controlled CFCs, with a view to import prohibitions. If determined feasible and a list drawn up, such imports would be banned by non-objecting Parties within one year of the list becoming effective.

Pressures on existing commitments

17. Conceivably there may be calls at Helsinki (notably from North America and the Nordic countries) for these lists to be drawn up and imposed more rapidly. Sweden has already announced a proposal to ban, from 1991, imports (and domestic production) of several products made with or containing CFCs.

18. The previous paragraphs examined the likely pressures for more stringent commitments beyond the present Protocol. Paragraphs 19-41, again ordered under the three headings used above, set out the implications of such pressures for UK producers and users whom we have consulted extensively since the London Conference on Saving the Ozone Layer.

I. ACCELERATED PRODUCTION AND CONSUMPTION CUTS

Consequences for UK producers

19. Both ICI and RTZ-ISC are generally content with the existing Protocol cuts and ICI has called for the Protocol to be

strengthened by providing for total elimination of CFCs - but without setting a specific deadline. The producers are actively seeking to research and develop alternatives to the controlled CFCs, in order to capture new markets as the CFC market shrinks (ICI is spending £100 million in this area).

20. A list of new chemical alternatives under development by the producers is at Annex F. Two points are crucial. First, it will be 1992-93 before any of the new alternatives come on stream (and then only given the successful outcome of toxicity tests). Secondly, for one important controlled CFC (CFC 113 which is used as a solvent) and the halons, no new alternatives have yet been identified. The ability to cope with accelerated CFC cuts will depend on the pace (and success) of technological developments by the producers (a point which the Prime Minister made at the Saving the Ozone Layer Conference). Changing the political timetable does not guarantee technical success; indeed, by weakening confidence it can be counter-productive.

21. Accelerated cuts would accentuate two particular problems affecting producers, which need to be resolved under the Montreal Protocol:

(a) Need for a joint EC production quota

22. The EC is allowed, under the Protocol, to exercise joint consumption but not joint production controls - each Member State must make individual production cuts. The EC has 11 producers, split as follows:

France	1	
Netherlands	2	
FRG	2	
Italy	1	
Greece	1	
Spain	2	(subsidiaries of one or other of the above - it is believed a third plant has recently closed)
UK	2	

By comparison, the USA and Japan each has 5 producers. Thus, each EC producer country is in a much less flexible position than USA or Japan in seeking to absorb production cuts by rationalisation. The producer companies themselves are unlikely to wish to continue producing ever-decreasing quantities of controlled CFCs at ever-increasing expense. At some point (even with higher CFC prices), production would become uneconomical. But premature closedown of its production plants would leave the EC dependent on CFC imports. This would, in turn, lessen the pressure on and perceived ability of exporting countries (eg the USA) to reduce their production. The net global effect would simply be a shift in production of CFCs, at the expense of the EC but with no benefit to the environment. This could be avoided and accelerated cuts absorbed more readily, if EC producer

companies were able to rationalise production among themselves freely.

(b) Need to exempt the use of controlled CFCs as intermediates

23. CFC 113 (a controlled substance) can be used as an intermediate for making HFC 134a, (the most important completely ozone-benign new substitute). The Protocol does not yet recognise such use as an intermediate as an "approved destruction technique" (indeed there are no approved destruction techniques). Qualification as a destruction technique would enable production of such CFCs for use as intermediates to be discounted from the national production quota. It is important for this to be recognised in the Protocol. Otherwise, with accelerated production cuts, the failure to grant exemption for production of intermediates would jeopardise the development and production of new substitutes.

24. We believe that amendment of the Protocol's trade provisions should also be made to cover cases where intermediates were produced but not used up ("destroyed") within the same country. If it were only agreed that such conversion counted as destruction, a producer country could secure a proportionate credit if it took place domestically (under the production formula) or within the EC (under the consumption formula) - although the latter would be subject to the Commission agreeing that all of the credit were given back to the producing member state rather than not given back at all (in whole or part) or sharing out more widely within the Community. But, if ICI were to export say CFC 113 to, say, the US for conversion there, then US would get a "negative production" credit, and the UK production quota (and EC consumption quota) left correspondingly depleted. The Protocol should be made to have as neutral an effect as possible on commerce: since there would be no environmental cost, it should be left to market forces alone to influence where the conversion takes place. The EC therefore needs to secure inclusion in the Protocol of the concept of transferable production credits for the export of controlled substances knowingly (and perhaps subsequently duly certified) for conversion to a less ozone-depleting substance. In the case of CFC 113 to HFC 134a in particular, every encouragement should be given to freedom of trade on environmental grounds.

Consequences of accelerated cuts for UK users

25. The CFC users have been relatively relaxed about existing Protocol commitments. This is mainly because the Protocol specifies only the necessary overall reduction, leaving it to market forces (consumer demand; higher prices of dwindling CFCs) to determine the extent of reductions by each user sector. In the UK, the large reductions planned by the aerosol sector alone (see paragraph 4 above) mean that the UK will have achieved the Protocol's 50% overall reduction target by the end of 1989. Halon users have also taken a relaxed line to date, since the existing

control only amounts to a freeze (not a cut) and does not come into effect until 1992.

26. Based on extensive contacts with UK industry, Annex G examines in detail the projected ability of each CFC user sector to adjust to the probable accelerated cuts, particularly an 85% cut as soon as possible (say 1995); and phaseout of CFC use by the year 2000. The halon users are also covered, given the like-likelihood of calls for more stringent controls on halons as well. The ease of adjustment to the proposed cuts differs from sector to sector and will entail, in varying degrees, penalties in terms of increased risks to health and safety, reduced energy efficiency and higher capital/operating costs. In addition, cuts of 100% may, if carried out to the letter, require a cessation of production in some sectors (eg solvents), given the lack of suitable alternatives to CFCs. Summarising the information in Annex G sector by sector, the following picture of our ability to meet more stringent Protocol cuts emerges.

