EUROPEAN ECONOMIC COMMUNITY

Aspects of Implementing a Reduction in Chlorofluorocarbon Usage in Aerosols

Final Report

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ABSTRACT

Technical aspects are reviewed of implementing the Council Decision (80/372/EEC) of 26 March 1980, requiring a standstill on chlorofluorocarbons F-11 and F-12 production capacity in the EEC, and a reduction of at least 30% in the use of these CFCs in aerosols relative to usage in 1976.

World and EEC F-11/F-12 production and use statistics for the four years 1976 to 1979 are analysed and compared. Technical progress in substitution by non-CFC aerosol propellants is reviewed, and opportunities for reducing CFC usage in non-aerosol applications are briefly considered.

Existing and planned legislation limiting CFC usage in aerosols within and outside the EEC is summarised.

Alternative means of implementing the Council Decision are examined. It is concluded that conventions between governments and industry represent the best approach, combining speed with being least onerous for industry, and the key provisions for such conventions are indicated.

CONCLUSIONS

A. Council Decision on Chlorofluorocarbons in the Environment

A.1 Technical problems arise in checking compliance with the provision of the Council Decision of 26 March 1980 requiring each Member State to achieve by 31 December 1981 a reduction of at least 30% compared with 1976 levels in the use of F-11 and F-12 in filling aerosols.

A.2 A baseline is available for the Community as a whole for total F-11/F-12 usage in aerosols in year 1976, but there will be difficulties in establishing baselines for individual Member States.

A.3 Seasonal fluctuations in aerosol filling make CFC usage measurements reliable only on a calendar year basis, but conversion by fillers to non-CFC propellants will occur progressively through 1980 and 1981. To estimate the reduction achieved by 31 December 1981 it will be necessary to accept measurements over a short period straddling this date.

A.4 The problems of baselines and monitoring may be aggravated by changes in the territorial CFC usage pattern of multi-national companies.

B. Chlorofluorocarbon Production and Use Statistics

B.1 Following a secondary peak of 799.7 thousand metric tons in 1976, estimated world production of F-11/F-12 fell to 755.1 thousand tons in 1977, and again to 709.1 thousand in 1978, a total reduction of 11.3%. In the same period EEC production fell by 5.9%, from 326.4 thousand tons in 1976, to 307.0 thousand in 1978, and there has been a further fall to 304.2 thousand tons in 1979, making a 6.8% reduction since 1976.

B.2 F-11/F-12 sales for aerosols in the EEC decreased from 176,914 tons in 1976 to 136,552 tons in 1979, a reduction of 40,362 tons or 22.8%. To achieve at least 30% reduction as required by the Council Decision, annual sales must fall by a further 12,712 tons or more to reach the minimum reduction target of 53,074 tons. On the basis of a notional schedule of equal annual decrements the reduction programme is ahead of schedule irrespective of whether 1981 or 1982 is taken as the full comparison year.

B.3 From 1976 to 1979 there were also marginal decreases in F-11/F-12 sales in the EEC for refrigeration, and in export sales outside the EEC. The reductions in sales for aerosols, refrigeration and exports were substantially offset, however, by increased sales for foam plastics and 'other uses', especially the former for which sales rose from 42,154 tons in 1976 to 55,788 tons in 1979, an increase of 32.3%. The outcome was a net decrease in total sales of F-11/F-12 by EEC producers of 26,400 tons, or 8.1%.

B.4 Due mainly to the decline in CFC aerosol propellant sales in the USA in anticipation of the ban in 1979 on use in all non-essential aerosols, sales for aerosols in the EEC expressed as a proportion of CMA reporting company sales rose from 40.9% in 1976 to 49.0% in 1978. EEC sales for aerosols in 1978 corresponded to 19.3% of estimated world production in that year.

B.5 In 1978, the latest year for which world data is available, the pattern of F-11/F-12 usage within the EEC continued to present major differences from that outside, principally in aerosols and refrigeration. Aerosols accounted for 65% of EEC sales in 1978 but only 37.3% externally, while sales for refrigeration presented an even stronger contrast; 8.8% of sales in the EEC and 39.1% in sales outside the Community.

C. Aerosol Production Trends

C.1 EEC aerosol fillings peaked in 1976 at 1,873 million units, falling to 1,837 m. in 1978, but the world total of 6,027 m. in 1978 was the highest since the previous peak of 6,009 m. in 1974. For the EEC in 1979 only the UK has reported to date, recording a fall of 7.4% from the 1978 total of 563.5 m., to 522 m., with drops in hairspray and insecticide fillings being major factors in the decline.

C.2 Personal products are still the largest sector, accounting for 54.2% of EEC fillings in 1978, but there have been significant falls in fillings for hairsprays, anti-perspirants and de-oderants which have been partly offset by increases in household and other categories.

C.3 The CFC/non-CFC propellant usage distribution pattern varies among Member States, reflecting different aerosol product mixes and formulation differences associated with local regulations and economic factors governing the use of alcohols and other solvents.

C.4 The reduction in F-11/F-12 propellant usage between 1976 and 1979 is due to an unquantifiable combination of substitution by non-CFC propellants and changes in the aerosol sales pattern. The latter is believed to have been a significant factor because of the overall decrease in fillings coupled with the shift from the personal products sectors with high CFC concentrations, towards household and other sectors which are frequently formulated without CFCs.

D. F-11/F-12 Propellant Substitution

D.1 Hydrocarbon (propane/butane) propellants are proving to be the principal substitutes for F-11/F-12, with many fillers preferring to make gradual changes by using CFC/hydrocarbon blends. In Germany there is some use of CFC/carbon dioxide blends.

D.2 Dimethylether (DME) has potential as an alternative to hydrocarbons because of better solvent properties and miscibility with water. DME is mainly being used in Belgium and the Netherlands; fillers in other countries have a more cautious attitude towards adopting DME pending a fuller examination of its toxicological and environmental properties and research on these aspects is being supported by the Netherlands Government. Results to date are said to be very encouraging.

D.3 No fluorocarbon alternatives for F-11 and F-12 acceptable for large scale general use have yet emerged.

D.4 No recent quantitative data or estimates relating to the socio-economic impact of F-11/F-12 propellant usage reduction and substitution has been put forward by any Member State.

D.5 There is substantial capital investment entailed in converting to the principal CFC substitute - hydrocarbons - because of the extensive safety precautions required. In urban areas it may be impracticable to comply with local regulations, so that a filler may have the options of moving that part of his operations to another site, ceasing to produce aerosols, or employing a contract filler.

D.6 The cost and other problems attaching to conversion bear more heavily on the smaller fillers, and it is expected that the overall effect of reduced F-11/F-12 usage will be that some large fillers will expand their businesses and some small fillers will cease operation. In countries where there is a spectrum of aerosol business size the transfer of trade will reduce the net socio-economic disturbance, but there could be a greater net effect in countries such as Denmark and Ireland where all the fillers are comparatively small.

D.7 Any reduction in overall CFC production adversely affects the fluorspar mining industry and this is of special concern in Italy. A reduction of F-11/F-12 usage in aerosols going much beyond 30% is also likely to cause socio-economic problems in the CFC producing and allied industry sectors, because there is already an over-capacity situation and sales of CFCs for aerosols in the EEC in 1979 accounted for 45% of production.

E. Non-Aerosol Applications of F-11 and F-12

E.1 Scope for reducing F-11/F-12 usage in non-aerosol applications in the EEC lies mainly in plastic foam production and refrigeration, which respectively accounted for 25.4% and 9.2% of sales in the EEC in 1979.

E.2 There are potentialities for substitution and preventable loss reduction in refrigeration, but the technical and economic problems in reducing usage for polyurethane and other plastic foams are more complex.

E.3 The possibilities for reducing CFC release from non-aerosol applications are being extensively researched, especially in the USA, and the results to date merit careful examination.

F. CFC Regulatory Position Within and Outside the EEC

F.1 Within the EEC the only existing national regulation is the Netherlands requirement for all aerosols containing CFCs to carry a warning of potential damage to health and the environment.

F.2 Outside the EEC, regulatory action against the manufacture and importation of aerosols containing CFC propellants has been taken in Norway, Sweden and the USA, and is pending in Canada. The Canadian regulation applies to hairsprays, anti-perspirants and de-oderants; elsewhere the ban applies to all except specially exempted applications such as in certain pharmaceuticals.

F.3 The Council Decision applies only to F-11 and F-12 and is non-specific as to aerosol product sectors; external regulation applies to all fully halogenated chlorofluoroalkanes, including F-114, and specifies either the products affected or the exemptions.

F.4 The United States proposes to limit CFC production for domestic use and exports to the 1979 level. The EEC decision to freeze production capacity leaves scope for expanding production because capacity considerably exceeds demand.

G. Implementation of the Council Decision

G.1 Means available to Member State governments for implementing the Council Decision to freeze F-11/F-12 production capacity and reduce usage in aerosols are:

- direct regulations having calculable effects, such as concentration limits or bans on F-11/F-12 in particular aerosol products

- indirect action, such as fiscal measures, to discourage CFC usage but imposing no specific restrictions

- conventions, whereby industry would undertake action designed to ensure compliance with the Decision.

G.2 Having considered the alternatives, the reduction in F-11/F-12 usage in aerosols reached in 1979, and the evident progress in CFC substitution, the convention concept is concluded to be the most satisfactory approach, mainly on grounds of speed and as being the least burdensome to industry.

H. The Convention Approach

H.1 The convention concept commands sufficient support from industry for it to be a practicable means of implementing Article 1 of the Council Decision.

H.2 For reasons of commercial confidentiality, both the CFC producing and aerosol industries are reluctant for monitoring to be undertaken on a Member State basis, and there is no doubt that the most accurate indications of changes in CFC usage are provided by the Community statistics derived from confidential collation of producer company data by independent auditors.

1. INTRODUCTION

1.1 Scope of Study

The primary functions of this study were to:

a) examine ways and means and their implications for national authorities, the Commission and the relevant sections of industry, of implementing and monitoring a reduction by the end of 1981 of at least 30% compared with 1976 levels in the use of chlorofluorocarbons F-11 and F-12 in filling aerosols in the Community,

and b) to collate and analyse world and EEC chlorofluorocarbon production and use statistics for the years 1978 and 1979, and compare them with corresponding data for 1976 and 1977.

The main events giving rise to, and immediately following the commissioning of this study are outlined in the following paragraphs.

1.2 Background

1.2.1 1977-78 : Community Policy Evolution

The advisability of restricting chlorofluorocarbon (CFC) release into the atmosphere is a question which has received increasing attention in the European Economic Community since the CFC induced ozone depletion theory was propounded in 1974, and rapidly became an issue of international concern.

On 30 May 1978 the Council of the European Communities adopted a resolution /1/ recognising the problems pre-

sented by the effects of chlorofluorocarbons on the ozone layer and of ultra-violet radiation on health, and advocating intensification of research into ways of reducing F-11 and F-12 usage in the aerosol and plastic foam industries, steps to eliminate the discharge of these compounds from equipment containing them, and a standstill on F-11 and F-12 production capacity in the Community. The resolution also stated an intention to re-examine the situation in the second half of 1978, with a view to arriving at a Community policy.

As part of the preparation for the 1978 policy review the Commission assigned Metra to study the social and economic implications of CFC regulation in the Community, and a report was issued in October 1978, /2/. Metra examined three scenarios for regulating the use of fully halogenated CFCs in aerosols. Two of the scenarios assumed total bans except for essential applications after 3 and 5 years respectively, and the third entailed 50% reduction over 3 years followed by a total ban 2 years later. It was concluded that such restrictions would certainly carry socio-economic penalties, especially for the CFC producing and ancillary sectors - such as fluorspar mining - but that given enough time for research and plant conversion the aerosol manufacturing industry would successfully adapt to using CFC substitutes. An adequate time in this context was assessed at 5 years, including the scenario providing for 50% reduction over an initial 3 year period.

The study also included a review of the problems of reducing CFC usage in refrigeration, plastic foam manufacture and solvent cleaning processes, but no specific regulatory measures were considered for those applications.

Following a meeting of National Experts in Brussels in November, 1978, and in preparation for an International Conference on Chlorofluoromethanes in Munich, the Member States adopted a common position to the effect that a reduction in the release of CFCs was desirable as a precautionary measure, and that such a reduction should be sought particularly in respect of the use of CFCs in aerosols.

At the Munich Conference in December 1978, /3/, papers were presented and discussed on the latest scientific evidence on ozone depletion; the biological and environmental effects of UV-B radiation; the practicability of CFC substitution; and the socio-economic aspects of regulation. In its recommendations on Topic III, Alternatives for Political Decisions, the Conference advocated a global reduction in CFC release as a precautionary measure, and called for a significant reduction to be achieved in the next few years.

The final step in the crystallisation of Community policy in this period came at a meeting of the Council of Ministers for the Environment on 18/19 December 1978, which considered a report on the proceedings and recommendations of the Munich Conference, and asked the Commission to make specific proposals in respect of measures to reduce CFC usage in the Community, taking the results of the Munich Conference into account.

It should be added here that the chlorofluorocarbon producers and the aerosol industry in the Community have consistently expressed the view that the scientific evidence does not justify constraints on CFC production and use at the present time, and that a sufficient precaution would be to continue to review the research findings at two year intervals. Nevertheless, towards

the end of 1978, industry trade federation representatives intimated to the Commission that if a reduction in CFC usage in aerosols were deemed to be advisable as a precautionary measure, they believed that industry would support arrangements for securing a reduction of 30% relative to usage in 1976.

1.2.2 1979-80 : Progress to Council Decision of 26.3.80

In May 1979, the Commission submitted a Proposal for a Council Decision /4/ providing for Member States to take appropriate measures:

a) to ensure that industry situated in their territory does not increase its production capacity for chlorofluorocarbons

b) to ensure by 31 December 1981 a reduction of 30% in the use of CFCs in aerosols in relation to 1976 levels of use.

Other clauses dealt with the need to ensure that the measures taken are consistent with the proper functioning of the common market; the provision of evidence of the reduction achieved; and the intention to re-examine the position in 1982 in the light of the economic and scientific evidence then available.

The Proposal then passed through the Community review procedures, and in accordance with guidelines provided by Council, the Commission commenced to examine the possibility of implementing the restrictive provisions of the proposed Decision through conventions or agreements between Member State authorities and the national industries concerned, providing for control measures to execute the reduction programme and monitor the results.

In the autumn of 1979, the Commission assigned Metra to carry out a study designed to update the information contained in certain sections of the Metra 1978 report and to advise on aspects of implementing and monitoring the CFC reduction proposals, including the proposed convention concept.

The study commenced in September 1979 and continued until the end of March 1980, in parallel with the internal Community discussions culminating in the approval of a Decision by the Council of Ministers of the Environment on 17 December, 1979, and formal adoption on 26 March, 1980, /5/.

The text of the Decision is given in Appendix 1. The restrictive measures are in line with the Commission Proposal of May 1979, except that they relate only to chlorofluorocarbons F-11 and F-12, and the reduction requirement is at least 30%. Another difference is that the measures are to be re-examined during the first half of 1980 instead of in 1982.

1.3 Study Programme and Procedure

Although the study was primarily concerned with examining aspects of implementing and monitoring a reduction of CFC usage in aerosols, and with up-dating the CFC production and use statistics presented in the 1978 Metra report, we also considered:

- technical questions arising from the provisions of the Council Decision

- aerosol production trends in the EEC

- the present state of technical advance in CFC propellant substitution

- regulatory action on CFCs obtaining or pending in countries within and outside the EEC.

An interim statement of our preliminary findings and views was submitted to the Commission in October 1979, while deliberations on the Proposal for the Council Decision were still in progress. The second phase of the study concentrated on completing the information up-date and on developing the convention concept, with special attention to the monitoring procedure.

Information and views were obtained from the Federation of European Aerosol Associations (FEA); the European Fluorocarbon Producers Technical Committee (EFCTC) of CEFIC; direct contacts with firms in the aerosol industry; and the principal journals dealing with aerosol technology. A series of informal discussions between members of the Environment and Consumer Protection Service of the Commission, and representatives of the FEA and EFCTC, was also attended by the Metra consultant.