Aerosol industry

27. The industry will shortly have achieved a very substantial cut in use of CFCs by switching to existing alternatives, leaving only 10% of aerosols still using CFCs. This remaining 10% of CFC-using aerosols are used for medical purposes (eg asthma inhalers) and some specialised industrial applications. For the former, the industry's ability to eliminate CFC use in these applications primarily depends on the clearance and acceptability of an existing chemical, HCFC 22, for medical use. For both, it depends in the longer term on the successful development (and testing) of a new substitute, HFC 134a. Related capital costs are not expected to be high, but there will be an increased product (HFC 134a) cost.

Refrigeration/Airconditioning

28. Cuts of up to 45% in current levels are considered achievable in the short term (possibly by 1991) through better design, servicing and recycling. Further cuts up to 85% will depend on the use of HCFC 22 (for industrial/commercial units) and HFC 134a for domestic appliances (when cleared for toxicity). Development of other alternatives, though underway is further behind. Since there are no UK producers of compressors for many applications, the rate of adjustment will depend on foreign suppliers providing modified compressors capable of operating with the new substances. Use of HCFC 22 entails substantial costs in re-engineering. Use of HFC 134a entails a loss of energy efficiency. Cuts beyond 85% (even by the year 2000) will almost certainly entail the premature scrapping of installed equipment - at substantial extra cost in the case of industrial and commercial equipment - and, where the CFCs "banked" within the equipment are inadvertently released when the equipment is broken up, without any environmental benefit.

Foam industry

29. For the rigid foam sector, cuts of 85% will be hard to achieve and will involve (even with new substitutes) some loss of energy efficiency and possibly load-bearing capacity. This will have knock-on effects eg for building construction and refrigerator design. For the flexible foam sector, cuts of 45% in the short term are possible through recycling; further significant cuts will depend on the successful development of new substitutes, particularly alternatives which could provide the same flame-retarding capacity (in furniture foam) as existing CFCs already do.

Use as Solvents

30. In the electronics and engineering industries, where CFC 113 is used as an efficient, gentle cleaner, cuts of up to 65% may be possible in the longer term mainly through better housekeeping; but further cuts would be difficult (short of curtailing manufacture of the products involved eg computers, avionics, engineering parts) since there is no substitute in prospect for CFC 113. In dry-cleaning, any significant cuts in CFC use would be difficult because of the lack of a suitable alternative to CFC 113.

Halons (Fire Protection industry)

31. There are few means to make reductions other than through better housekeeping (reducing test discharges), recovery and recycling of halons in extinguishers - no suitable new chemical alternatives are yet identified. Imposed additional cuts could be costly to life and property.

Accelerated cuts - overall conclusions

32. The complete elimination of CFCs and additional cuts in halons by the end of the century could have severe implications for health, safety and electronics and defence equipment industries - failing the successful development and testing of suitable alternatives on which the ability of user sectors to achieve cuts is heavily dependent. This is demonstrated by Annex H. With such alternatives, significant cuts should be possible in three sectors (aerosols; refrigeration; foam). But in other sectors (solvents; halons) no alternatives are in prospect. For the foreseeable future, it is likely that some (residual) use of CFCs cannot be avoided.

33. It is also apparent that even 85% cuts are achievable in the short term in some sectors but not others. To allow for this, the Protocol targets should remain applicable to consumption overall rather than being sector-specific. This would retain flexibility of reductions between sectors.

II. EXTENDING THE RANGE OF SUBSTANCES CONTROLLED

Consequences for UK producers

34. Of the three existing substances that might be proposed for inclusion in the Protocol - methyl chloroform, HCFC 22 and carbon tetrachloride - only the last would raise few problems for the UK (provided the exemption for intermediates is granted). This is because some 98% of carbon tetrachloride produced in the UK is used as an intermediate to produce two controlled CFCs (CFC 11 and 12). The ODP of carbon tetrachloride (1.06) is also higher than that of the controlled CFCs, so its inclusion would not suggest the inclusion of other low-ODP substances. But it may be important to protect the very small usage (1-2%) of carbon tetrachloride, since it is likely that this is as a product in its own right, because of its unique properties.

35. By contrast, the inclusion of methyl chloroform (ODP = 0.1-0.15) or HCFC 22 (ODP = 0.05) in the Protocol would, we believe, have a demotivating effect on the producers. Looking first at methyl chloroform, this is used widely as a solvent for cleaning electrical and engineering equipment (like CFC 113, though methyl chloroform is a less gentle and less effective cleaner). If methyl chloroform were included in the Protocol, alongside CFC 113, industry would be faced with having to find substitutes for methyl chloroform as well. This would divert energy away from finding substitutes for the CFCs (including CFC 113) already controlled. Turning to HCFC 22, its ODP is the same as or similar to the ODP of some of the new substitutes under development (see Annex F). Its inclusion would therefore call into question the value of developing those substitutes and could also lead to a "snowballing" effect for inclusion of any substances with an ODP, however low. This would act as a further disincentive to R&D investment by the producers and could put a brake on the development of precisely those substitutes which might help solve the ozone problem. Inclusion of HCFC 22 would also penalise companies, eg in the refrigeration industry, now considering conversion at some expense to HCFC 22 as a less harmful alternative - since such companies would be faced with the need to convert again when new substitutes are commercially available (mid-late 1990's). Any threat to include HCFC 22 this century will only encourage companies to continue for the time being with the much more damaging controlled substances.

Consequences for UK users

36. The inclusion of carbon tetrachloride in the Montreal Protocol is irrelevant to the CFC users. But the inclusion of methyl chloroform and/or HCFC 22 (which are used as replacements for controlled CFCs) would significantly affect the ability of users to meet the Protocol cuts. Annex I shows the extent to which the users are currently dependent on these low-ozone-depleting substances. It also demonstrates the extent to which

users will be dependent on other low-ODP substitutes being developed, which would be threatened with inclusion in the wake of methyl chloroform and/or HCFC 22. There are few new alternatives in prospect having zero-ODP - and those that are (eg HFC 134a) still await toxicity clearance.

37. The inclusion of HCFC 22 in the Protocol would particularly affect the refrigeration industry, where a number of manufacturers have already switched to this (low-ODP) chemical as a non-controlled alternative - at considerable expense. The industry would expect such investment to cover the normal product lifetime (10-20 years) without having to switch prematurely - at yet more expense - to, say HFC 134a (with zero ODP).

38. The inclusion of methyl chloroform would particularly affect the engineering industry, where it is widely used in its own right as a cleaner (for de-greasing metal parts), as well as being a partial replacement for CFC 113. It would also affect the electronics and dry-cleaning industries where methyl chloroform is used as a partial replacement for CFC 113.

Extending the range of controlled substances - overall conclusion

39. To avoid jeopardising the development of new substitutes and in order for user sectors to achieve Protocol cuts, no further substances should be added to the Protocol (except carbon tetrachloride). Methyl chloroform and HCFC 22 are part of the solution (at least for the time being), not part of the problem.

III. IMPLICATIONS OF POSSIBLE IMPORT PROHIBITIONS

40. The Protocol (and the EC implementing Regulation) provides for the adoption of lists prohibiting imports from non-parties of products containing, or made with but not containing, the controlled substances. Annex B shows the wide range of products that could be affected. Adoption of such proscribing lists would be a major backwards step in terms of trade liberalisation, and could be severely disruptive to international trade in other ways too. Even if defensible under the GATT (and that has yet to be proved) concessions might, in the event of a complaint, have to be given away in other areas. The implications and (in the event of a GATT case) potential for embarrassment to the UK should not be underestimated. Quite separately, substantial problems of identification, verification and enforcement - particularly in the case of products (eg electronic equipment) made with but not containing the controlled substances - can be envisaged. At the very least, a very complex certification scheme would probably need to operate and, in the event of contraband imports being detected, there would be the difficult (and probably costly) problem of disposal/destruction of the goods concerned. The provisions under Article 4(8) of the Protocol for countries who are not Parties to be deemed as parties (and thus exempt from application of the

prohibitions) could further complicate matters very considerably in each of these areas.

41. Since the envisaged import prohibitions apply to countries not party to the Protocol, such lists are implicitly an acknowledgement of failure to persuade such countries to join. The greater the number of countries that accede, the less need there will be for import prohibitions (that in any case would be costly, impractical and easy to evade). They will do nothing to stop, and may even encourage, trade in CFC (and halon) products between non-Parties. Nor do we have any indication that some of our major trading partners and competitors within the Protocol would adopt such lists. This would be particularly damaging to us if, for example we had adopted such a list and Japan (as would be quite likely) did not, given not only their electronics and other capital industries, but also their sourcing of components from lesser developed countries. Whilst, therefore, the UK can continue to sympathise with the aim of the options to proscribe products from those countries which refuse to accede, we should point to the overwhelming impracticalities and difficulties that prevail against their implementation.

Recommendations

42. We now set out, again in the same order, our proposals for HMG's line at the Helsinki meeting later this month.

I. ACCELERATED PRODUCTION AND CONSUMPTION CUTS

43. The UK is already committed, following the EC Environment Council agreement, to an 85% cut (in CFCs) as soon as possible with a view to elimination towards the end of the century. Without drawing back from this political commitment, our representatives should draw the attention of the Protocol Parties at Helsinki to:

- the dependence of such cuts on the successful development of new substitutes; (see paragraph 32 above)
- the difficulties which different sectors would face in coping with such cuts, and the possibility that in some sectors (eg health, safety, defence) there may need to be a safeguard on residual essential use of CFCs and halons; (paragraph 32)
- the need, given the different abilities of different sectors to cope with cuts, to continue to apply cuts to overall consumption. (paragraph 33).

44. Our representatives should also suggest two technical amendments to the Protocol which would be concomitant with accelerated cuts. These are a joint EC production quota (paragraph 22); and exemption for use of CFCs as intermediates

(paragraph 23). Together with the more general policy stances, these points should be discussed (at our request if necessary) at the EC meeting on 21 April (see paragraph 47 below). Support for a joint EC production quota can be expected from the EC Commission and certainly the CFC producer Member States (though heavy opposition can be expected at Helsinki from USA, on commercial grounds). It seems unlikely that there would be any objections to the proposal for exemption for use of CFCs as intermediates, but there would probably be some from the US on transfer of production quotas.

II. EXTENDING THE RANGE OF SUBSTANCES CONTROLLED

45. On the possible inclusion of (three) new substances in the Protocol, the UK is not publicly committed one way or the other on carbon tetrachloride; and should be able to accept its inclusion if this were proposed, subject to satisfactory resolution of the intermediates question. The UK has given a commitment to HCFC 22, (in the Government's reply in December 1988 to the First Report from the Environment Committee), to the effect that it recognises that HCFC 22 can play an important part (particularly in the refrigeration industry) in reducing dependence on more damaging CFCs, at least in the short to medium term. We conclude that this line must be maintained at the Helsinki meeting. On methyl chloroform, the UK has not given any commitment; but we should argue, at Helsinki, for its continued exclusion from the Protocol.