Outside the EEC we were in touch with the United States Environmental Protection Agency and the Chemical Manufacturers Association, and with the Environment Departments of Canada, Norway and Sweden.

1.4 Acknowledgement

Metra gratefully acknowledges the invaluable help received in the course of this study by way of data, information and views from numerous organisations and individuals in the public and private sectors.

2. COUNCIL DECISION ON CHLOROFLUOROCARBONS IN THE ENVIRONMENT

2.1 Outline

The definitive English text of the Environment Council Decision approved on 17 December 1979, and formally adopted on 26 March 1980, is reproduced as Appendix 1.

The Preamble includes citations of the Common Position adopted by Member States on 6 December 1978, the recommendations of the 1978 Munich Conference, and the Commission's Proposal of May 1979. The Decision is addressed to Member States and provides for:

a) No increase in F-11 and F-12 production capacity.

b) A reduction by 31 December 1981 of at least 30% compared with 1976 levels in the use of F-11 and F-12 in aerosol filling.

c) In the first half of 1980, a re-examination of the measures taken in the light of available scientific and economic data, and the adoption by 30 June 1981 of any further measures necessitated in the light of this re-examination.

2.2 Technical Aspects of Interpretation

2.2.1 Production Capacity Standstill

a) While some CFC plants are designed and used exclusively for F-11 and F-12 production, there are also multi-purpose plants which are normally used for making, say, F-22 ($CHClF_2$), or F-113 ($C_2Cl_3F_3$) and F-114 ($C_2Cl_2F_4$), but which could also be used for

making F-11 and F-12. It is presumed that the intention of the Decision is that such multi-purpose plant should not be used to augment the output of the regular F-11/12 installations. The question then arises as to whether they may be used by a company for making F-11/F-12 if the capacity of its regular units is reduced by breakdown or maintenance requirements, and there seems no logical reason why such spare capacity should not be so used since a legitimate alternative would be for the company to make up a deficiency by importation from within or even outside the Community.

b) In the short term there is little likelihood of the CFC industry as a whole wanting to increase F-11/12 production capacity since existing capacity is under-utilised and the margin will probably rise as usage in aerosols declines. It is possible to envisage situations, however, in which a particular company might want to increase capacity, for example because a competitor decided to cease production.

2.2.2 Time for Achieving CFC Usage Reduction Target

Article 1(2) of the Decision requires the minimum reduction target to be reached 'not later than 31 December 1981', and this raises the following questions in respect of interpretation and monitoring:

a) For most countries the only accurate baseline for 1976 is that of total F-11/12 sales to the EEC aerosol industry in that year, as determined by the CFC producers' returns collated by independent auditors acting for the EFCTC in connection with the 1977/78 Metra Study.

b) Aerosol output, and hence the consumption of propellants, fluctuates throughout the year for seasonal and other reasons. Consumption in any particular month or quarter cannot necessarily be compared with the relevant fraction of an annual total.

c) Reduction of CFC propellant usage will proceed at an irregular rate as the individual aerosol fillers convert their plants and introduce new formulations at different times. By the letter of the Decision, companies need not feel obliged to effect a reduction until the last month of 1981, and in our view it would be difficult to construe the Decision as meaning that it is total usage in 1981 which must be at least 30% lower than that in 1976.

d) Although it could be contended that it is the 1982 total which should be compared with 1976, that figure will not be available until well into 1983 and the Community may not be content to wait that long to verify compliance with the decision.

e) The only CFC tonnage figures that are obtainable with acceptable accuracy are those of sales and purchases, and sales by producers are probably the more accurate because far fewer companies are involved. Actual consumption is difficult to measure due to the complications of material in transit and stock changes. Over a period of a year, sales approximate to consumption but the accuracy diminishes as the period shortens, and little confidence could be attached to a figure for a month.

It is concluded that there is no wholly satisfactory answer to the difficulty. Fortunately, it seems probable that overall reduction in year 1981 could be well over

20%, so that the 1981 total in conjunction with supplementary evidence from industry, possibly including a special four month survey covering the last two months of 1981 and the first two of 1982, may well suffice to indicate whether the minimum reduction target has been achieved.

2.2.3 Implementation and Monitoring

Two points arise from the provisions of Articles 1(2) and 3, which require at least 30% reduction of CFC usage in aerosols to be attained in the territory of each Member State:

a) Special problems may be encountered by multi-national companies wishing to reduce the number of their filling stations, for reasons of safety and economy, when switching to flammable hydrocarbon propellants. This could result in their CFC consumption in one country falling to zero, and that in another rising above the present level. On an overall basis they would be achieving a reduction of 30% or more, but the Council Decision precludes treating the reduction on a Community rather than a Member State basis.

b) Member States may wish to monitor CFC production and propellant consumption in their own territories, but for reasons of commercial confidentiality the CFC and aerosol industries have a strong preference for monitoring on a Community basis, and they can contend that what really matters is the control of total CFC release. Against this it can be argued that it is desirable for each Member State to establish that it is making its due contribution to CFC release reduction, although it would still seem reasonable to find some way of accommodating the multi-national approach mentioned in (a) above.

2.3 Conclusions

2.3.1 Technical problems arise in checking compliance with the provision of the Council Decision of 26 March 1980 requiring each Member State to achieve by 31 December 1981 a reduction of at least 30% compared with 1976 levels in the use of F-11 and F-12 in filling aerosols.

2.3.2 A baseline is available for the Community as a whole for total F-11/F-12 usage in aerosols in year 1976, but there will be difficulties in establishing baselines for individual Member States.

2.3.3 Seasonal fluctuations in aerosol filling make CFC usage measurements reliable only on a calendar year basis, but conversion by fillers to non-CFC propellants will occur progressively through 1980 and 1981. To estimate the reduction achieved by 31 December 1981 it will be necessary to accept measurements over a short period straddling this date.

2.3.4 The problems of baselines and monitoring may be aggravated by changes in the territorial CFC usage pattern of multi-national companies.

3. CHLOROFLUOROCARBON PRODUCTION AND USE STATISTICS

3.1 Data Sources

3.1.1 Global Statistics

Under a scheme administered by the USA Chemical Manufacturers Association (the CMA, formerly the Manufacturing Chemists Association - the MCA), 20 companies have regularly submitted their annual F-11 and F-12 production and sales statistics to Alexander Grant and Company, an independent United States firm of accountants. Alexander Grant collate this data and prepare various aggregate tabulations which have been supplemented in recent years by data and estimates in respect of India, Argentina and the Eastern Bloc Countries.

On the basis of the Alexander Grant tabulations and previously established CFC data processing procedures, the CMA Fluorocarbons Technical Panel prepares three sets of tables; one set gives annual and cumulative F-11 and F-12 production, sales and release figures for all years from 1931, in respect of reporting companies only; the second gives annual and cumulative production and release figures for F-11 and F-12 in respect of Communist Countries, Argentina and India from year 1950; and the third set gives world totals for F-11 and F-12 annual and cumulative production and release figures from year 1931.

The Alexander Grant collation for the year under review breaks down the F-11 and F-12 sales statistics for reporting companies into six categories:

a) refrigeration - hermetically sealed
b) refrigeration - non-hermetically sealed
c) blowing agent - closed cell foam
d) blowing agent - open cell foam
e) aerosol propellant
f) all other uses.

The CMA collation in respect of sales gives categories a), b) and c) separately, but combines categories d), e) and f).

Since 1977 the number of reporting companies has decreased from 20 to 19, due to cessation of F-11 and F-12 production by the Union Carbide Corporation (USA). The reporting companies include all the CFC producers in the EEC.

The Metra 1978 report included abstracts of the Alexander Grant/CMA statistics up to 1977. The present report includes corresponding data kindly provided by the CMA for 1978, which is the latest available at this time.

3.1.2 USA Statistics

The CMA has also provided us with the Alexander Grant aggregated F-11 and F-12 production and sales statistics for the six United States reporting companies for years 1976 and 1977, and has advised that these are the only USA data available. The six sales categories are the same as listed in 3.1.1 for the Alexander Grant collation for all reporting companies.

3.1.3 EEC Statistics

For the Metra 1978 report the nine CFC producer-marketers in the EEC all participated in an exercise administered by the EFCTC, and submitted production and sales data in respect of F-11, F-12, F-113 and F-114 for the years 1976 and 1977 to an independent UK firm of accountants: Peat, Marwick Mitchell and Co., who provided aggregate tabulations including sales breakdowns as follows:

Home Market Sales	Sales to Other EEC Markets	Export Sales Outside EEC
a) Aerosols	a) Aerosols	
b) Refrigeration	b) Refrigeration	No breakdown
c_1) Foam-flexibles		
c_2) Foam-rigid	c) Foam	
c_3) Foam-other		
d) Solvents and other uses.	d) Other	

The EFCTC subsequently stated the intention to continue the 1976/77 exercise on an annual basis; this has been implemented but the full collated 1978 and 1979 data did not become available to us until May 1980.

Data collection for 1978 and 1979 has been in respect of F-11 and F-12 but not F-113 and F-114, and only F-11 and F-12 usage is affected by the recent Council Decision. Comparison with world statistics is also only possible for F-11 and F-12 up to year 1978, and the 1979 CMA world figures are not expected to be available before August 1980.

The difference in detail for sales for foam plastics between home and other EEC markets reflects the better information available in respect of the former, although this is not easy to reconcile with the additional breakdown provided in the CMA statistics, to which the EEC producers have contributed.

It should be noted that the sales figures exclude any trading between CFC producers in the Community, and the production totals include any importation from outside the Community. Such importation is occasionally undertaken, for example, to make up a shortfall due to operating problems. It is believed that virtually all importation of F-11 and F-12 is through the EEC producer-marketers and that relatively small quantities are involved, but no figures are available from official sources

and the producers do not wish to disclose details because only one or two companies may be concerned.

Discrepancies between production and sales totals are attributable to stock changes and reporting errors, and in no year does the difference exceed 2%.

3.2 Data Presentation

Annual World production of F-11 and F-12 over the years 1968 to 1978 together with EEC production for 1976 to 1978 are shown graphically in Figure 3.1.

In the tabulations that follow we have used F-11/F-12 totals because this permits a clearer presentation of annual trends, and the Council Decision relates to the aggregate of these two CFCs.

Another simplification which has been made is to combine the statistics for different types of foam plastics. To do otherwise involves making assumptions as to the break-down of the 'other EEC markets' figures for foams, which seems unnecessary in a study concerned mainly with usage in aerosols. Accordingly, from the original EFCTC data for F-11/F-12 for years 1976-79, the home and other EEC sales statistics have been consolidated to give total sales by category in the EEC, and these are presented in Table 3.1, which also shows the changes from 1976 in terms of tonnage and percentage.

Table 3.2 shows EEC producer sales of F-11/F-12 by category, expressed as proportions of all sales within the EEC and of combined EEC and export sales.

Table 3.3 provides a comparison of the available data from 1976 onwards of F-11/F-12 sales by category for the EEC, the USA and all CMA reporting companies. The figures for non-EEC countries (which include the USA) are derived by difference from the CMA and EEC totals.

FIGURE 3.1 : CHLOROFLUOROCARBONS F-11 AND F-12 WORLD AND EEC PRODUCTION : 1968 - 1978

Sources: U.S. Chemical Manufacturers Association.
European Fluorocarbon Producers Technical Committee

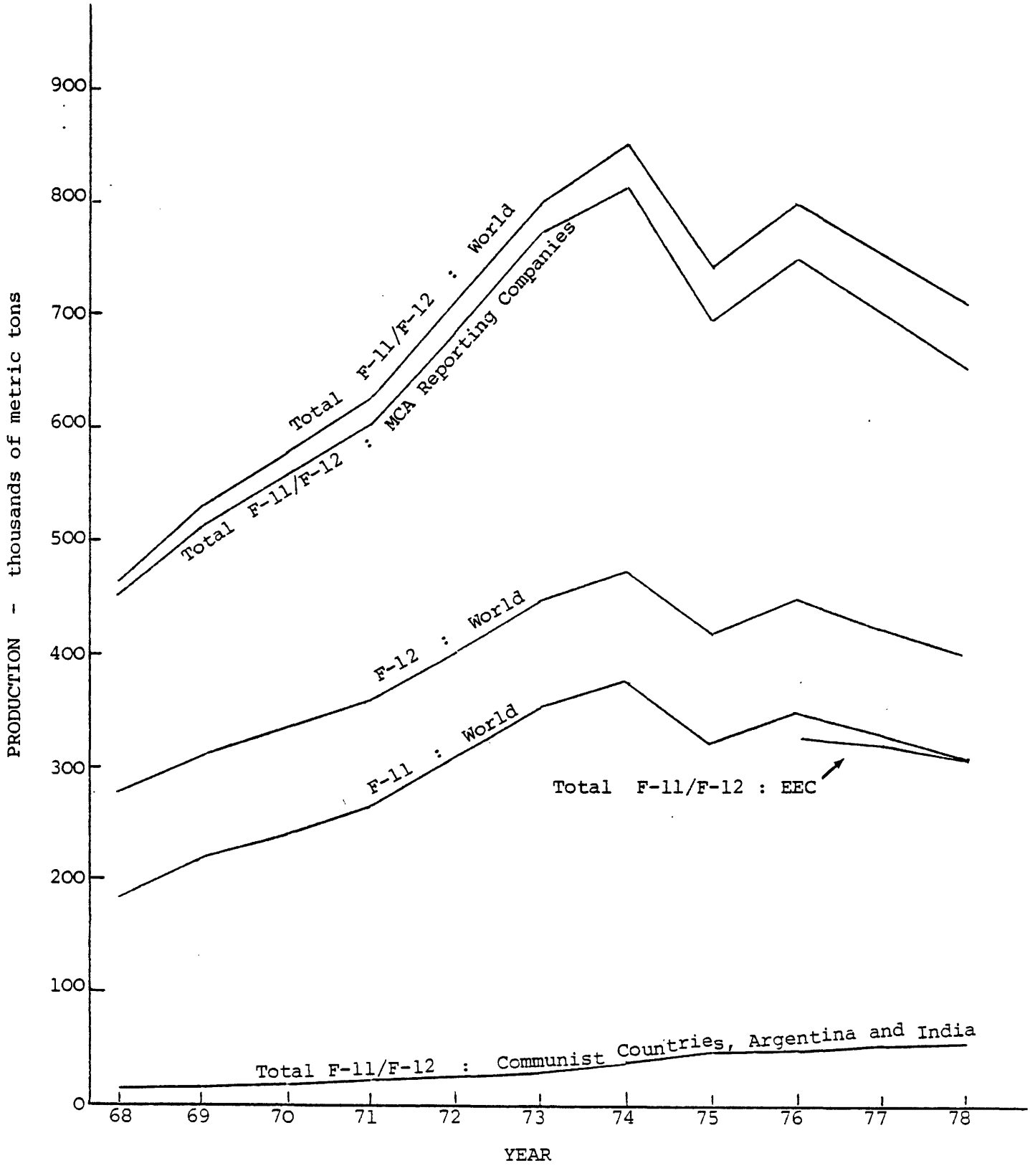

TABLE 3.1 : F-11/F-12 PRODUCTION AND SALES BY EEC PRODUCERS : 1976 - 1979.