III. IMPORT PROHIBITIONS

46. The Government has pointed out, in its above reply to the First Report from the Environment Committee, that the administrative, logistical and enforcement difficulties of such controls should not be underestimated. This line should be maintained at Helsinki.

Tactical considerations

47. Before the EC meeting on 21 April, officials should seek the views of the Commission and individual Member States on the above recommendations, to coordinate an EC line for Helsinki. On the general policy line there should be substantial common ground, since CFC producers and users throughout the EC will be facing the same problems of adjustment. On the two more specific issues, support for a joint EC production quota can be expected from the EC Commission and certainly the CFC producer Member States (though heavy opposition can be expected at Helsinki from USA, motivated predominantly by commercial considerations). It seems unlikely that there would be any objections to the proposal to exempt the use of CFCs as intermediates, but there would be some on the related issue of transfer of production quotas.

48. At the same time, a wider - but relatively low-key - diplomatic effort should be considered prior to Helsinki discussions (which start on 26 April). This would involve a briefing telegram to all Posts to alert them to the significant practical difficulties outlined above, with a view to informing other (non-EC) Parties (particularly USA, Japan and Nordic countries) of our position.

Timetable for amendment of the Montreal ProtocolKey Dates

- 21 April: meeting of EC national experts ("Management Committee") in Brussels to coordinate on EC line for:
- 26-28 April: first meeting of the Parties to the Vienna Convention for the Protection of the Ozone Layer (the "parent" treaty for the Montreal Protocol) in Helsinki, and
- 2-5 May: first meeting of the Parties to the Montreal Protocol (also in Helsinki);
- October 1989: latest date for submission of proposed amendments to the Protocol for adoption in:
- April 1990: second meeting of the Protocol Parties (in London);
- October 1990: earliest date for amendments adopted at the second meeting to come into effect.
- not later than 31 December 1991: list to be drawn up of products containing the controlled substances, with a view to import prohibitions;
- not later than 31 December 1993: Parties to decide on the feasibility of drawing up a list of products made with but not containing the controlled substances, with a view to import prohibitions.

Products Made With or Containing Chlorofluorocarbons

	Made with	Contains or uses		Made with	Contains or uses
Rigid Foam			Refrigeration and Air Conditioning (cont'd)		
■ automotive door panel padding		●	■ cold storage warehouses		●
■ boat hull void filler		●	■ commercial fishing boat refrigeration		●
■ building steel fire protection		●	■ dehumidifiers		●
■ buoy, dock protection foam padding		●	■ grocery store freezers		●
■ crack or crevice filler		●	■ grocery store refrigerators		●
■ disposable dishes		●	■ home air conditioners, central and window units		●
■ egg cartons		●	■ home freezers		●
■ extruded polystyrene insulating foam		●	■ home heat pumps		●
■ fast food "clam shell" package		●	■ home refrigerators		●
■ foam drinking cups		●	■ ice machines		●
■ foam ice chests		●	■ mail air conditioning		●
■ foam in place urethane packaging (computers)		●	■ office building chillers		●
■ foam packing cushion chips		●	■ process industry refrigerations, heat recovery		●
■ foundation/basement insulating sheets		●	■ refrigerated storage		●
■ freezer insulation		●	■ refrigerated transport trucks, rail cars		●
■ home insulating sheathing		●	■ rooftop and office building air conditioners		●
■ refrigerated truck insulation		●	■ soda fountain dispensers		●
■ refrigerator insulation		●	■ soft ice cream or yogurt machines		●
■ rigid pipe insulation		●	■ store air conditioning		●
■ roof insulation		●	■ train air conditioning		●
■ storage tank insulation		●	■ truck air conditioning		●
■ styrofoam		●	■ vending machines		●
■ supermarket meat trays		●	■ warehouse air conditioning		●
■ tank car insulation		●	■ water coolers/fountains		●
Flexible Foam			Miscellaneous		
■ automobile dashboards		●	■ aerosol cleaners		●
■ automobile seat cushions		●	■ aerosol insecticides		●
■ bedding foam pillows and mattresses		●	■ aircraft fire extinguisher systems		●
■ bicycle seats		●	■ pipeline pumping station fire extinguishers		●
■ carpet pads		●	■ aluminium impurity removal		●
■ coaxial cable		●	■ blood plasma		●
■ flexible pipe insulation		●	■ bronchial inhalant medications		●
■ furniture cushions		●	■ chewing gum remover		●
■ furniture protective wrapping		●	■ computer disc envelopes		●
■ motorcycle seats		●	■ computer room fire extinguishers		●
■ packaging cushions		●	■ dusters for cameras		●
■ postal mailers		●	■ electric transformer dielectric fluid		●
■ soft toy stuffing		●	■ flash spun polyethylene sheet		●
■ sports cushioning or pads		●	■ gum remover		●
■ vibration dampeners		●	■ hemorrhoidal foam		●
Refrigeration and air conditioning			■ hospital sterilization		●
■ agricultural food chiller		●	■ immersion food freezing		●
■ aircraft air conditioning		●	■ insecticides for agricultural applications		●
■ auto air conditioners		●	■ insecticides for commercial food preparation areas		●
■ beer dispensers		●			
■ bus air conditioning		●			

[Source: Du Pont]