tons F-11/F-12

	1976	1977	1978	1979
PRODUCTION				
(including imports by CFC producers from outside the EEC)	326,433	319,107	307,033	304,238
Change from 1976 - tons	-	- 7,326	- 19,400	- 22,195
- %	-	- 2.2	- 5.9	- 6.8
SALES				
SALES IN EEC MARKETS				
(exluding sales to co-producers)				
Aerosols Sales - tons	176,914	162,568	150,424	136,552
Change from 1976 - tons	-	- 14,346	- 26,490	- 40,362
- %	-	- 8.1	- 15.0	- 22.8
Refrigeration Sales - tons	20,773	20,293	20,416	20,300
Change from 1976 - tons	-	- 480	- 357	- 473
- %	-	- 2.3	- 1.7	- 2.3
Foam Plastics Sales - tons	42,154	45,254	54,524	55,788
Change from 1976 - tons	-	+ 3,100	+ 12,370	+ 13,634
- %	-	+ 7.4	+ 29.3	+ 32.3
Other Uses Sales - tons	4,178	4,871	6,073	6,921
Change from 1976 - tons	-	+ 693	+ 1,895	+ 2,743
- %	-	+ 16.6	+ 45.4	+ 65.7
TOTAL SALES IN EEC - tons	244,019	232,986	231,437	219,561
Change from 1976 - tons	-	- 11,033	- 12,582	- 24,458
- %	-	- 4.5	- 5.2	- 10.0
TOTAL EXPORTS OUTSIDE EEC - tons	83,578	81,187	82,236	81,636
Change from 1976 - tons	-	- 2,391	- 1,342	- 1,942
- %	-	- 2.9	- 1.6	- 2.3
TOTAL EEC AND EXPORT SALES - tons	327,597	314,173	313,673	301,197
Change from 1976 - tons	-	- 13,424	- 13,924	- 26,400
- %	-	- 4.1	- 4.3	- 8.1
Production less Sales - tons	- 1,164	+ 4,934	- 6,640	+ 3,041

Source : EFCTC. Further analysis by Metra

TABLE 3.2 : EEC PRODUCER SALES OF F-11/F-12 BY CATEGORY AS PROPORTION OF EEC AND TOTAL SALES

tons F-11/F-12

Application	1976	1977	1978	1979
SALES IN EEC MARKETS (excluding sales to co-producers)				
Aerosols				
tons	176,914	162,568	150,424	136,552
% EEC Sales	72.5	69.8	65.0	62.2
% All Sales	54.0	51.7	48.0	45.3
Refrigeration				
tons	20,773	20,293	20,416	20,300
% EEC Sales	8.5	8.7	8.8	9.2
% All Sales	6.3	6.5	6.5	6.7
Foam Plastics				
tons	42,154	45,254	54,524	55,788
% EEC Sales	17.3	19.4	23.6	25.4
% All Sales	12.9	14.4	17.4	18.5
Other Uses				
tons	4,178	4,871	6,073	6,921
% EEC Sales	1.7	2.1	2.6	3.2
% All Sales	1.3	1.6	1.9	2.3
TOTAL EEC SALES				
tons	244,019	232,986	231,437	219,561
% All Sales	74.5	74.2	73.8	72.9
TOTAL EXPORTS OUTSIDE EEC				
tons	83,578	81,187	82,236	81,636
% All Sales	25.5	25.8	26.2	27.1
TOTAL EEC AND EXPORT SALES				
tons	327,597	314,173	313,673	301,197

Source : EFCTC. Further analysis by Metra.

TABLE 3.3 : F-11/F-12 SALES BY CATEGORY FOR EEC, USA, AND ALL CMA REPORTING COMPANIES : 1976 - 1979

Sales Category	Data Source (Note 1)	1976	1977		1978		1979	
		'000 tons	'000 tons	% Change on '76	'000 tons	% Change on '76	'000 tons	% Change on '76
Aerosols	EEC	176.9	162.6	- 8.1	150.4	- 15.0	136.6	- 22.8
	non-EEC	255.4	176.5	- 30.9	156.8	- 38.6	n.a.	
	All CMA	432.3	339.1	- 21.6	307.2	- 28.9	n.a.	
	USA	138.0	84.0	- 39.2	n.a.		n.a.	
Refrigeration	EEC	20.8	20.3	- 2.4	20.4	- 1.9	20,300	- 2.3
	non-EEC	131.5	158.7	+ 20.7	164.2	+ 24.9	n.a.	
	All CMA	152.3	179.0	+ 17.5	184.6	+ 21.2	n.a.	
	USA	88.0	99.7	+ 13.2	n.a.		n.a.	
Foam Plastics	EEC	42.1	45.2	+ 7.4	54.5	+ 29.3	55.8	+ 32.3
	non-EEC	68.3	82.2	+ 20.4	77.2	+ 13.0	n.a.	
	All CMA	110.4	127.4	+ 15.4	131.7	+ 19.2	n.a.	
	USA	44.4	50.3	+ 13.5	n.a.		n.a.	
Other Uses	EEC	4.2	4.9	+ 16.7	6.1	+ 45.4	6.9	+ 65.7
	non-EEC	25.6	47.7	+ 86.3	21.7	+ 15.2	n.a.	
	All CMA	29.8	52.6	+ 76.5	27.8	- 6.7	n.a.	
	USA	18.6	14.1	- 24.2	n.a.		n.a.	
TOTALS	EEC	244.0	233.0	- 4.5	231.4	- 5.2	219.6	- 10.0
	non-EEC	480.8	465.1	- 3.3	419.9	- 12.7	n.a.	
	All CMA	724.8	698.1	- 3.7	651.3	- 10.1	n.a.	
	USA	289.0	248.1	- 14.2	n.a.		n.a.	

Sources : EFCTC and CMA. Further analysis by Metra.

Note (1) : 'non-EEC' = Difference between totals for all CMA reporting companies and EEC.

Table 3.4 shows F-11/F-12 sales by category in the EEC expressed as percentages of CMA sales in the corresponding categories over the period 1976-1978, and Table 3.5 contrasts the percentage sales distribution by category for EEC and non-EEC countries.

3.3 F-11/F-12 Production Trends

As will be seen from Fig. 3.1, the decline in world production of both F-11 and F-12 in 1977 following the secondary peak of 1976 continued in 1978, for which the estimated world total for F-11/F-12 was 709.1 thousand metric tons, as compared with 755.1 thousand in 1977, and 799.7 thousand in 1976.

In the EEC, F-11/F-12 production fell from 326.4 thousand tons in 1976 to 307.0 thousand in 1978, a drop of 5.9%, whereas world production declined by 11.3% over the same period. In 1979 there was a further fall in EEC production to 304,238 tons, a reduction of 6.8% on 1976.

As will be apparent from the sales figures in Table 3.3, the principal reason for the decline since 1976 is reduced usage in aerosols, which has been a bigger factor in the USA than in Europe due to a combination of lower aerosol unit sales with the phasing out of CFC propellants in preparation for the ban on use in most aerosols in the USA, which became fully effective in 1979.

Due to the differential rate of decline in production, EEC output as a proportion of the world total rose from 40.8% in 1976 to 43.3% in 1978.

3.4 F-11/F-12 Sales Trends

3.4.1 Sales by EEC Producers : 1976-79

From the statistics presented in Tables 3.1 and 3.2 it is noteworthy that:

- Within the EEC there has been a progressive decline in sales for aerosols, from 176,914 tons in 1976 to 136,552 tons in 1979, a total fall of 40,362 tons, or 22.8%.

- There has been no significant change in sales for refrigeration and air conditioning, which at 20,300 tons in 1979 accounted for only 9.2% of total sales in the EEC and were only marginally lower than the 1976 total of 20,773 tons.

- Sales for foam plastics have increased considerably, from 42,154 tons in 1976 to 55,788 tons in 1979, a rise of 32.3%, of which the major part occurred in 1978.

- Sales for other uses have risen by the high percentage of 65.7, but from a relatively low base, and at 6,921 tons in 1979 these accounted for 3.2% of EEC sales.

- Exports outside the EEC were 81,636 tons in 1979, a decrease of 1,942 tons, or 2.3% on the 1976 total, and the net effect of all sales category changes was a decrease in total sales by EEC producers from 327,597 tons in 1976, to 301,197 tons in 1979, or 8.1%.

- The decline in sales for aerosols amounting to 40,362 tons has been substantially offset by increases in sales for foam plastics and miscellaneous uses, so that the net reduction over the period is 26,400 tons.

- Although sales within the EEC for aerosols have fallen from 54% of total (EEC and export) sales in 1976 to 45.3% in 1979, this is still a high proportion and any new measures which rapidly and substantially eroded these sales would obviously have a major impact on the CFC manufacturing industry. The fact that these

TABLE 3.4 : F-11/F-12 SALES IN EEC AS PROPORTION OF ALL CMA REPORTING COMPANY SALES : 1976-1978

Sales Category	F-11/F-12 Sales in EEC as % of CMA sales		
	1976	1977	1978
Aerosols			
% CMA Aerosol Sales	40.9	48.0	49.0
% CMA Total Sales	24.4	23.3	23.1
Refrigeration			
% CMA Refrigeration Sales	13.7	11.3	11.1
% CMA Total Sales	2.9	2.9	3.1
Foam Plastics			
% CMA Foam Sales	38.1	35.5	41.4
% CMA Total Sales	15.8	6.5	8.4
Other Uses			
% CMA Other Use Sales	14.1	9.3	21.9
% CMA Total Sales	0.6	0.7	0.9
Total Sales in EEC			
% CMA Total Sales	33.7	33.4	35.5

Source : EFCTC and CMA Statistics; analysis by Metra.

TABLE 3.5 : EEC AND NON-EEC SALES DISTRIBUTION BY CATEGORY : 1976 - 1978

Sales Category	F-11/F-12 Sales as % Total Sales (Note 1)					
	1976		1977		1978	
	EEC	non-EEC	EEC	non-EEC	EEC	non-EEC
Aerosols	72.5	53.1	69.8	37.9	65.0	37.3
Refrigeration	8.5	27.4	8.7	34.1	8.8	39.1
Foams	17.3	14.2	19.4	17.7	23.6	18.4
Other Uses	1.7	5.3	2.1	10.3	2.6	5.2
	100.0	100.0	100.0	100.0	100.0	100.0

Source : EFCTC and CMA statistics; analysis by Metra.

Note (1) : EEC sales distribution relates to sales within the EEC. Non-EEC distribution relates to difference between CMA sales by all reporting companies and EEC sales.

aerosol sales amounted to nearly two thirds of EEC sales - which presumably carry a somewhat higher profit margin than exports - would tend to increase the socio-economic consequences of further constraints on F-11/F-12 usage in the Community.

3.4.2 Member State Sales Statistics

Individual EEC Member State statistics are available only in respect of sales of F-11/F-12 for aerosols in the Federal Republic of Germany, where they fell from 48.2 thousand tons in 1976 to 38.6 thousand in 1978, and to approximately 35 thousand in 1979. The total reduction of ca. 27.4% is significantly higher than that of 22.8% for the EEC as a whole.

For reasons of commercial confidentiality, the EEC chlorofluorocarbon producers prefer only to provide data for the Community as a whole, by submitting individual company statistics to independent auditors for collation.

3.4.3 Contrasts between EEC and CMA/non-EEC Sales : 1976-78

The EEC sales patterns may be viewed against the backgrounds of sales by all CMA reporting companies and of sales outside the EEC in Tables 3.3, 3.4 and 3.5. There are three particularly interesting features:

- due mainly to the decline in CFC propellant sales in the USA, sales for aerosols in the EEC have risen as a proportion of the CMA total for aerosols from 40.9% in 1976 to 49.0% in 1978, but because of changes in other categories the proportion as a percentage of the CMA total for all uses has actually fallen from 24.4 to 23.1, (Table 3.4).

- total sales by EEC producers within and outside the Community amounted to 45.2% of all CMA reporting company sales in 1976 and to 48.2% in 1978; the corres-

TABLE 3.6 : MAXIMUM ANNUAL F-11/F-12 SALES FOR AEROSOLS IN EEC TO REACH 30% REDUCTION TARGET IN 1981/82

	Metric tons
Sales in EEC for aerosols in 1976	176,914
Annual sales for minimum reduction target of 30% relative to sales in 1976	123,840
Minimum total reduction on sales in 1976	53,074
Annual reduction to reach 30% reduction by equal decrements on calendar year comparison basis:	
a) In 1981	10,615
b) In 1982	8,846

Metric tons F-11/F-12

Year	Maximum Sales to Reach Reduction of 30% cf. 1976 at Constant Rate:				Actual Sales	
	a) in 1981		b) in 1982			
	tons	% redn. on 1976	tons	% redn. on 1976	tons	% redn. on 1976
1976	176,914	-	176,914	-	176,914	-
1977	166,299	6.0	168,068	5.0	162,568	8.1
1978	155,684	12.0	159,222	10.0	150,424	15.0
1979	145,069	18.0	150,376	15.0	136,552	22.8
1980	134,454	24.0	141,530	20.0		
1981	123,840	30.0	132,684	25.0		
1982			123,840	30.0		

Sources : EFCTC and Metra

ponding proportions represented by sales within the Community were 33.7% respectively, (Tables 3.3 and 3.4).

- the sales distribution patterns within and outside the EEC continue to be very different, especially in respect of aerosols and refrigeration. Outside the EEC the refrigeration sales share rose from 27.4% in 1976 to 39.1% in 1978, when it overtook the aerosol share - 37.3%. By contrast, the refrigeration share in the EEC in 1978 was 8.8%, which was little different from 1976, and aerosols continued to provide the dominant demand, with 65% in 1978 compared with 72.5% in 1976, (Table 3.5).

3.5 EEC F-11/F-12 Aerosol Propellant Sales and the Minimum 30% Reduction Target

In Table 3.6 are shown some implications of the Council Decision requirement of at least 30% reduction in F-11/F-12 usage in filling aerosols relative to 1976.

To reach the minimum target, usage (as measured by annual sales) must fall from 176,914 tons in 1976 to 123,840 tons, a reduction of 53,074 tons. If the reduction were to be achieved by constant annual decrements, these would amount to 10,615 tons if the target is to be reached over 5 years, i.e. in 1981, or 8,846 tons over 6 years to reach it in 1982.

On the completely notional basis of constant annual decrements, the actual reduction of 22.8% achieved in 1979 can be considered ahead of schedule, regardless of the interpretation placed on the Council Decision wording which specifies reaching the target by 31 December 1981.

3.6 Conclusions

3.6.1 Following a secondary peak of 799.7 thousand metric tons in 1976, estimated world production of F-11/F-12 fell to

755.1 thousand tons in 1977, and again to 709.1 thousand in 1978, a total reduction of 11.3%. In the same period EEC production fell by 5.9%, from 326.4 thousand tons in 1976, to 307.0 thousand in 1978, and there has been a further fall to 304.2 thousand tons in 1979, making a 6.8% reduction since 1976.

3.6.2 F-11/F-12 sales for aerosols in the EEC decreased from 176,914 tons in 1976 to 136,552 tons in 1979, a reduction of 40,362 tons or 22.8%. To achieve at least 30% reduction as required by the Council Decision, annual sales must fall by a further 12,712 tons or more to reach the minimum reduction target of 53,074 tons. On the basis of a notional schedule of equal annual decrements the reduction programme is ahead of schedule irrespective of whether 1981 or 1982 is taken as the full comparison year.

3.6.3 From 1976 to 1979 there were also marginal decreases in F-11/F-12 sales in the EEC for refrigeration, and in export sales outside the EEC. The reductions in sales for aerosols, refrigeration and exports were substantially offset, however, by increased sales for foam plastics and 'other uses', especially the former for which sales rose from 42,154 tons in 1976 to 55,788 tons in 1979, an increase of 32.3%. The outcome was a net decrease in total sales of F-11/F-12 by EEC producers of 26,400 tons, or 8.1%.

3.6.4 Due mainly to the decline in CFC aerosol propellant sales in the USA in anticipation of the ban in 1979 on use in all non-essential aerosols, sales for aerosols in the EEC expressed as a proportion of CMA reporting company sales rose from 40.9% in 1976 to 49.0% in 1978. EEC sales for aerosols in 1978 corresponded to 19.3% of estimated world production in that year.

3.6.5 In 1978, the latest year for which world data is available, the pattern of F-11/F-12 usage within the EEC continued to

present major differences from that outside, principally in aerosols and refrigeration. Aerosols accounted for 65% of EEC sales in 1978 but only 37.3% externally, while sales for refrigeration presented an even stronger contrast; 8.8% of sales in the EEC and 39.1% in sales outside the Community.

4. AEROSOL PRODUCTION TRENDS

4.1 Filling Statistics

Total aerosol filling statistics for the years 1970 to 1978 in respect of the individual EEC countries, the rest of Europe, the USA and the rest of the world are presented in Table 4.1, and the overall EEC production trend in the global context is shown graphically in Figure 4.1.