Miscellaneous (cont'd)	Made with	Contains or uses
■ insecticides for government use _____	●	●
■ low tar tobacco _____	●	●
■ marine horns and sirens _____	●	●
■ medical apparatus syringes, surgical tubing _____	●	●
■ medical sterile packaging _____	●	●
■ military aerosols _____	●	●
■ mold release agents dispersant _____	●	●
■ molded plastic parts _____	●	●
■ oil exploration fire protection _____	●	●
■ nuclear power plant control room fire extinguishers _____	●	●
■ polyolefin concrete reinforcement _____	●	●
■ polyolefin envelopes for "Federal Express" mail _____	●	●
■ polyolefin filter elements _____	●	●
■ polyolefin garments for toxics cleanup _____	●	●
■ portable fire extinguishers _____	●	●
■ race car fire extinguishers systems _____	●	●
■ skin sterilant used prior to surgery _____	●	●
■ space craft propellant _____	●	●
■ spices _____	●	●
■ urethane sole shoes _____	●	●
■ weld inspection dye and developer _____	●	●

Electronics, cleaning agents

■ air conditioner condenser coils _____	●	●
■ air conditioner evaporator coils _____	●	●
■ aircraft sheet metal assemblies _____	●	●
■ artificial hip joints _____	●	●
■ artificial limbs, implants _____	●	●
■ automotive electronic components _____	●	●
■ ball bearings _____	●	●
■ calculators _____	●	●
■ cameras _____	●	●
■ cardiac pace makers _____	●	●
■ catheters _____	●	●
■ chemical warfare decontamination fluids _____	●	●
■ clothes dryers _____	●	●
■ clothes washers _____	●	●
■ computer disc memory storage components _____	●	●
■ computers _____	●	●
■ contact lenses _____	●	●
■ coolant systems for infrared sensing missiles _____	●	●

Electronics, cleaning agents (cont'd)	Made with	Contains or uses
■ coolant systems for space shuttles _____	●	●
■ dielectric fluids for radar and microwave communications _____	●	●
■ electric and electronic toys _____	●	●
■ electric transmission transformers _____	●	●
■ electro-mechanical controls _____	●	●
■ electronic switches _____	●	●
■ fluorinated polymer seal materials _____	●	●
■ garment drycleaning fluid _____	●	●
■ home heating thermostats _____	●	●
■ hospital oxygen systems _____	●	●
■ hydraulic controls _____	●	●
■ hydraulic systems for civilian, military and space craft _____	●	●
■ jewelry _____	●	●
■ kidney dialysis capillaries _____	●	●
■ kitchen dishwashers _____	●	●
■ lenses for glasses _____	●	●
■ microwave ovens _____	●	●
■ nuclear reactor vessels _____	●	●
■ photocopiers _____	●	●
■ plasma etchant and desmearing gases _____	●	●
■ plastic auto body parts _____	●	●
■ plastic mold release fluids _____	●	●
■ plated metal and plastic parts _____	●	●
■ printed circuit board _____	●	●
■ radioactive decontamination _____	●	●
■ radios _____	●	●
■ rifle scopes _____	●	●
■ satellite, airplane, naval inertial guidance gyroscopes _____	●	●
■ semiconductors _____	●	●
■ silicon wafers _____	●	●
■ smoke alarms _____	●	●
■ telephone CBX systems _____	●	●
■ telephones _____	●	●
■ televisions _____	●	●
■ tetraoxide fuel systems for space program _____	●	●
■ textile fabric garments _____	●	●
■ thermal bulbs for temperature controllers _____	●	●
■ thermostats _____	●	●
■ typewriters _____	●	●
■ VCR's _____	●	●

PERCENTAGE BREAKDOWN OF CFC CONSUMPTION BY SECTOR, 1986

	<u>World</u>	<u>EC</u>	<u>UK</u>	<u>US</u>
Aerosols	24	46	62	4
Refrigeration/Air conditioning	24	10	8	31
Rigid Foam	19	18	12	25
Flexible Foam	7	9	6	6
Solvents	19	13	8	27
Other uses (mainly sterilisation and liquid food freezing)	7	4	4	7
	100	100	100	100

Source: Department of Environment

I CFC PRODUCTION 1986

<u>Country</u>	<u>Total</u>	<u>000 tonnes</u>		
		<u>CFC 11 [ODP* 1.0]</u> <u>& 12 [ODP 1.0]</u>	<u>CFC 113 [ODP 0.8]</u> <u>& 114 [ODP 1.0]</u>	<u>CFC 115</u> <u>[ODP 0.6]</u>
UK **	111	90	15	6
EC	>438	372	66	(small)
US	>295	235	60	(small)
Japan	125	70	55	-
USSR	100	100	(small)	-
China	20	20	-	-
Others	45	45	-	-
<hr/>				
World Total	>1038	842	>181	15

Source: UK industry estimates

II HALON PRODUCTION 1986

Halons are produced by UK, China, GDR, France, Japan, USA, USSR and FRG.