EEC total fillings peaked in 1976 at 1,873 million units, falling to 1,857 m. in 1977 and to 1,837 m. in 1978. The world total of 6,027 m. in 1978 is the highest since the previous peak of 6,009 m. in 1974, and the USA production in 1978 was higher than in the previous year - reversing for the first time the decline which set in after the peak of 1973. EEC fillings in 1978 represented over 30% of the world total.

Within the EEC the United Kingdom continued to be the largest producer in unit terms, having increased production each year since 1975 to the highest total yet of 563 m. units in 1978. Production in F.R. Germany, the Netherlands and Belgium was marginally lower in 1978 compared with 1977; Italy increased production from 192 m. to 207 m., but in France output dropped sharply from 466 m. to 412 m.

The distribution of fillings among the principal product groups in the five main EEC aerosol manufacturing countries is shown in Table 4.2, which presents comparative statistics for 1976 and 1978. Personal products are still the largest sector, accounting for 54.2% of EEC fillings in 1978, compared with 58.7% in 1976, but there have been significant falls in the fillings for hairsprays, anti-perspirants and deoderants, which have been partly offset by increases in the household and other categories.

TABLE 4.1 : EEC AND WORLD AEROSOL FILLINGS : 1970 - 1978

Millions of units

	1970	1971	1972	1973	1974	1975	1976	1977	1978	1978 Percentage Distribution	
										%	%
United Kingdom	304	349	361	438	478	440	495	532	563	30.6	
West Germany	401	412	389	397	418	425	457	454	450	24.5	
France	254	304	359	394	450	383	454	466	412	22.4	
Italy	138	158	173	194	203	173	253	192	207	11.3	
Netherlands	90	119	120	136	155	147	145	143	139	7.6	
Belgium	39	45	45	49	46	46	51	54	52	2.8	
Denmark	13	13	14	14	14	14	13	11	9	0.5	
Ireland	8	12	13	22	15	5	5	5	5	0.3	
TOTAL EEC :	1,247	1,412	1,474	1,644	1,779	1,633	1,873	1,857	1,837	100.0	30.5
Rest of Europe	181	217	246	286	299	277	301	339	303		5.0
TOTAL EUROPE:	1,428	1,629	1,720	1,930	2,078	1,910	2,174	2,196	2,140		35.5
U. S. A.	2,623	2,554	2,823	2,902	2,722	2,354	2,295	2,150	2,231		37.0
Rest of the World	724	830	922	1,078	1,209	1,213	1,335	1,427	1,656		27.5
TOTAL WORLD	4,775	5,013	5,465	5,910	6,009	5,477	5,804	5,773	6,027		100.0

Source : Metal Box

FIGURE 4.1 : WORLD AEROSOL FILLINGS : 1970 - 1978

Source: Metal Box

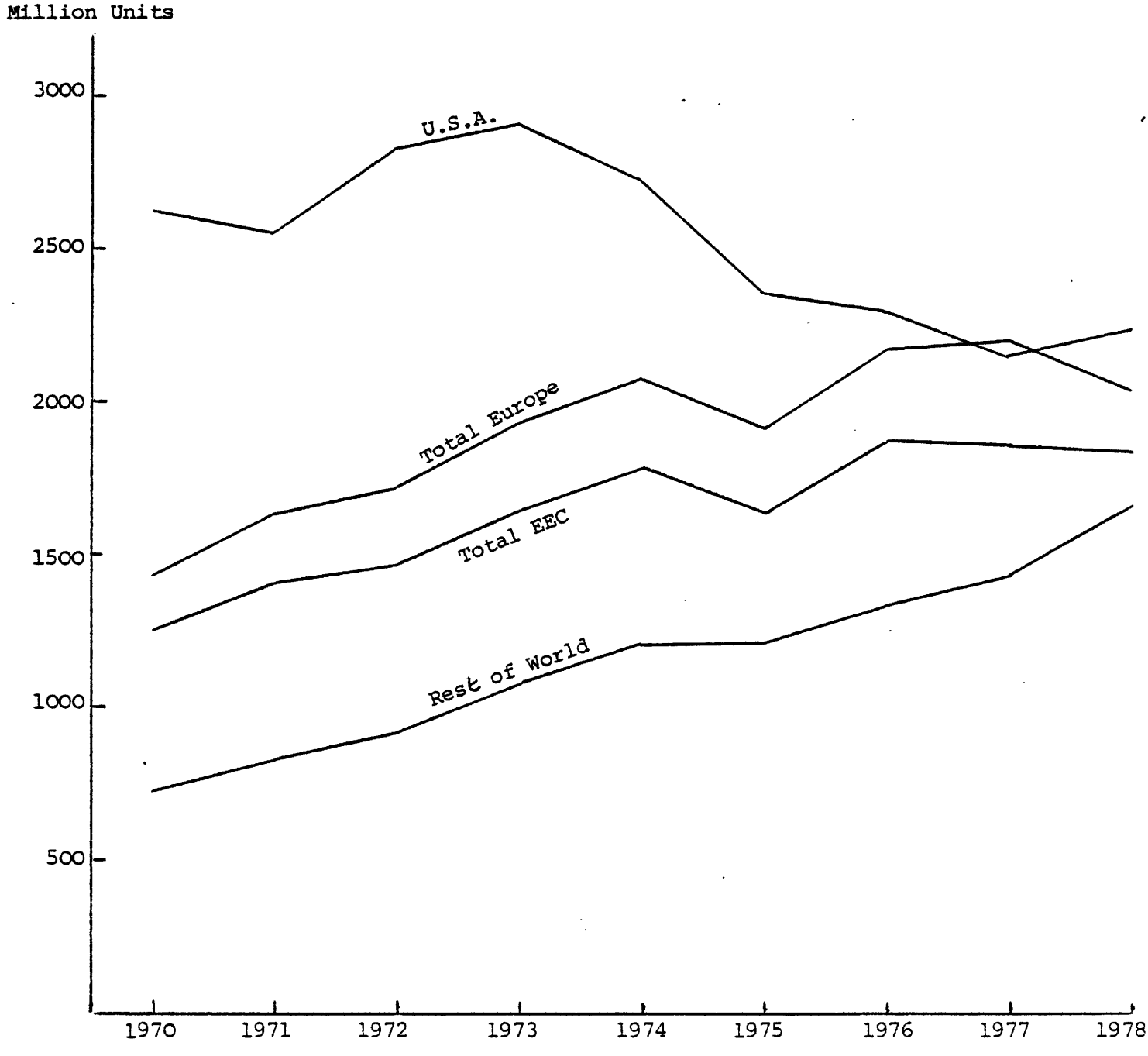

TABLE 4.2 : AEROSOL FILLINGS BY PRODUCT SECTOR IN 5 EEC COUNTRIES : 1976 AND 1978

Fillings - million units	United Kingdom		West Germany		France		Italy		Netherlands		Totals (5 Countries)	
	1976	1978	1976	1978	1976	1978	1976	1978	1976	1978	1976	1978
Hairsprays	139	127	133	121	105	91	56	60	18	13	451	412
Deoderants and Antiperspirants	66	49	140	126	46	31	46	37	12	2	310	245
Other Personal Products	81	90	34	34	155	152	22	22	6	5	298	303
Household Products	96	102	54	64	54	48	32	24	68	83	304	321
Insecticides	47	85	27	25	26	14	55	39	25	23	180	186
Paint	16	28	23	27	3	5	3	7	16	13	261	304
Miscellaneous	50	82	46	53	65	71	39	18				
TOTAL	495	563	457	450	454	412	253	207	145	139	1804	1771
Percentage Distribution												
Hairsprays	28.0	22.6	29.1	26.9	23.1	22.1	22.1	29.0	12.4	9.4	25.0	23.3
Deoderants and Antiperspirants	13.3	8.7	30.6	28.0	10.1	7.5	18.2	17.9	8.3	1.4	17.2	13.8
Other Personal Products	16.4	16.0	7.4	7.6	34.1	36.9	8.7	10.6	4.1	3.6	16.5	17.1
Household Products	19.4	18.1	11.8	14.2	11.9	11.7	12.6	11.6	46.9	59.7	16.9	18.1
Insecticides	9.5	15.1	5.9	5.6	5.7	3.4	21.7	18.8	17.2	16.5	10.0	10.5
Paint	3.2	5.0	5.0	6.0	0.7	1.2	1.2	3.4	11.0	9.4	14.5	17.2
Miscellaneous	10.1	14.6	10.1	11.8	14.3	17.2	15.4	8.7				
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source : Metal Box. Note : These 5 countries accounted for over 96% of EEC fillings in 1976 and 1978.

It would be possible to provide more detailed breakdowns for the individual countries, but comparison then becomes difficult because of variations in product categorisation. Another problem in drawing comparisons is that unit statistics are not a reliable guide to relative product volumes. In their publication of recent aerosol statistics entitled 'Aerosol Figurama' /6/, from which we have abstracted the data presented in this section, Metal Box quote the example of a comparison between German hairspray fillings of 121 m. in 1978 and corresponding UK fillings of 127 m. However, the average German can is larger than the UK equivalent, and possibly 70% more product volume is consumed. Also, the average container sizes for de-oderants and anti-perspirants are smaller than those for hairsprays so that unit figures for these product sectors are not directly comparable.

Useful collations of production, consumption and export statistics for West European countries and the USA have also been compiled by Imperial Chemical Industries Ltd., /7/ but comparative presentation is again impeded by the differences in breakdown adopted by the national aerosol associations, from which Metal Box and I.C.I. derive much of their data.

Although it has not been possible to present comparative filling statistics for the main EEC countries beyond 1978, the 1979 estimates for the United Kingdom have recently been released by the British Aerosol Manufacturers Association. U.K. fillings in 1979 totalled 522 million, a fall of 7.4% from the 1978 total of 563.5 m. The product categories which mainly contributed to the reduction were hairsprays and hairdressings which fell from 127 m. in 1978 to 103.5 m. in 1979 (-18.5%), and insecticides, which declined from 85.0 m. to 60.5 m. (-28.8%). 21% of aerosols filled in the UK in 1979 were exported.

TABLE 4.3 : PROPELLANT USAGE IN THE EEC : 1979

	Propellant Usage Distribution % No. of Aerosol Units			
	Fluoro-carbon only	Hydro-carbon *	Dimethyl-ether ('DME') *	Carbon dioxide *
Belgium	50	28	18	4
Denmark	55	40	-	5
France	70	25	-	5
F.R. Germany	67	23	-	10
Italy	60	30	-	10
Netherlands	10	70	15	5
U.K.	68	30	-	2

Source : Confidential * Including blends with CFCs

4.2 Propellant Usage in the EEC

Little quantitative information is available on trends in propellant usage in the Community beyond that provided through the EFCTC for F-11/F-12 sales for aerosols, and presented in Section 3. It is known, however, that some switches from pure CFC propellants to non-CFC propellants and CFC/non-CFC blends have occurred since 1976 and that further moves in this direction are planned.

Table 4.3 shows estimates from an industrial source of the distribution of propellant usage in EEC countries. The same source notes that the use of dimethylether

('DME') is increasing in Belgium and the Netherlands, and Metra is aware that some major companies in other EEC countries are also evaluating DME based formulations. However, from widespread enquiries we have made of fillers and of propellant and component suppliers it seems clear that the predominant current trend is towards CFC substitution by hydrocarbon propellants.

An annual publication entitled 'Aerosol Review' provides a comprehensive tabulation of most of the aerosol products manufactured and marketed in the United Kingdom, together with commercial and technical information which includes, for the majority of brands, the identity of the propellants used. A specimen page from the 1979 edition of Aerosol Review, /8/ , is reproduced as Appendix 2. Metra has compared the information on propellants given for some 2000 UK brands in the 1977 and 1979 editions and the results are summarised in Table 4.4. It will be seen that the use of non-CFC propellants is concentrated in the household and other non-personal product sectors, but there is some indication of a trend away from CFCs in that the total number of brands declared as using hydrocarbon propellants rose from 190 in the 1977 Edition to 224 in that for 1979, the numbers in the personal product sector being 10 and 24 respectively. In certain instances it is possible to identify when a specific brand has switched from CFC to hydrocarbons.

For 26% of the brands listed in the 1979 Edition the identity of the propellant has not been disclosed although it could readily be ascertained by analysis. Also, there is no equivalent publication for any other EEC country. Our reason for citing 'Aerosol Review' is that it demonstrates that many aerosol manufacturers are prepared to disclose a good deal of technical information about their products, and they presumably believe that no commercial disadvantage is likely to result. On this evidence it would not seem unreasonable for manufacturers

TABLE 4.4 : U.K. AEROSOL PRODUCTS : BRAND AND PROPELLANT STATISTICS - 1977/1979

PRODUCT GROUP	Number of Brands		PROPELLANT - DISTRIBUTION BY NUMBERS OF BRANDS											
			F-11/F-12 (including 100% F-12)		F-12/F-114 (= No. with 100% F-114)		Propane/ Butane		Carbon Dioxide		Other (See Note)		Not Stated	
Personal Products:	1977	1979	1977	1979	1977	1979	1977	1979	1977	1979	1977	1979	1977	1979
Antiperspirants/Deoderants	134	106	94	75	14 (5)	12 (2)	-	3	-	-	-	-	26	16
Hair preparations	178	149	134	110	7	8	-	3	-	-	1 (12/B)	-	36	28
Perfumes/toilet waters	237	245	3	6	180	190 (16)	-	-	-	-	-	-	54	49
Shave Creams	42	42	1	2	23 (1)	19 (1)	9	16	-	-	-	-	9	5
Others	88	65	38	27	21 (1)	21	1	2	-	1	1 Fc	1 Fc	27	13
	679	607	270	220	245 (7)	250	10	24	-	1	2	1	152	111
Household Products:														
Room freshners	68	61	26	21	-	-	37	38	-	-	-	-	5	2
Furniture polishes	39	43	5	5	-	-	30	35	-	-	-	-	4	3
Carpet etc. cleaners	31	26	5	3	1 (1)	1	16	15	-	-	-	-	9	7
Oven cleaners	13	15	-	-	6	6	4	4	-	-	-	-	3	5
Window cleaners	10	8	1	1	-	-	8	7	-	-	-	-	1	-
Leather & fabric treatment	47	48	28	24	-	-	7	10	-	1	-	-	12	13
Others	31	28	11	9	-	-	12	14	-	-	-	1 Fc	8	4
	239	229	76	63	7	7	114	123	-	1	-	1	42	34
Insecticides/Mothproofers	73	77	27	30	-	-	26	31	-	-	1 N_2	1 N_2	19	15
Paints, lacquers, display etc	90	83	61	54	1	1	1	4	-	-	-	1 Fc	27	23
Automotive	212	215	112	112	-	-	10	16	9	7	2 Fc 2 12/B	3 Fc 1 N_2	77	76
Industrial	560	513	311	280	4	1	23	22	-	-	7 Fc	10 Fc	215	200
Medical	86	77	38	37	26	26 (2)	-	-	-	-	1 N_2	1 N_2	21	13
Veterinary	82	75	70	62	1	-	4	2	-	-	-	1 (P/12)	7	10
Miscellaneous	53	37	23	17	-	-	2	2	3	2	-	1 Fc	25	15
TOTALS :	2074	1913	988	875	284 (15)	285 (21)	190	224	12	11	15	21	585	497

Source : 'Aerosol Review', 1977 and 1979. (Further analysis by Metra.)

Note : Fc = Fluorocarbon (not specified); B = Butane; P = Propane.

to be required to disclose propellant identities and concentrations.

4.3 Reasons for Decreasing CFC Usage in Aerosols Prior to EC Council Decision

The statistics presented in Section 3 indicate that a progressive decline in CFC usage in aerosol formulations in the EEC set in some while before the formal proposal for a cutback decision was put forward by the Commission in May 1979.

Public concern about the ozone layer and the CFC propellant ban introduced in the United States undoubtedly stimulated the EEC aerosol industry to intensify research on CFC substitution as an insurance policy against regulatory action in the Community, but the recorded decline in CFC usage in advance of regulation is attributable to a number of factors, including:

a) the economic attraction of substituting CFCs with hydrocarbons and other cheaper propellants and solvents

b) the marketing efforts of the non-CFC propellant suppliers and the filling machinery manufacturers

c) additional confidence acquired by fillers in handling flammable hydrocarbon propellants as a result of research and study of practice in other organisations

d) influence of USA parent companies

e) the view that if regulation is likely it would be as well to gain practical experience of substitution in advance, and to secure consumer acceptance by making progressive step-wise changes in formulations

f) changes in the aerosol market volume and product distribution pattern. The aggregate production of hairsprays, deoderants and antiperspirants in the five major EEC aerosol manufacturing countries fell from 761 m. units in 1976 to 657 m. in 1978 (Table 4.2). In terms of unit numbers this drop of 13.7% would go some way towards accounting for the fall of 15% in F-11/F-12 sales for aerosols over this period, because these products have high CFC contents, typically around 70% when based exclusively on CFC propellants. The aerosol sales decline in these categories may be partly due to changes in hair fashions and the attraction of cheaper non-aerosol deoderant packs, but consumer concern about the ozone depletion threat, augmented by adverse publicity about aerosols, has probably been a contributory factor.

No direct evidence is available as to the relative effects on CFC usage of action by industry and changes in the demand pattern, but it seems likely that the latter was a major factor in the period 1976 to 1978. If the U.K. filling statistics for 1979 are any indication of what has happened in the EEC generally in that year, then the further fall of 7.5% in F-11/F-12 propellant consumption from 1978 to 1979 is also partly attributable to changes in the aerosol sales pattern, since a major factor in the decline of 7.4% in total U.K. fillings was the drop of 18.5% in hairspray and hairdressing sales, and this is a high CFC content product category.

4.4 Conclusions

4.4.1 EEC aerosol fillings peaked in 1976 at 1,873 million units, falling to 1,837 m. in 1978, but the world total of 6,027 m. in 1978 was the highest since the previous peak of 6,009 m. in 1974. For the EEC in 1979 only the UK has reported to date, recording a fall of 7.4% from the 1978 total of

563.5 m., to 522 m., with drops in hairspray and insecticide fillings being major factors in the decline.

4.4.2 Personal products are still the largest sector, accounting for 54.2% of EEC fillings in 1978, but there have been significant falls in fillings for hairsprays, anti-perspirants and de-oderants which have been partly offset by increases in household and other categories.

4.4.3 The CFC/non-CFC propellant usage distribution pattern varies among Member States, reflecting different aerosol product mixes and formulation differences associated with local regulations and economic factors governing the use of alcohols and other solvents.

4.4.4 The reduction in F-11/F-12 propellant usage between 1976 and 1979 is due to an unquantifiable combination of substitution by non-CFC propellants and changes in the aerosol sales pattern. The latter is believed to have been a significant factor because of the overall decrease in fillings coupled with the shift from the personal products sectors with high CFC concentrations, towards household and other sectors which are frequently formulated without CFCs.

5. F-11/F-12 PROPELLANT SUBSTITUTION

5.1 Basic Alternatives

To eliminate or substantially reduce the use of F-11/F-12 propellants while still providing a dispensing device with comparable characteristics there are five basic alternatives available:

A. Propellants which are a component of the filling

1. Alternative fluorocarbon liquefied gas propellants which are currently exempt from the Council Decision and which are also acceptable in respect of physico-chemical properties, biological safety, etc.

2. Non-fluorocarbon liquefied gas propellants, also environmentally and otherwise acceptable, such as propane/butane mixtures.

3. Compressed and dissolved gases such as nitrogen and carbon dioxide.

B. Internal pressure source separate from formulation

This category includes devices in which the expulsion force is provided mechanically by a spring or elastomeric bag, and those in which a propellant gas is separated from the filling by a piston or membrane. The latter type may use much smaller amounts of liquefied gas propellants than are used as ingredients of formulations.

C. Pressure source external to container

These dispensers include manually operated pumps, and those connected to an external source of compressed air.

The industry definition of an aerosol dispenser relates to internally pressurised non-reusable containers and thus excludes Category C, although for marketing and consumer purposes manually operated pumps must be considered as substitutes for aerosols since the mode of dispensation is similar. Under EEC regulations the term aerosol dispenser is restricted to pressurised packs in which a propellant gas is used.

In the October 1978 Metra report the technical situation then obtaining on CFC substitution was reviewed and some recent developments were mentioned. In the present report it is proposed simply to summarise the present situation and to indicate the main directions in which the EEC aerosol industry is heading.

5.2 Principal Substitution Trend : Use of Hydrocarbons

Although in 1978 the main substitution trend in the USA and in Western Europe was towards hydrocarbons, it appeared that a number of alternatives might still play fairly prominent roles. These included:

- dimethylether (DME), as an alternative liquefied gas propellant to CFCs and hydrocarbons

- carbon dioxide, especially in conjunction with CFC propellants

- a distinct possibility that two or three non-perhalogenated fluorocarbons might have significant potentiality

- hydrocarbon-water systems in conjunction with improved vapour tap valves giving safer flammability characteristics and low droplet size with high evaporation rates

- finger operated pumps of greatly improved design, giving higher mechanical advantage and better spray characteristics

- new designs of compressed air actuated devices.

While all these lines of development are finding some share of the market it is now clear that hydrocarbons are the predominant substitute for F-11/F-12, especially in the large volume personal and household product sectors. Although fluorocarbon alternatives have been the subject of intensive research by the major producers, the current situation is that there are no serious contenders as substitutes for F-11/F-12. The prospects for other fluorocarbons are discussed in more detail in Section 5.3 below.

At present, the principal potential alternative or complementary non-CFC propellant to hydrocarbons is DME, and this is reviewed in Section 5.4.

Carbon dioxide makes little headway because of basic physico-chemical limitations: liability to leakage due to the high initial pressure required to provide enough propellant in the system; falling pressure and deteriorating spray characteristics in use; and problems associated with formulation acidity. CO_2/CFC blends made some initial progress in Germany, but are now believed to be giving way to hydrocarbon/CFC mixtures. Nitrous oxide has not been seriously promoted outside France, and seems to have gained no ground: fillers do not view it as having any substantial advantages over CO_2.

The improved vapour tap valves for hydrocarbon - water systems which appeared such a promising development in 1978 have not yet fulfilled the hopes held for them by their inventors. There seem to be a number of technical and economic factors responsible for the failure to make

a major impact: the valves are more expensive than conventional ones, and because the dimensions are so critical there is less versatility, and construction must be closely aligned to formulation. Aqueous systems also have a number of application limitations, and specially developed hair spray resins are needed to provide suitable solubility characteristics.

Finger pumps appear to be finding their main application in the perfume and cologne spray sector, where relatively small volumes are dispensed at a time, and small container sizes predominate. Consumer acceptability in other sectors has been generally disappointing, and pumps are particularly awkward and tedious to use with hairsprays. Other mechanical and compressed air or nitrogen operated devices are largely limited to minor and specialised product sectors.

5.3 Fluorocarbon Alternatives to F-11/F-12

Since 1974, a large number of fluorocarbons has been examined - or re-examined - as potential alternative propellants, and following initial screening for physico-chemical properties and acute toxicity, the most promising survivors have undergone longer term biological assaying for chronic inhalation effects, and mutagenic, teratogenic etc. characteristics.

The outcome as at September 1979 has been reviewed by J.D. Sterling of Du Pont (USA), /9/ , who states that only three compounds are still in the running:

Fluorocarbon Ref. No.	Formula	B.pt. °C
F-152a	$CH_3.CHF_2$	-25
F-142b	$CH_3.CClF_2$	-10
F-22	$CHClF_2$	-40.6

Of these, only F-152a is currently considered acceptable as an aerosol propellant, and Du Pont recommend it for use in colognes, breath sprays, insecticides, feminine hygiene sprays, medical pharmaceuticals and paints. On making enquiries, we were advised in January 1980 by Du Pont de Nemours International S.A. that F-152a is not being produced in Europe, and that: 'the relative high production cost of F-152a would make it unlikely that this product might eventually become a serious replacement for propellants like F-11 and F-12'.

F-142b is said to be attractive as a propellant for dry type antiperspirants, but more toxicological data is needed before it can be recommended.

F-22 is considered to have important commercial potential as a propellant - it is already in general use as a refrigerant - and toxicological testing is expected to be completed in 1980.

To sum up, it appears that only F-22 - if proved safe - would be likely to have any large volume potentiality as a propellant, but it is more expensive than F-11/F-12, and although less stable in the troposphere it cannot be considered innocuous to the ozone layer. The present situation, therefore, is that no fluorocarbon substitute for F-11/F-12 is available and in our view the prospects for the only remaining candidate, F-22, must be considered dubious.

A few words must be added about the other perhalogenated CFCs, F-113($C_2Cl_3F_3$) and F-114($C_2Cl_2F_4$) which are used

in aerosols in the EEC but are not covered by the Council Decision, although in the USA they are subject to the same prohibitions as F-11 and F-12.

F-114 is mainly used in place of F-11 in personal products such as shave foams and perfume sprays because of its greater stability in aqueous systems. As it costs more than twice as much it is unlikely to be used simply to reduce usage of F-11 to conform with the Decision requirement, and since it is also ranked as a potential threat to the ozone layer if released in sufficient quantities, any greatly increased usage would only invite regulation. In 1977, sales in the EEC of F-114 for aerosols amounted to 5261 tons, or 3.2% of the F-11/F-12 propellant tonnage. F-113 sales for aerosols were smaller still - 120 tons in 1977 - the principal application being in cleaning sprays, in which F-113 functions as a solvent rather than a propellant.

The production and use of F-113 and F-114 are not currently being monitored in the EEC, and although annual checks appear unnecessary it may be advisable to repeat the 1976/77 surveys every four years or so, as long as restrictions on CFC usage continue.

5.4 Dimethylether ('DME')

DME - $CH_3.O.CH_3$ - is a liquefied gas, boiling point - 25°C(-13°F), which is produced in an aerosol and also a technical grade in Western Europe by Union Rheinische Braunkohlen Kraftstoff AG of Wesseling, Köln. The aerosol grade is distributed under the trade name 'Aeropur' by Aerofako bv of Apeldoorn. In volume terms the ex-works price is about 50% above that of hydrocarbon propellants but less than a third of that of F-11/F-12.

DME has been enthusiastically promoted as a propellant by Aerofako for some years, but while it finds significant

application in Belgium and the Netherlands (see Table 4.3), and it has been considered by many fillers including major multi-nationals, it has not yet been adopted elsewhere in Europe or in the USA - although there are signs that breakthroughs in both these areas may occur within the next year or so. By contrast it is being used in Japan - where it is available from four manufacturers - to the extent of more than 100 million units annually, mainly in paints, insecticides and industrial aerosols, but not in personal products.

The principal virtues claimed for DME include:

- lower flammability than hydrocarbons

- low toxicity on inhalation, and to the skin, as demonstrated by biological tests to date

- environmental safety (it is considered to present a negligible threat to the ozone layer if released in amounts similar to current CFC emissions)

- suitable vapour pressure/temperature characteristics (similar to F-12)

- partially miscible with water and completely miscible by addition of 6% ethanol

- permits formulation of water based compositions up to 65% 'flammables' showing less than 20 cm. flame extension test. (This test does not figure in EEC regulations, under which formulations containing 45% or more flammables are classified as flammable and must be so labelled, but is recognised in Switzerland and Scandinavia).

- good polar solvent characteristics for perfumes, resins, insecticides, etc., making it a superior solvent to hydrocarbons and a cheaper alternative to ethanol when the latter is subject to excise duty

- compatibility with perfumes and fragrances

- usable as a propellant for most applications except foam products - it has foam breaking properties

- can be used in conjunction with CFCs and with methylene chloride.

The past reluctance of many major fillers to consider DME is linked with a number of doubts and fears including the explosion hazards of peroxide formation to which some ethers are prone; the possible formation in contact with chlorine compounds of a carcinogen; bis (chloro-methyl) ether - 'BCME'; toxicity generally; and that there is only one supplier in Western Europe and, indeed, possibly only one supplier of the Aeropur purity grade in the World.

In rebuttal, Aerofako have adduced evidence discounting the dangers of peroxide and BCME formation, and an extensive toxicity testing programme has been initiated which is being supported by the Netherlands Government. This programme is partly complete with acceptable results to date, and it is claimed that more data is already available on DME than on hydrocarbon propellants.

In recent discussions with fillers we found a spectrum of views, ranging from acceptance and active consider-ation, through continuing misgivings to firm opposition.

As one of the objections is that there is only one source of supply of the aerosol grade, and there were doubts about capacity, a visit was made to URBK at Wesseling to clarify the position. The answers obtained to our questions are summarised below:

a) Production Process and Capacity

DME is a co-product of the high pressure synthesis of methanol by reaction of carbon monoxide with hydrogen, and it arises essentially from the dehydration reaction:

$$2CH_3OH \longrightarrow CH_3.O.CH_3 + H_2O$$

The DME yield is controllable by varying the process conditions and is typically variable between 10,000 and 30,000 tons per annum. After separation from the methanol there is an additional purification step to produce propellant grade DME.

b) Continuity of Production

The hydrocarbon feedstock position is considered guaranteed but in the longer term it would be practicable to switch back to coal for synthesis gas production. The methanol plant has several reactors so that DME production can continue during reactor maintenance and there are two DME separation units.

c) Expansion of Output

The methanol market is expanding and is several hundred times the present DME market. Additional DME capacity could be created at relatively short notice by further integration of methanol capacity with the methanol-DME separation process. Storage capacity and distribution facilities could be expanded accordingly

and URBK believe the they would have at least 12 months notice of any major increase in demand.

d) Effect on Price of Higher DME Output

At present, over 80% of DME output is produced as technical grade for making dimethylsulphate - the only application of DME apart from aerosols. Aerosol grade is sold at a premium price to cover the extra purification costs; installation of additional capacity at present day capital costs could lead to a marginal price increase.

e) Other Supply Sources

No other sources of a grade equivalent in purity to Aeropur are known. Ugine Khulmann make DME in Europe; Japanese producers offer technical grade for use in non-personal product aerosols; Du Pont in the USA make a technical grade and may decide to produce an aerosol grade.

URBK thus appear to have facilities for meeting forseeable growth in demand for Aeropur in Europe, and to be able to assure continuity of supply against interruptions by ordinary equipment failures and routine overhauls. Nevertheless, a finite risk of major disaster attaches to any petrochemical complex, and it is understandable that potential users of DME would prefer to see alternative West European suppliers in other locations; in addition to the supply guarantee aspect, transport costs would also be reduced. This is a typical 'chicken and egg' situation in that a single supply source retards acceptance of DME propellant, but growth of demand might well lead to the emergence of other producers.

Technically, given acceptance that there are no hidden hazards, DME clearly has the potential to assist in

overcoming a number of the formulation difficulties generated by restrictions on CFCs, and the incentive to use DME would increase in the event of a further cutback in F-11/F-12 usage beyond the 30% minimum. A more widespread adoption of DME propellant seems essentially a matter of confidence.

5.5 Technical and Socio-Economic Aspects

5.5.1 General

It is not part of this study brief to attempt to evaluate the socio-economic consequences of the Council Decision, and the purpose of the following comments is simply to highlight the principal problems which are likely to be encountered. The socio-economic implications of a major cutback in CFC usage were examined in our 1978 report and we must first say that no fundamentally new aspects have arisen. To the extent that the Decision can be satisfied by a reduction of only 30% in CFC usage in aerosols, the socio-economic impacts will be much less severe than those resulting from the total ban scenarios examined in the previous study.

5.5.2 The CFC Manufacturing and Allied Industries

In our 1978 report we concluded that the over-capacity situation arising from a total ban on CFC propellants would entail plant closures and possibly some restructuring of the CFC manufacturing industry. Concomitant problems would arise in associated industry sectors, particularly fluorspar mining, hydrofluoric acid, chlorine/caustic soda and hydrochloric acid; and carbon tetrachloride and co-produced chlorocarbons.