World Production in 1986:	Halon 1211 [ODP 3.0]	9,700 tonnes
	Halon 1301 [ODP 10.0]	8,000 tonnes
	Halon 2402 [ODP 6.0]	_____?
	Total	17,700+ tonnes

[UK Production ** in 1986: Halon 1211 ca 6000 tonnes]

Source: Department of Environment

* ODP = Ozone depleting potential

** The figures for UK production are commercially confidential

CFC CONSUMPTION 1986

<u>country</u>	<u>percentage</u>
EC	29
(incl UK	6)
US	29
East Bloc	14
Other developed	13
Developing	16

Source: Department of Environment

New chemical alternatives to CFCs under development

<u>Chemical</u>	<u>Replaces</u>	<u>Anticipated Commercial Production</u>	<u>ODP *</u>
HFC 134a	CFC 12	1991/92	0
HCFC 123	CFC 11	toxicity tests complete by 1993	<0.05
HCFC 141b	CFC 11	toxicity tests complete by 1993	<0.05
HCFC 124	CFC 11/12	not known	<0.05
HFC 125	CFC 11/12	not known	0
HFC 143a	CFC 11/12	not known	0

* ODP = Ozone-depleting potential

ANALYSIS OF THE ABILITY OF USER SECTORS TO REDUCE DEPENDENCE ON CFCs AND HALONS

I. AEROSOLS industry

Size of Sector

1. In 1987, the UK industry sold 828 million aerosols (over 10% of world and 25% of European production). Annual production is worth more than one billion pounds (of which exports more than £200 million). The industry employs approximately 10,000 people.

Current use of CFCs

2. The sector's use of CFCs as propellants is expected to fall by the end of 1989, to only 10% of aerosols. This is mainly as a result of switching to hydrocarbon propellants (butane and propane) or dimethyl ether (DME). These alternatives are flammable and require additional safety measures during manufacture. The remaining 10% of aerosols still using CFCs relate to specialised pharmaceutical and industrial uses, namely:

Pharmaceutical

- broncho-inhalation sprays for asthma sufferers;
- skin-sterilisation sprays in preparing patients for surgery and spray-on wound dressings;
- spray-on analgesics;
- metered-dose inhalers for medical use.

Specialised Industrial (primarily where flammability is a concern)

- lubricating sprays during continuous operation (of moving parts);
- fluorescent sprays for crack detection.

Current CFC use amounts to "some hundreds of tonnes". Hydrocarbons and DME cannot be used in these cases because of flammability/toxicity.

Alternatives to current use of CFCs

3. HCFC 22 is a product commercially available, which could possibly be used as an alternative propellant in some of the remaining 10% of aerosols (for industrial purposes). However, HCFC 22 has not yet been cleared for toxicity in general aerosol use by ICI, the producer. Even if it were, clearance for medical use

are achievable through better housekeeping and HCFC 22 in commercial applications. Reductions of 85% by 1995 are dependent on the ability to switch to HCFC 22 as an uncontrolled substance and the availability of HFC 134a. Savings beyond 85% seem questionable at present, given the need to continue servicing equipment already installed.

would remain questionable.

4. HFC 134a (under development) is also a possibility subject to toxicity tests, once it becomes available in commercial quantities (in the mid-nineties). But testing for medical use is likely to delay introduction.

Cost of switching to alternatives

5. HCFC 22 will require investment in new tanks. It is expected to cost about twice as much as the CFC 12 which it would replace.

6. HFC 134a is expected to be a "drop-in" substitute requiring no appreciable additional investment in production plant. However, the aerosol industry believes it will cost up to five times as much as CFC 12.

Other measures to reduce use of CFCs

7. Product replacements (eg tablets; syrups) is unrealistic for inhalation uses because the dosage would have to be too high to obtain the equivalent effect and the substitutes are slower-acting.

Factors affecting substitutability

8. The main factor is the decision by companies on whether to switch to HCFC 22 for some of the remaining 10% of aerosols if and as soon as it becomes available. This would entail adaptation costs and the possibility (that cannot be discounted) of HCFC 22 one day being included in the Protocol. The alternative is to wait until HFC 134a becomes available - in which case, clearance for medical use might take up to 10 years.

9. But whichever course is taken, the aerosol sector should shortly have achieved substantial cuts in CFC use; and should be able to cope with 100% cuts using HFC 134a.

II REFRIGERATION AND AIR-CONDITIONING

Size of sector

1. Annual turnover in the refrigeration industry is estimated at about £250 million; about 1.5 million UK-made fridges and freezers were sold in the UK in 1987 (a further 1.1 million were imported). There are about 30 million fridges and freezers in the UK. The market is growing at about 10% a year. The industry employs about 6000 workers. In the air conditioning sector, turnover is estimated at about £250 million; the industry employs more than 20,000 workers.

Current use of CFCs

2. The refrigeration industry has traditionally used two of the controlled CFCs, CFC11 (as insulant in the rigid foam insulation material) and CFC12 (as refrigerant). CFC502 (a 50/50 mixture of a controlled CFC - 115 - and HCFC22) is also used for refrigerated displays. 1986 use as a percentage of total CFC use in the UK amounted to 8%.

Chemical and other alternatives

3. For domestic refrigeration, the principal prospective alternative is HFC 134a - which requires development of a compatible lubricant but is otherwise a near "drop in" replacement ie involving little re-engineering (apart from new tubing). However, HFC134a is less efficient than CFC 12 and would require 5-12% more energy to achieve the same cooling.

4. HFC 134a is not a suitable alternative for commercial (retail) refrigeration which requires a wide range of freezing temperatures. Instead HCFC 22 is already being used as a replacement for CFC 12 and CFC 502 (in display units). However, HCFC 22 requires substantial re-engineering and design work and is more difficult to use at low temperatures. Nearly all new commercial plant being installed uses HCFC 22.

5. A further drop-in replacement for CFC 502 is under development (HFC 125) but is not expected to be available until the end of the century. Other alternatives (HCFC 142b; HCFC 123; HCFC 124) are still at the experimental stage.

6. In transport refrigeration, 84% of ships worldwide use HCFC 22. Nearly all containers use CFC 12.

7. Further alternatives include ammonia, hydrocarbons, HFC 152a and Dimethyl ether. Ammonia is cheaper and both it and hydrocarbons are often more efficient than CFCs. However, there are problems with toxicity and flammability in all these cases; none would be safe to use in commercial (retail) or domestic situations. Large-scale industrial applications are

conceivable (a reversion to old technology) but at some cost in re-design and re-engineering.