As shown by the statistics presented in Section 3, the fall from 1976 to 1979 of 40,362 tons in sales of F-11/ F-12 in the EEC for aerosols was partly offset by increased sales for other applications, mainly foam plastics, so that the net reduction in total sales by the CFC producers was only 26,400 tons. We must re-iterate, however, that major difficulties could occur if the 30% reduction is considerably exceeded - either as a result of further regulation, or because substitution measures by the aerosol industry go well beyond the minimum requirement. Indeed, the Italian authorities believe that any reduction in CFC sales has an adverse effect on their fluorspar industry.

The resource limitations of the 1978 socio-economic study coupled with commercial confidentiality barriers made it impracticable to evaluate in depth the consequences of a severe CFC butback for every sector of the chemical and fluorspar mining industry involved. The advisability of conducting such studies should, perhaps, be considered in the event of such a cutback appearing probable, but a high degree of co-operation and frank disclosure would be needed from industry for the studies to yield reliable quantitative results.

5.5.3 The Aerosol Manufacturing Industry

This sector can be considered in the context that, to conform with the Council Decision, the EEC aerosol industry will rely mainly on substitution by hydrocarbon propellants, which may be complemented to an increasing extent with DME.

The problems of conversion to hydrocarbon propellants were dealt with at length in Section 4 of the 1978 Metra

report and the discussion need not be repeated here. Since that time, although further research and development have enabled manufacturers to decide with more confidence how they can best re-formulate to reduce CFC usage, there have been no major technical innovations and the fundamental problems and their implications remain. We believe the most important of these to be as follows.

a) Aerosol Filling : Conversion to Flammable Propellants

Fillers not already equipped to use hydrocarbons or DME or who need to expand existing facilities may face two problems:

- the extra capital requirement represented by new equipment and alterations entailed to meet the safety precautions needed, including the specific requirements of local regulations.

- the necessity to re-locate the filling plant if the safety requirements cannot be met at the present site. Re-location will increase the capital cost of conversion and may involve re-deployment and other personnel and management problems.

For fillers who cannot convert to hydrocarbons and for whom no acceptable alternative is available the options are to cease aerosol manufacture or to switch to contract filling. To repeat our 1978 prediction, the net consequence to the industry is likely to be a re-structuring whereby some major contract and self-fillers will grow larger, and the number of small and medium capacity fillers will decline.

In terms of employment these changes will be socially beneficial in some areas and have adverse effects in others, but they will not necessarily reduce the overall added value component of sales. Even without regulation

there would have been a trend towards substitution for cost saving reasons, and fillers adhering exclusively to CFC propellants were liable to become uncompetitive.

From the safety angle - also an important social factor - it may be as well for flammable propellants to be handled mainly by the larger organisations which will be less likely to cut corners in respect of equipment and working practices, and which can provide the back-up technical and management resources needed to maintain the highest standards of safety.

At the 3rd Meeting of National Experts in Brussels in April 1980, no socio-economic appraisals of the consequences of CFC aerosol propellant regulation were mentioned more recent than those provided by the Metra studies for the Netherlands in 1976, and the EEC as a whole in 1978. A number of delegations made the point, however, that net socio-economic disturbance is more likely in countries such as Denmark and Ireland where all the fillers are comparatively small, than in the larger countries where there is a spectrum of business size and an internal transfer of trade can occur. The view was also expressed that a gradual step-wise reduction in CFC usage, such as is now happening through the use of CFC/hydrocarbon blends in some personal product sectors, is to be preferred on socio-economic grounds (including that of safety) to more substantial and abrupt reductions.

b) Aerosol Marketing: the Product Flammability Problem

Under EEC regulations aerosols containing a total of 45% or more of flammable substances are classified as flammable and most carry prescribed warnings. The industry believes that this can be a considerable marketing disadvantage at the wholesale, retail and consumer levels, especially with personal and household products. With water based products such as

shave foams and household polishes it is possible to replace CFCs entirely while still keeping below the 45% flammables limit, but difficulties arise particularly in non-aqueous personal products, where limits also apply on the concentration of methylene chloride - 35% under the EEC Cosmetics Directive.

A typical hairspray formulation might contain the maximum of 35% methylene chloride, 15% alcohol and the balance CFCs. Over half the CFC content can be replaced with hydrocarbons without exceeding the 45% limit but further substitution will incur a flammable classification. The problem is minimised by limiting the minimum CFC usage reduction to 30% but will be aggravated in the event of decisions to go beyond this level.

Some members of the industry regard this as a marketing rather than a technical problem, i.e. a matter of gaining customer acceptance of the flammability classification. There are also arguments in favour of changing the regulations so that they relate to the closed drum and flame extension tests instead of concentration. In practice, fillers do have regard to flame extension, and another economic aspect is that if discharge rates are reduced on this account, product life may lengthen and unit sales decreased.

c) Variation in Alcohol Regulations in the EEC

It is important to appreciate that CFCs are multi-functional aerosol ingredients. This particularly applies to F-11, which with a boiling point of 23.8^{o}C is not itself a propellant, and whose functions are to act as a vapour pressure moderator and as a solvent and diluent.

Hydrocarbons are relatively poor solvents (DME scores in this respect) and formulation problems can occur when they replace CFCs, especially in non-aqueous systems. The facility to use alcohols, especially ethanol and iso-propanol, which are good solvents, adds an important element of flexibility in formulation. Because of major differences between the regulations of EEC Member States governing the use and cost of alcohols, particularly in cosmetic products, the extent of this formulation flexibility varies from country to country, thus imposing unequal burdens on individual manufacturers and marketers and interfering with free competition.

Aspects to which fiscal and other regulatory differences apply include:

- rates of excise duty and tax
- sources and types which may be used: agricultural vs. synthetic; ethanol vs iso-propanol
- extent to which duty and tax relief applies to exports
- importation restrictions in respect of type, origin and tax rates
- monopoly or free supply
- de-naturation regulations.

The regulations apply most onerously in France and Italy, and least in the UK. Some details were provided in Table 4.7 of our 1978 report, and the FEA has recently provided the Commission with a summary of the current situation in each Member State.

It is not so much harmonisation as relaxation of the more onerous measures which would assist the industry to cope with re-formulation dictated by CFC usage reduction. The problem is difficult to tackle because of the contentious political and economic issues involved, including protective agricultural policies. It

has been discussed between the FEA and the Commission and it is generally accepted to be a matter which must be treated as a separate issue from CFC regulation. A first step would be to obtain quantitative evidence about the inequalities imposed on industry, but this would be a major exercise and not one which trade federations are likely to have the internal resources to attempt in the short term.

At the 3rd Meeting of National Experts a view was expressed that a special review should be made of all non-CFC propellants and solvents which might be used in aerosols, in order to evolve a 'positive list' of acceptable substances.

5.6 Conclusions

5.6.1 Hydrocarbon (propane/butane) propellants are proving to be the principal substitutes for F-11/F-12, with many fillers preferring to make gradual changes by using CFC/hydrocarbon blends. In Germany there is some use of CFC/carbon dioxide blends.

5.6.2 Dimethylether (DME) has potential as an alternative to hydrocarbons because of better solvent properties and miscibility with water. DME is mainly being used in Belgium and the Netherlands; fillers in other countries have a more cautious attitude towards adopting DME pending a fuller examination of its toxicological and environmental properties and research on these aspects is being supported by the Netherlands Government. Results to date are said to be very encouraging.

5.6.3 No fluorocarbon alternatives for F-11 and F-12 acceptable for large scale general use have yet emerged.

5.6.4 No recent quantitative data or estimates relating to the socio-economic impact of F-11/F-12 propellant usage reduction and substitution has been put forward by any Member State.

5.6.5 There is substantial capital investment entailed in converting to the principal CFC substitute - hydrocarbons - because of the extensive safety precautions required. In urban areas it may be impracticable to comply with local regulations, so that a filler may have the options of moving that part of his operations to another site, ceasing to produce aerosols, or employing a contract filler.

5.6.6 The cost and other problems attaching to conversion bear more heavily on the smaller fillers, and it is expected that the overall effect of reduced F-11/F-12 usage will be that some large fillers will expand their businesses and some small fillers will cease operation. In countries where there is a spectrum of aerosol business size the transfer of trade will reduce the net socio-economic disturbance, but there could be a greater net effect in countries such as Denmark and Ireland where all the fillers are comparatively small.

5.6.7 Any reduction in overall CFC production adversely effects the fluorspar mining industry and this is of special concern in Italy. A reduction of F-11/F-12 usage in aerosols going much beyond 30% is also likely to cause socio-economic problems in the CFC producing and allied industry sectors, because there is already an over-capacity situation and sales of CFCs for aerosols in the EEC in 1979 accounted for 45% of production.

6. NON-AEROSOL APPLICATIONS OF F-11 AND F-12

6.1 Opportunities and Problems

Before contemplating making reductions in CFC usage in aerosols substantially beyond that provided by the present Council Decision, it would be appropriate to review the principal non-aerosol uses and the potentialities for substitution.

The statistics presented in Section 3 show very clearly that the greatest scope in the EEC lies in the use of F-11 and F-12 as blowing agents for plastic foams. This application accounted for 25.4% of sales in the EEC in 1979, whereas refrigeration sales were only 9.2% and miscellaneous uses 3.2%.

The possibilities for reducing CFC usage in non-aerosol applications have been receiving extensive examination in the United States, and the findings of the National Academy of Sciences Committee on Alternatives for the Reduction of CFC Emissions were reported towards the end of 1979, /10/. Possibilities for reduction in release from refrigeration and plastic foam applications are also considered in the UK Department of Environment Pollution Paper No. 15, /11/.

It is recognised that scope exists for some substitution for the perhalogenated CFCs used in refrigeration and air conditioning, and also for reducing losses in manufacture, operation and maintenance - which probably account for 70% or so of refrigerant sales in the Community. These losses are capable of being substantially reduced and it has been suggested that an international code of practice to this effect should be evolved.

In the plastic foam application the greatest use is in the manufacture of flexible and rigid polyurethane (PU) foams. Flexible PU foams such as are so extensively used in furniture and vehicle upholstery can be made without CFC blowing agents, but not some of the most important (low density) grades. Further research is needed on non-CFC blowing agents such as methylene chloride, and on the practicability of CFC recovery.

The CFCs used in making rigid PU foams are gradually released during the life of the foams but make an essential contribution to their insulation properties and hence an important contribution to energy conservation. No alternatives for this application are in sight and if this use were to be curtailed industry would have to resort to other insulating materials with less advantageous characteristics.

The problems of non-aerosol applications of CFCs are receiving most attention in the USA, and it would be important to study the results to date in detail before considering what action might be taken in the Community to implement reductions in these areas of CFC usage.

6.2 Conclusions

6.2.1 Scope for reducing F-11/F-12 usage in non-aerosol applications in the EEC lies mainly in plastic foam production and refrigeration, which respectively accounted for 25.4% and 9.2% of sales in the EEC in 1979.

6.2.2 There are potentialities for substitution and preventable loss reduction in refrigeration, but the technical and economic problems in reducing usage for polyurethane and other plastic foams are more complex.

6.2.3 The possibilities for reducing CFC release from non-aerosol applications are being extensively researched, especially in the USA, and the results to date merit careful examination.

7. CFC REGULATORY POSITION WITHIN AND OUTSIDE THE EEC

No regulatory action on CFC usage has yet been introduced by Member States of the Community as a result of the Council Decision adopted in March 1980, and the present position is that regulation has been introduced or is pending in five countries: The Netherlands, Norway, Sweden, the USA and Canada.

7.1 The Netherlands

To date this is the only EEC country to have adopted any regulatory measure.

A requirement that aerosols containing CFCs must carry a warning of possible effects on health and the environment was promulgated in 1978 and came into effect in April 1979.

The Netherlands Ministry of the Environment is responsible for ensuring compliance and this is being checked by analysis of samples.

7.2 Norway

Under a Product Control Act of June 1976, the Norwegian Ministry of the Environment issued regulations on 1st June 1979 which provide for prohibition after 1st July 1981 of the manufacture or import of aerosols employing completely halogenated chlorofluorocarbons as propellants.

Dispensation of the prohibition is given in respect of medical products as described in an Act of 1964, and other exemptions may be granted by the State Pollution Control Authority which may stipulate 'such conditions as are found to be necessary'.

Enforcement is the responsibility of the State Pollution Control Authority, whose decisions may be appealed to the

Ministry of the Environment, and penalties for violation of the regulations, including fines and other sanctions, are as provided under the 1976 Product Control Act.

7.3 Sweden

Under an Ordinance (1973:334) on Products Hazardous to Health and to the Environment, an Amendment was issued on 15th December 1977 providing for a new section to be added with the following wording:

'Aerosol dispensers containing propellants in the form of fully halogenated chlorofluoroalkanes shall not be manufactured or imported after June 30th, 1979.

If the aerosol dispenser is intended for medical use the Products Control Board may exempt it from the provisions of the first subsection above. Such exemption may also be granted if there are any other special grounds for so doing.'

7.4 United States

The United States was the first country to introduce restrictions on the use of CFCs in aerosols. Initially, aerosols containing CFCs were required to carry a label warning that CFCs might be harmful to health and the environment by damaging the ozone layer. In March 1978 the Environment Protection Agency, the Consumer Product Safety Commission and the Food and Drug Administration registered federal regulation defining a three stage schedule for eliminating the use of fully halogenated chlorofluoroalkanes in all 'non-essential' aerosols:

- from October 15, 1978, no company could manufacture CFCs for use as a propellant in non-essential aerosol products;

- from December, 1978, the use of CFC's as propellants in non-essential aerosols was to cease;

- from April 15, 1979, products containing CFC propellants were not to be introduced into inter-state commerce.

A mechanism exists for granting exemptions in respect of products which can be shown to fulfil an essential purpose and for which there is no technically feasible alternative to the use of a CFC in the product. Exemptions listed in the March 1978 regulations included:

a) Mercaptan stench warning devices

b) Release agents for molds used in the production of plastic and elastomeric materials

c) Flying insect pesticides for use in non-residential food handling areas, and for space spraying of aircraft

d) Diamond-grit spray

g) Non-consumer articles used as cleaner-solvents, lubricants or coatings for electrical and electronic equipment

f) Articles necessary for safe maintenance and operation of aircraft

g) Uses essential to the military preparedness of the United States

h) Certain medical products including metered-dose steroid, adrenergic bronchodilator and ergotamine tartrate human drugs for nasal/oral inhalation, and contraceptive vaginal foams for human use.

We understand from the EPA that there have been no significant additions to the above exemptions since 1978, most of the questions arising having concerned interpretation. No problems with enforcement of the regulations were mentioned to us.

Although no embargo exists on the export of fully halogenated CFCs from the United States, the EPA has proposed a rule under the Toxic Substances Control Act (TSCA) whereby an exporter will be required to submit to the EPA a notice each calendar year in respect of each country to which a regulated CFC is to be exported. The EPA will then advise the countries of import about the U.S. regulatory action on CFC usage in aerosols.

At a Meeting on International Regulation of Emissions of CFCs held in Oslo in April 1980 it was announced that the EPA would propose a regulatory production ceiling where U.S. production of CFCs for domestic use and export would be frozen at the 1979 level, assessed at 253 thousand metric tons.

7.5 Canada

In 1976 the Canadian aerosol industry gave a voluntary undertaking to the Federal Government to reduce the consumption of CFCs F-11 and F-12 to 50% or less of the 1974 level, and the target was said to have been achieved in 1977.

Subsequently, following discussions with industry and socio-economic studies, regulations were promulgated in March 1979 under the Environmental Contaminants Acts prohibiting the use of totally halogenated chlorofluoroalkanes as propellants in manufactured or imported aerosol products in three product sectors: hairsprays, deoderants, and antiperspirants.

The regulations were intended to become effective from 1st December 1979, but there was a postponement due to an appeal from a CFC manufacturer which was eventually withdrawn, and it is understood that implementation is now imminent.

7.6 EC Decision Compared with Other Regulations

There are five important contrasts between the provisions of the EC Council Decision and those of regulations applying outside the Community:

a) The Council Decision relates only to F-11 and F-12. All other regulation applies either to all fully halogenated CFCs or to fully halogenated chlorofluoroalkanes, and thus includes F-114, which is frequently used in conjunction with F-12 as a propellant for perfume and cologne sprays.

b) None of the existing regulation outside the EEC imposes a standstill on CFC production capacity, as does the Council Decision, although the U.S. Environmental Protection agency is proposing that U.S. production should be frozen at the 1979 level. A production ceiling in the EEC with respect to the same year would be a more stringent requirement than the ban on raising capacity, because there is currently a surplus of production capacity in the Community.

c) The effect of the regulation outside the EEC is to secure a cutback in CFC usage in aerosols with respect to a recent reference year considerably greater than the 30% reduction required in the Community. (The reduction is expected to be over 88% in Canada, and 95% or more elsewhere.)

d) The Council Decision is non-specific as to aerosol product sector. Other regulation either relates to specific products (Canada), or imposes a blanket prohibition with provision for specific exemptions.

This is interesting in that if certain aerosols containing CFC propellants are considered to be 'essential', then the 30% minimum reduction in the EEC must be achieved by obtaining a reduction of more than 30% overall in the other product sectors.

e) The Council Decision is unique in specifically providing for an early review of the restrictive measures in the light of available economic and scientific evidence.

7.7 Conclusions

7.7.1 Within the EEC the only existing national regulation is the Netherlands requirement for all aerosols containing CFCs to carry a warning of potential damage to health and the environment.

7.7.2 Outside the EEC, regulatory action against the manufacture and importation of aerosols containing CFC propellants has been taken in Norway, Sweden and the USA, and is pending in Canada. The Canadian regulation applies to hairsprays, anti-perspirants and de-oderants; elsewhere the ban applies to all except specially exempted applications such as in certain pharmaceuticals.

7.7.3 The Council Decision applies only to F-11 and F-12 and is non-specific as to aerosol product sectors; external regulation applies to all fully halogenated chlorofluoroalkanes, including F-114, and specifies either the products affected or the exemptions.

7.7.4 The United States proposes to limit CFC production for domestic use and exports to the 1979 level. The EEC decision to freeze production capacity leaves scope for expanding production because capacity considerably exceeds demand.

8. IMPLEMENTATION OF THE COUNCIL DECISION

8.1 General Considerations

We are concerned here with the action to be taken to implement the provisions of Article 1 of the Council Decision of March 1980 relating to a 'freeze' of F-11/F-12 production capacity and a reduction of 30% in F-11/F-12 usage in aerosols.

Since the Decision is addressed to Member States, individual governments are responsible for giving effect to the Decision, and there are three possible courses of positive action:

a) Direct regulation, having an assessable quantitative outcome, such as a ban on the use of CFCs in particular products.

b) Indirect measures, for example a tax on CFCs used in aerosols, which will discourage but not limit CFC usage.

c) Conventions with industry, i.e. contracts or agreements whereby industry will undertake specific measures designed to achieve compliance with the Decision.

In the following sub-sections aspects of these alternative approaches are discussed in relation to the Decision requirements, and in accordance with the Council request, special consideration is given to the convention concept.

8.2 F-11/F-12 Production Capacity Standstill

From the observed trends in CFC sales it is unlikely that there will be any commercial incentive to increase total production capacity in the EEC for some years.

While it would be possible to effect the standstill by regulation this would appear an unnecessarily cumbersome procedure when there are no more than two producers in any EEC country, and it should suffice for governments to obtain undertakings from the producers in their territories not to raise capacity without prior consideration.

8.3 Reduction of CFC Usage in Aerosols

8.3.1 Alternative Means

Fundamentally there are only two ways of obtaining the required reduction although there are numerous methods of catalysing these:

a) Reduction in aerosol sales volumes, especially of the higher CFC content products.

This has already occurred in the main personal product groups due to demand pattern changes, and various approaches are available for fostering this trend (see Section 6.3.2 below).

An extreme mode would be the total withdrawal of aerosol packs for certain types of product, but this could hardly come about by voluntary action and many would consider it a gross interference with freedom of choice.

Obviously this means of reducing CFC usage will not appeal to industry unless profit losses in aerosol products are counterbalanced by gains in other sectors.

b) Formulation changes, involving the reduction or complete elimination of the CFC content.

As discussed in Section 5 (and in Section 4.5 of the 1978 report) this is now practicable for all the major and most minor product categories, although not necessarily without affecting product quality or causing the product to be classified as flammable.

8.3.2 Sectors Able to Effect or Influence Reduction

Action to reduce or promote reduction of CFC usage in aerosols can be taken mainly by:

a) Consumers - by changing product demand patterns, or preferring products in non-aerosol forms of packaging.

b) Aerosol manufacturers and marketers - by reducing the CFC content of formulations, and by switching promotional emphasis and development effort to non-aerosol packaging. Pricing policy could also be used.

c) Suppliers to Aerosol manufacturers and marketers - e.g. by developing components and systems which facilitate production of high quality aerosols with lower CFC contents, and by providing technical advice and services.

d) Trade associations and federations, by influencing members (and non-members) to co-operate in following defined policies and participating in conventions, and by disseminating technical information relating to CFC substitution.

e) Governments - by introducing regulatory restrictions; making compacts with industry; and by influencing industry and public opinion.

f) The media, environment conservation organisations, consumer groups and other bodies contributing to modifications in public attitudes and behaviour.

8.3.3 Regulatory Measures and Potential Barriers to Trade

Possible regulatory measures applicable to the manufacture and marketing of aerosols include:

a) A ban on CFCs F-11 and F-12 in new brands in specified product sectors.

b) A ban on these CFCs in all brands of specified products.

c) CFC concentration limits in specified products or in all except exempt products, possibly with a schedule of stepped reductions in maximum allowable concentrations.

d) Labelling of aerosols containing CFCs, including a warning of environmental hazard.

e) Import licences and quota restrictions for aerosols containing CFCs.

The main argument in favour of regulatory measures is that if properly designed and fully enforced they will guarantee that a CFC reduction target will be achieved.

A disadvantage of regulation is its rigidity, and it can be contended that fillers should be allowed reasonable latitude in how they re-formulate to meet the required reduction. One filler might prefer to make a major

reduction in one product, another to make smaller reductions in several: does this matter if the overall target is achieved?

Another problem of specific regulation, such as the introduction of CFC concentration norms that is mooted in one country, is that unless such regulations are harmonised among Member States they will result in inequalities in competition, especially in export markets, since they can affect product price and quality. Indirect regulation, such as excise duties on CFCs at different rates would be particularly liable to interfere with free competition, as is already the case with alcohol regulations and duties.

Whereas total ban type regulations are relatively easy to enforce, because it is simply necessary to check the presence or absence of CFCs in a product, enforcement of a reduction scenario by imposing conentration limits would entail extensive quantitative analysis.

8.3.4 Impracticability of CFC Rationing by Producers

It would be wrong to suppose that a reduction in CFC usage could be effected by enjoining CFC producers to restrict supplies to their customers because it would be impossible to devise a fair and workable system, and any form of rationing other than that associated with force majeure such as plant failure would probably be illegal.

To illustrate the difficulties, consider two fillers receiving similar amounts of CFCs in 1976 and being allocated 70% rations on this basis. Since that year one firm might have expanded its business relative to the other and would therefore have a much greater problem in coping with the reformulations entailed. There would also be the question of how to deal with fillers who had started operations after 1976, and with fillers taking CFC supplies from more than one producer.

8.3.5 Contracts between Governments and Industry

An alternative to governmental ordinance is some form of contract or convention between government and industry. It might be supposed that another option is a voluntary undertaking on the part of the aerosol industry but this is most unlikely to be politically acceptable in all member states, especially those with a leaning towards regulation, and a firm contractual agreement is considered to be the only realistic alternative.

The principal advantages of the convention approach are speed and flexibility. Most governments have already enacted environmental control legislation under which regulations on CFCs could be issued, but while it is easy to specify a ban it takes much longer to devise restrictions having a limited effect. Each government would have to obtain data on the amounts of CFCs being used in the various product sectors and extensive discussions with industry could be involved in arriving at fair and practicable measures. Bearing in mind the desirability of harmonising these measures as mentioned in Section 8.3.3, the administrative processes could be so lengthy as to be incompatible with the timescale of the Decision. Conventions requiring an overall reduction would be less burdensome to industry and provide more scope for competitive ingenuity in re-formulation.

It is concluded that for the purpose of the present Council Decision the convention concept is the better approach, and it is developed in the next Section.

8.4 Conclusions

8.4.1 Means available to Member State governments for implementing the Council Decision to freeze F-11/F-12 production capacity and reduce usage in aerosols are:

- direct regulations having calculable effects, such as concentration limits or bans on F-11/F-12 in particular aerosol products

- indirect action, such as fiscal measures, to discourage CFC usage but imposing no specific restrictions

- conventions, whereby industry would undertake action designed to ensure compliance with the Decision.

8.4.2 Having considered the alternatives, the reduction in F-11/F-12 usage in aerosols in 1979 reached, and the evident progress in CFC substitution, the convention concept is concluded to be the most satisfactory approach, mainly on grounds of speed and as being the least burdensome to industry.

9. THE CONVENTION APPROACH

9.1 Feasibility

The essential ingredients for success in the convention approach are:

- credibility - all the parties involved, particularly Member State governments, must be convinced that there is a very high degree of probability that the approach will meet the Decision requirements and operate equitably within industry and as between Member States.

- acceptability - the convention concept must be acceptable to the Community as a whole and individual Member States, and command very substantial and active support from industry in every EEC country.

- homogeneity - for the smooth functioning of the approach and compatibility with the Community Treaty conditions, it is important that similar provisions should apply in each country.

- verification - reliable systems must be operated for monitoring progress towards the target and verifying its attainment.

Regarding acceptability, there appears to be no doubt that although industry does not regard the need to reduce CFC usage to be proven on scientific grounds, it much prefers the convention concept to regulatory measures. From discussions with officers of the FEA and others it is also clear that industry is anxious to demonstrate its ability to implement agreements of this type, and recognises that failure could lead to the imposition of irksome restrictions and destroy confidence in assurances given by trade associations and federations in the future.

As to acceptability by governments, this has not yet been generally established but our impression is that the larger Member States favour conventions but that some of the others are disposed to regulate.

In the course of informal discussions between representatives of the ECPS, the EFCTC and the FEA it was found that specimen convention articles could be drafted which were acceptable to the participants and which appeared to us to be sound in principle. We believe, therefore, that the convention concept is a feasible approach and worthy of serious consideration by Member States.

9.2 Key Provisions for a Convention

In the following paragraphs we indicate the more important types of provision which we believe should be incorporated in a convention. They are based on the ECPS-EFCTC-FEA discussions referred to above, and which a Metra consultant attended as an observer.

9.2.1 F-11/F-12 Production Capacity Standstill

A suitable undertaking by CFC producers would include agreement to comply with Article 1(1) of Council Decision 80/372/EEC, and a proviso to the effect that any new plant, or modifications to existing plant, designed for the production of CFCs other than F-11 and F-12, but technically capable of producing them, would not be used to augment F-11 and F-12 production. Such a proviso would deal with the problem discussed in Section 2.2.1.

9.2.2 Reduction of F-11/F-12 Usage in Aerosols

It would be necessary for the aerosol industry in a Member State to undertake to comply with Article 1(2) of the Decision.

In all EEC countries except Ireland there is an aerosol trade association which represents a substantial proportion of the aerosol filling capacity of the country and which could reasonably be empowered by its members to enter into a convention. In Ireland the Federation of Irish Chemical Industries might act in this capacity.

Specific action which could be taken by the national trade associations could include:

- acquainting all members and non-members of the aerosol industry with the implications of the Council Decision and the Convention, and urging them to co-operate in achieving the required reduction in CFC usage

- ensuring that specialised technical knowledge and practical expertise in the safe use of propellants other than F-11 and F-12 is disseminated and promoted to the industry as a whole

- assisting members of the industry with general and individual problems in effecting a reduction in F-11/F-12 usage.

The FEA could perform a valuable advisory and co-ordinating role.

9.3 Monitoring of CFC Usage Reduction

For the Community as a whole, the most accurate method of monitoring is through the annual production and use statistics prepared by auditors from figures submitted by the individual CFC producers, and it is understood that the producers are prepared to continue with this procedure.

Because there are no more than two producers in any EEC country, the industry is averse to supplying figures on a Member State basis for reasons of commercial confidentiality, and because there is a substantial volume of intra-Community trading and four countries do not produce CFCs, we do not think individual Member States could check CFC usage in aerosols in their territories by recourse to producer statistics.

Individual country checks would necessitate returns being supplied by all aerosol fillers, and most countries would need to obtain figures for 1976 to provide a baseline. To preserve confidentiality, these returns could be collated by independent auditors as is done for the producer statistics.

As there are many more fillers than producers, monitoring on a country basis will require a very high degree of industry co-operation, and we have previously mentioned the problem of establishing accurate baselines where firms have ceased or started operation since 1976. Given the co-operation of the larger firms in supplying returns, it should be possible to make reasonable estimates, but we are aware that many fillers are also reluctant for figures to be divulged on a country basis.

9.4 Conclusions

9.4.1 The convention concept commands sufficient support from industry for it to be a practicable means of implementing Article 1 of the Council Decision.

9.4.2 For reasons of commercial confidentiality, both the CFC producing and aerosol industries are reluctant for monitoring to be undertaken on a Member State basis, and there is no doubt that the most accurate indications of changes in CFC usage are provided by the Community statistics derived from confidential collation of producer company data by independent auditors.

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APPENDIX 1 : ENGLISH TEXT OF EC COUNCIL DECISION ON CFCs OF 26 MARCH 1980

EUROPEAN COMMUNITIES

THE COUNCIL

COUNCIL DECISION
OF 26 MARCH 1980

concerning chlorofluorocarbons
in the environment

THE COUNCIL OF THE EUROPEAN COMMUNITIES,

Having regard to the Treaty establishing the European Economic Community, and in particular Article 235 thereof,

Having regard to the proposal from the Commission (1),

Having regard to the Opinion of the European Parliament (2),

Having regard to the Opinion of the Economic and Social Committee (3),

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(1) OJ No C 136, 31.5.1979, p. 7
(2) Opinion delivered on 14.12.1979 (not yet published in OJ)
(3) Opinion delivered on 21.11.1979 (not yet published in OJ)

Whereas, as stated in the Resolution of the Council of the European Communities and of the Representatives of the Governments of the Member States, meeting within the Council, of 17 May 1977 on the continuation and implementation of a European Community policy and action programme on the environment (1), it is necessary to review continuously at Community level the impact of chemicals on the environment;

Whereas the Council Resolution of 30 May 1978 on fluorocarbons in the environment (2) states that the problems of the effects of chlorofluorocarbons on the ozone layer and of ultraviolet radiation on health cannot be ignored;

Whereas the Member States, in accordance with the terms of the Resolution of 30 May 1978, adopted a common position on 6 December 1978 concerning chlorofluorocarbons in the environment, to be put to the International Conference on chlorofluorocarbons held in Munich from 6 to 8 December 1978; and whereas that Conference adopted certain Recommendations, in particular Recommendation III;

Whereas, in accordance with the common position of Member States of 6 December 1978 and in accordance with Recommendation III of the Munich Conference, a significant reduction should, as a precautionary measure, be achieved in the next few years in the use of chlorofluorocarbons giving rise to emissions; and whereas such a reduction should be sought on the basis of a policy with particular reference to the use of chlorofluorocarbons in aerosols;

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(1) OJ No C 139, 13.6.1977, p. 1
(2) OJ No C 133, 7.6.1978, p. 1

Whereas during the first half of 1980 the measures to be taken will be re-examined in the light of the scientific and economic data available and such further measures as may prove necessary in the light of this re-examination will be adopted as soon as possible and in any event no later than 30 June 1981;

Whereas, since the specific powers of action required to adopt this Decision have not been provided for in the Treaty, it is necessary to invoke Article 235 thereof,

HAS ADOPTED THIS DECISION:

Article 1

1. Member States shall take all appropriate measures to ensure that industry situated in their territories does not increase its chlorofluorocarbon production capacity F-11 (CCl_3F) and F-12 (CCl_2F_2).