Cost of switching to alternatives

8. The value of domestic, commercial and industrial plant made obsolescent were a switch to be made overnight from CFC 12 to HCFC 22 is approximately £600 million. Average lifetime of plant is 12-15 years. If it became necessary to phase out HCFC 22 in ships (because of its inclusion in the Protocol), this could cost approximately another £500 million. In addition, there are the extra energy costs once HFC 134a is introduced.

Other measures to reduce CFC use

9. In domestic refrigeration, savings of up to 50% have been achieved in the CFC 11 used in the foam insulation. Further savings have been proposed by the International Institute of Refrigeration through reducing the amounts of CFC 12 refrigerant lost during servicing and maintenance and by cutting down leaks. It is estimated that total savings of 45% can be achieved by these measures.

Factors affecting substitutability

10. Commercial refrigerator manufacturers would be prepared to switch rapidly to HCFC 22, even with the associated re-engineering costs, provided they had some assurance that HCFC 22 itself will not be included in the Protocol. Industry representatives estimate that cuts of 85% could be made by 1995, provided HCFC 22 were usable and in conjunction with other savings.

11. For UK refrigerator manufacturers, a particular problem is that there are no UK producers of the compressors which need to be modified to use the safer substitutes. To this extent, the rate at which UK industry can adapt is dependent on foreign suppliers.

12. It is also estimated that there are some 30,000 tonnes of CFCs contained in refrigeration/airconditioning systems in the UK alone. Given the lifetime of such systems, there will be a continuing need for quantities of CFC 12 (to top up lost refrigerant) for another 12-15 years. And the "banked" CFCs pose problems of recovery and disposal.

13. A further factor is the impending EC Frozen Food Directive imposing lower temperature standards not readily achievable except with controlled CFCs.

CONCLUSION

14. For the refrigeration industry limited short-term savings

III. RIGID AND FLEXIBLE FOAM

(1) Rigid Foam

Size of Sector

1. The three main types of rigid foam (polyurethane, polystyrene and phenolic foam), which are used primarily as packaging and as insulating materials eg in buildings, represent about 14% of the insulant market in the UK, the remaining 86% being taken by mineral fibre. There are relatively few employees in this sector (concentrated around Manchester).

Current use of CFCs

2. CFC 11 and 12 are used as insulating and as blowing agents in the manufacture of rigid foam. 1986 use as a percentage of all CFCs used in the UK was 12%. The industry has replaced CFC use in the manufacture of polystyrene, by switching to HCFC 22.

Chemical and other alternatives

3. Substitutes are possible for applications which do not require thermal insulation (eg CO₂, steam, butane and pentane for packaging foams). HCFC 22 is also used for polystyrene foam. But for insulation, these and other alternatives under development (HCFC 123, 141b) or product replacements (mineral fibre, fibre glass) are less efficient insulators and/or load-bearing materials than CFC-blown rigid foams. Phenolic foams are particularly threatened by CFC cuts, since they rely on CFCs not only as insulant but also for ignition resistance.

Cost of switching

4. CO₂-blown foam is more expensive to produce as it uses twice as much polymer. The new alternatives are expected to cost as much as 3½ times the price of existing CFCs. There would be unquantified energy consumption costs to compensate for the less efficient insulating properties of alternatives; and the knock-on effect of having to re-design buildings/refrigerators to house larger amounts of less efficient (non-CFC) insulating material.

Other measures to reduce use

5. The industry estimates that a 25% cut will have been achieved by the end of 1989 through switching to or mixing with CO₂-blown foam where possible; and a 40% cut by the end of 1990.

Factors affecting substitutability

6. New building regulations which require better thermal transmittance values most efficiently achieved by CFCs.

Conclusion

7. For the rigid foam sector, even cuts of 85% will be hard to achieve, pending the satisfactory development of HCFC 123 and HCFC 141b.

(ii) Flexible foamSize of sector [not known]Current use of CFCs

8. Flexible polyurethane foam is a predominant cushioning material (used in furniture, car seats). 1986 use of CFC 11 as a percentage of all CFCs used in the UK was 6%. The CFC is used as blowing agent in the manufacture of the foam.

Chemical and other alternatives

9. The main currently available alternative is methylene chloride (already used widely in the USA). Methylene chloride is toxic and requires extensive factory ventilation. It is also a suspected carcinogen. But its ODP is very low: .003. A further (limited) alternative is to use steam as a blowing agent. Alternative processes (AB technology) are also under development. In the longer term, HCFC 123 and HCFC 141b are also possibilities.

Cost of switching

10. Methylene chloride is cheaper than CFC 11. But it is estimated that factory conversion costs (ventilation and re-equipping) would amount to £150,000-£200,000 per plant. Investment costs for AB technology are similar. HCFC 123 and HCFC 141b would also entail process adaptation.

Other measures to reduce CFC use

11. Progress has been made in the development of CFC recovery systems capable of catching and recycling 45% of CFCs used. (Vertifoam process)

Factors affecting substitutability

12. Some caution on whether methylene chloride might one day (because of its ODP) be included in the Protocol. More seriously, there are problems with producing combustion-modified foam to the required standard when

flame-retarding CFCs cannot be used.

Conclusion

13. The flexible foam sector estimates that reductions of 85% should be possible by 1995, provided the new HCFCs are developed quickly.

IV. SOLVENTSSize of Sector

1. CFC 113 is used as a cleaning agent in the electronics sector (several thousand businesses), precision engineering (eg British Aerospace) and dry-cleaning.

Current use

2. CFC 113 is used in electronics for cleaning the soldering flux from printed circuit boards; in precision engineering for cleaning metal or other parts eg computer equipment, avionics and guidance systems (there is a substantial emphasis on defence equipment); and for dry cleaning. It accounted for 12% of UK use of CFCs in 1986.

Chemical and other alternatives

3. In electronics and precision engineering, methyl chloroform is a limited alternative for CFC 113 in some cases (and is used substantially in other applications). A new terpene solvent may have some limited applications. Otherwise, there are no chemical alternatives available or in prospect. Aqueous cleaning is a possibility in both sectors but provides lower reliability (important for defence purposes). For dry-cleaning, perchloroethylene is a partial substitute, with methyl chloroform (It is already used in its own right, but cannot be used for certain fabrics or dyes. They are also possible carcinogens).

Cost of switching

4. (No chemical alternatives in prospect)

Other measures to reduce CFC use

5. The electronics and engineering sectors estimate that savings could be achieved fairly rapidly on the following scale:

- through use where possible of a diluted CFC 113 mix and better housekeeping: up to 50%
- through aqueous cleaning: 10%
- through no-flux soldering: 5%

Factors affecting substitutability

6. The principal factors are the specifications (both on materials and their production) imposed by the Ministry of Defence and other clients on electronic and engineering components.

Conclusion

7. In the electronics and engineering sectors, it should be possible to achieve savings of up to 65% in the short term; but it would be difficult to go beyond that without impairing product performance, until a viable alternative chemical is produced.

8. For dry-cleaning, there is very little alternative at present to continued use of CFC 113 - except perchloroethylene or methyl chloroform with their associated drawbacks.

B. HALONS**Size of sector**

1. The market has grown by 30-40% since 1986.

Use of halons

2. Halons 1211, 1301 and 2402 are used for fire-fighting. 1211 is used in portable fire extinguishers; 1301 in sprinkler systems. Halon 2402 is not generally used in the West, on toxicity grounds. The advantages of halons are that they are very efficient; clean (do not damage equipment); and relatively non-toxic. They are particularly suitable for use in aircraft, ships, oil rigs and other means of transport as well as in computer rooms.

Chemical and other alternatives

3. No chemical alternatives available for use in confined spaces or with same efficiency. Halon prohibition would, it is estimated, lead to an extra 500 deaths/year worldwide.

Other means of reducing use

4. Mainly through improved housekeeping. Control of test discharges (of 1301 sprinkler systems) is estimated to save 20%. The industry is also making efforts to prevent accidental discharges and to encourage recovery and recycling of "banked" halons in old extinguishers. Only a very small percentage (less than 10%) of halons are estimated to be used in extinguishing fires.

Factors affecting substitutability

5. Safety standards affecting eg public service vehicles; Ministry of Defence specifications for fire equipment in military applications.

Conclusion

6. For halons, there are few means to make reductions other than through improved housekeeping, recovery and recycling: though this should lead to potentially substantial cuts in emissions. But given the extent to which the industry has expanded since 1986, even a freeze at 1986 levels in 1992 is viewed as difficult; and a cut of (say) 50% is regarded as untenable.

ANNEX B

Achievability of accelerated CFC consumption cuts with existing/prospective alternatives

<u>Sector</u>	<u>Use of controlled CFCs/halons</u>	<u>85% cut by 1995</u>	<u>Phaseout by 2000</u>
1. Remaining 10% of CFC-using aerosols (medical industrial)	CFC 11, 12	Possible but only if HCFC 22 is cleared for medical use (which is unlikely)	Possible with HFC 134a [subject to toxicity]
2. Refrigeration/Air conditioning	CFC 11, 12, 115	Possible with existing HCFC 22 and (new) HFC 134a	<u>Problematic</u> (product lifetime)
3(a) Rigid Foam	CFC 11, 12	<u>Problematic</u> (but cuts of 40% possibly by 1990)	<u>Problematic</u> (dependent on (new) HCFC 123, HCFC 141b)
(b) Flexible Foam	CFC 11	Possible with methylene chloride (new) HCFC 123 (new) HCFC 141b	Possible
4. Solvents			
(a) Electronics	CFC 113	Some cuts possible through house-keeping; aqueous cleaning; no-flux soldering	<u>Problematic</u>
(b) Engineering	CFC 113	Some cuts possible through house-keeping; aqueous cleaning	<u>Problematic</u>
(c) Dry-cleaning	CFC 113	<u>Problematic</u>	<u>Problematic</u>
5. Fire protection	Halon 1211, 1302, 2402	<u>Problematic</u>	<u>Problematic</u>

Existing and prospective dependence of users on low-ODP alternatives to CFCs

Sector	Existing/prospective use of alternatives with some ODP	Existing/prospective use of alternatives with zero ODP
1. Remaining 10% of CFC-using aerosols) (medical industrial)	HCFC 22 [unlikely for use in for medical aerosols]	HFC 134a [under development]
2. Refrigeration	HCFC 22 [now available]	HFC 125 HFC 134a [under development]
3. (a) Rigid Foam (b) Flexible Foam	HCFC 123 HCFC 141b [under development] methylene chloride	None Water/CO ₂ (limited use)
4. Solvents (a) Electronics	Methyl chloroform [used for cleaning]	Water/terpenes (limited use)
(b) Engineering	Methyl chloroform [widely used]	" " "
(c) Dry cleaning	Methyl chloroform [limited use]	Perchloroethylene (possibly carcinogenic)
5. Fire-fighting (halons)	None	None