2. Member States shall take all appropriate measures to ensure that not later than 31 December 1981 industry situated in their territories achieves reduction of at least 30% compared with 1976 levels in the use of these chlorofluorocarbons in the filling of aerosol cans.

Article 2

In the course of the first half of 1980, the measures taken will be re-examined in the light of the scientific and economic data available. To this end, Member States shall, subject to considerations of commercial confidentiality, provide the Commission with the results of any study or research available to them. The Council shall adopt, as soon as possible and in any event no later than 30 June 1981, on a proposal from the Commission, such further measures as may be necessary in the light of this re-examination.

Article 3

This Decision is addressed to the Member States.

Done at Brussels, 26 March 1980,

For the Council

The President

APPENDIX 2

EXTRACTS FROM 'AEROSOL REVIEW - 1979'

Abbreviations

The following is a list of abbreviations used in the tabular guide. The first entry, under company, usually gives a 'shorthand' version of the company name; thus, Balmain stands for Les Parfums Pierre Balmain which is included in the list of suppliers under the letter B

A	Aluminium
A_2	Aluminium 2-piece
A_3	Aluminium 3-piece
Am	Aluminium monobloc
amp	2-Amino-2-methyl-1-propanol
AR	Aerosol Research
Atb	Aluminium tinplate base
B	Butane
BCF	Bromochlorodifluoromethane
BK	Bespak
Br	Brass
C	Contract filled
CBM	Chlorobromomethane
CTAB	Cetyl trimethyl ammonium bromide
DHA	Dihydroxyacetone
DMHF	Dimethyl hydantoin formaldehyde
DPV	Deutsche Prazisions Ventil
EP	Extreme pressure
F	Filled by
f	Fill
Fc	Fluorocarbon (unspecified)
F/g	Frosted glass
G	Glass
GinA	Glass in aluminium outer
Gp	General purpose
hd	High density
ims	Industrial methylated spirits
Intro	Date introduced
ipa	Isopropyl alcohol
ipm	Isopropyl myristate
iu	International units
MAFF	Ministry of Agriculture, Fisheries & Food (UK)
Moa	Modified
Mp	Melting point
NHS	National Health Service (UK)
oba	Optical brightening agent
OEL	Oil Equipment Laboratories
P	Propane
P&C	Propellant & container
Pe	Polythene
P/g	Pvc coated glass
Pp	Polypropylene
Prof	Professional use only
PSPS	Pesticides Safety Precautions Scheme (UK)
QAC	Quaternary ammonium compound
QB	Quick break
S	Self filled
SOA	Sucrose octa acetate
Ss	Stainless steel
Syn	Synergised (pyrethrum) Synthetic (resins, etc)
T	Tinplate
t	Tall
TEA	Triethanolamine
V	Valve
VA	Vinyl acetate
VCA	Valve Corp of America
VPT	Vapour phase tap

'Aerosol Review - 1979' - Specimen Page.

COSMETICS & TOILETRIES : . . continued

Company	Brand	Purpose	Ingredients	P & C	V	F	Intro.	Notes
Faberge	20 : 21 Creme Shave	Creme shave foam	Creme shave concentrate; perfume	12/114 : A 57 : 43		S	1978	150 ml £1.95
Faberge	Brut 33 Creme Shave	Creme shave foam	Creme shave concentrate, perfume	P/B : T		C	1978	209 g
Faberge	Macho Creme Shave	Creme shave foam	Creme shave base, perfume	P/B: A	AR74	C	1977	170 g £2.50
Max Factor	Fresh Amber Lazy Shave	Brushless shaving foam	Triethanolamine soaps, lubricants, foam stabilisers	12/114 : T202	AR KN38	S	May 1972	8 oz (200 g *f*) 83p
Max Factor	Lazy Shave	Brushless shaving foam	Triethanolamine soaps, lubricants, foam stabilisers	12/114 : T202	AR KN38	S	Oct 1956	8 oz (200 g *f*) 83p
Gillette	Foamy Regular	Shaving cream	Triethanolamine soaps	B: T202	AR	S	May 1966	8 oz (200 g *f*) 61p
Gillette	Foamy Tanker	Shaving cream	Triethanolamine soaps	B: T211	AR	S	1970	12 oz (395 g *f*) £1.01 Regular & Lemon/lime
Gillette	Foamy Lemon/Lime	Shave cream		B:T202	AR	S	1970	8 oz (200 g *f*) 61p
Gillette	Foamy Deluxe Regular	Shaving cream	Potassium stearate, peanut oil, isobutane laureth 23, sorbitol, mineral oil, stearic acid	B : A202		S	May 1979	200 g 75p
Gillette	Foamy Deluxe Lemon/Lime	Shaving cream	Potassium stearate, peanut oil, isobutane laureth 23, sorbitol, mineral oil, stearic acid	B : A202		S		200 g 75p
Givenchy	Monsieur de Givenchy	Shave foam	Base, essential oil	12/114 : A 40: 60	Valois		1970	160 g £2.25
Givenchy	Givenchy Gentleman	Shave foam	Base, essential oil	12/114 : A	Valois	C	July 1974	160 g £2.35
Goya	Cedar Wood Foam Shave	Shaving foam	Soap, humectants, perfume	12/114 : T211	AR KN38	S	1970	16 oz (300 g *f*)
Goya	Zendiq	Shave foam	Soap, humectants, perfume	12/114 : A	AR KN 38	S	May 1977	185g £1.35
E. R. Holloway	Sabre Shave Foam	Shaving foam	Shave cream	12/114 : T211	Precision foam or AR foam	S	Nov. 1977	16 oz (350 g *f*)
Houbigant	Monsieur Houbigant	Shave foam		—: —				£2.00
Marks & Spencer	Shave Foam	Shave foam						
Roberre	Denim	Shave foam		12/114 : T202	Precision	S	1975	10 oz (200 g *f*) 45p
Rochas	Monsieur Rochas Shaving Cream	Shaving cream				C		174 g £3.60
Rochas	Moustache Shaving Cream	Shave cream		—: —				£3.60
Sainsbury	Shave Foam	Shave foam		B : T202	AR PKN 38			200 g
Shulton	Old Spice Smooth Shave	Shave foam	Soap base	B: T211	Precision foam	S	Jan 1968	24 oz (600 g *f*)
Shulton	Blue Stratos Smooth Shave	Shave cream	Soap base	12/114: T202	Precision foam	S		8 oz (200 g *f*)
Vanda Beauty Counselor	Vanda for Men Shave Foam	Shaving foam	Shave foam	12/114 : T202 40 : 60	AR BKN38	C	1975	85g, 86p
Victor of Milan	Shaving Foam	Shaving foam		114 : A	Precision	C	1969	8 oz (198 g *f*) 99p
Yardley	Black Label Creme Shave	Shaving foam	Shaving foam base	12 : A	Precision	S	Jan 1975	200 g £1.10
Yardley	Sven Creme Shave	Shaving foam	Shaving foam base	12 : A	Precision	S	1976	£1.75

Sun tan preparations

Boots	No7 Instant Tan Foam	Tanning foam		12 : A	Precision	C	June 1977	103 g *f*
Charles of the Ritz	Ritz Bronze Self Tanning Foam	Sun tan products		CO_2			March 1979	4 oz £3.95
Estee Lauder	Sun Spree	Sun protection		—: T202		S	1968	6 oz £2.50
Plough	QT Speed Foam	Tan colourant foam & sunburn protective	Dihydroxy acetone, homomenthyl salicylate	12 : Am	Precision	C	April 1968	(125 g) £1.75 Coppertone Corp formula
Plough	Sudden Tan	To bronze and tan	Dihydroxyacetone homomenthyl salicylate	12 : A	Precision	C		(100 g) £1.95
Plough	Coppertone Tanning Butter Spray	Tans & protects	Homo-menthyl salicylate	12/11 : T202	Seaquist NS-31	C	Jan 1977	6 oz (115 g *f*) £1.95

Talcum powder

Dana	Canoe Royale Talc Spray	After bath talc	Talc, perfume	B: T202		C	June 1973	8 oz (196 g *f*) £1.20
Dana	Tabu Spray Bath Powder	After bath talc		12/11 : T202	AR PKN 39PV	C	July 1969	8 oz (196 g *f*) £1.35
Givenchy	Givenchy III	Powder spray	Talc, essential oil, Irgasan DP 300	—: Am	Powder valve	S	July 1974	£3.95
Houbigant	Monsieur Houbigant Spray Talc	Spray talc	Essence, talc	12/11 : T202		C	May 1971	£2.10
Estee Lauder	Youth Dew Cool Spray Bath Powder	After bath powder	Talc, perfume	12/11 : T202	AR PKN39PV	S	1966	6 oz £3.25
Estee Lauder	Azuree Cool-Spray Bath Powder	After bath talc	Talc	12/11 : T202	AR PKN39PV	S	1970	6 oz £2.40
Worth	Je Reviens Talc Glace	Talc	Talc, perfume	12/114 : Am	AR PKN 39PV	C	1968	£1.75

B.2 F-11/F-12 sales for aerosols in the EEC decreased from 176,914 tons in 1976 to 136,552 tons in 1979, a reduction of 40,362 tons or 22.8%. To achieve at least 30% reduction as required by the Council Decision, annual sales must fall by a further 12,712 tons or more to reach the minimum reduction target of 53,074 tons. On the basis of a notional schedule of equal annual decrements the reduction programme is ahead of schedule irrespective of whether 1981 or 1982 is taken as the full comparison year.

B.3 From 1976 to 1979 there were also marginal decreases in F-11/F-12 sales in the EEC for refrigeration, and in export sales outside the EEC. The reductions in sales for aerosols, refrigeration and exports were substantially offset, however, by increased sales for foam plastics and 'other uses', especially the former for which sales rose from 42,154 tons in 1976 to 55,788 tons in 1979, an increase of 32.3%. The outcome was a net decrease in total sales of F-11/F-12 by EEC producers of 26,400 tons, or 8.1%.

B.4 Due mainly to the decline in CFC aerosol propellant sales in the USA in anticipation of the ban in 1979 on use in all non-essential aerosols, sales for aerosols in the EEC expressed as a proportion of CMA reporting company sales rose from 40.9% in 1976 to 49.0% in 1978. EEC sales for aerosols in 1978 corresponded to 19.3% of estimated world production in that year.

B.5 In 1978, the latest year for which world data is available, the pattern of F-11/F-12 usage within the EEC continued to present major differences from that outside, principally in aerosols and refrigeration. Aerosols accounted for 65% of EEC sales in 1978 but only 37.3% externally, while sales for refrigeration presented an even stronger contrast; 8.8% of sales in the EEC and 39.1% in sales outside the Community.

C. Aerosol Production Trends

C.1 EEC aerosol fillings peaked in 1976 at 1,873 million units, falling to 1,837 m. in 1978, but the world total of 6,027 m. in 1978 was the highest since the previous peak of 6,009 m. in 1974. For the EEC in 1979 only the UK has reported to date, recording a fall of 7.4% from the 1978 total of 563.5 m., to 522 m., with drops in hairspray and insecticide fillings being major factors in the decline.

C.2 Personal products are still the largest sector, accounting for 54.2% of EEC fillings in 1978, but there have been significant falls in fillings for hairsprays, anti-perspirants and de-oderants which have been partly offset by increases in household and other categories.

C.3 The CFC/non-CFC propellant usage distribution pattern varies among Member States, reflecting different aerosol product mixes and formulation differences associated with local regulations and economic factors governing the use of alcohols and other solvents.

C.4 The reduction in F-11/F-12 propellant usage between 1976 and 1979 is due to an unquantifiable combination of substitution by non-CFC propellants and changes in the aerosol sales pattern. The latter is believed to have been a significant factor because of the overall decrease in fillings coupled with the shift from the personal products sectors with high CFC concentrations, towards household and other sectors which are frequently formulated without CFCs.

E.3 The possibilities for reducing CFC release from non-aerosol applications are being extensively researched, especially in the USA, and the results to date merit careful examination.

F. CFC Regulatory Position Within and Outside the EEC

F.1 Within the EEC the only existing national regulation is the Netherlands requirement for all aerosols containing CFCs to carry a warning of potential damage to health and the environment.

F.2 Outside the EEC, regulatory action against the manufacture and importation of aerosols containing CFC propellants has been taken in Norway, Sweden and the USA, and is pending in Canada. The Canadian regulation applies to hairsprays, anti-perspirants and de-oderants; elsewhere the ban applies to all except specially exempted applications such as in certain pharmaceuticals.

F.3 The Council Decision applies only to F-11 and F-12 and is non-specific as to aerosol product sectors; external regulation applies to all fully halogenated chlorofluoroalkanes, including F-114, and specifies either the products affected or the exemptions.

F.4 The United States proposes to limit CFC production for domestic use and exports to the 1979 level. The EEC decision to freeze production capacity leaves scope for expanding production because capacity considerably exceeds demand.

G. Implementation of the Council Decision

G.1 Means available to Member State governments for implementing the Council Decision to freeze F-11/F-12 production capacity and reduce usage in aerosols are:

- direct regulations having calculable effects, such as concentration limits or bans on F-11/F-12 in particular aerosol products

- indirect action, such as fiscal measures, to discourage CFC usage but imposing no specific restrictions

- conventions, whereby industry would undertake action designed to ensure compliance with the Decision.

G.2 Having considered the alternatives, the reduction in F-11/F-12 usage in aerosols reached in 1979, and the evident progress in CFC substitution, the convention concept is concluded to be the most satisfactory approach, mainly on grounds of speed and as being the least burdensome to industry.

H. The Convention Approach

H.1 The convention concept commands sufficient support from industry for it to be a practicable means of implementing Article 1 of the Council Decision.

H.2 For reasons of commercial confidentiality, both the CFC producing and aerosol industries are reluctant for monitoring to be undertaken on a Member State basis, and there is no doubt that the most accurate indications of changes in CFC usage are provided by the Community statistics derived from confidential collation of producer company data by independent auditors.

making F-11 and F-12. It is presumed that the intention of the Decision is that such multi-purpose plant should not be used to augment the output of the regular F-11/12 installations. The question then arises as to whether they may be used by a company for making F-11/F-12 if the capacity of its regular units is reduced by breakdown or maintenance requirements, and there seems no logical reason why such spare capacity should not be so used since a legitimate alternative would be for the company to make up a deficiency by importation from within or even outside the Community.

b) In the short term there is little likelihood of the CFC industry as a whole wanting to increase F-11/12 production capacity since existing capacity is under-utilised and the margin will probably rise as usage in aerosols declines. It is possible to envisage situations, however, in which a particular company might want to increase capacity, for example because a competitor decided to cease production.

2.2.2 Time for Achieving CFC Usage Reduction Target

Article 1(2) of the Decision requires the minimum reduction target to be reached 'not later than 31 December 1981', and this raises the following questions in respect of interpretation and monitoring:

a) For most countries the only accurate baseline for 1976 is that of total F-11/12 sales to the EEC aerosol industry in that year, as determined by the CFC producers' returns collated by independent auditors acting for the EFCTC in connection with the 1977/78 Metra Study.

- Within the EEC there has been a progressive decline in sales for aerosols, from 176,914 tons in 1976 to 136,552 tons in 1979, a total fall of 40,362 tons, or 22.8%.

- There has been no significant change in sales for refrigeration and air conditioning, which at 20,300 tons in 1979 accounted for only 9.2% of total sales in the EEC and were only marginally lower than the 1976 total of 20,773 tons.

- Sales for foam plastics have increased considerably, from 42,154 tons in 1976 to 55,788 tons in 1979, a rise of 32.3%, of which the major part occurred in 1978.

- Sales for other uses have risen by the high percentage of 65.7, but from a relatively low base, and at 6,921 tons in 1979 these accounted for 3.2% of EEC sales.

- Exports outside the EEC were 81,636 tons in 1979, a decrease of 1,942 tons, or 2.3% on the 1976 total, and the net effect of all sales category changes was a decrease in total sales by EEC producers from 327,597 tons in 1976, to 301,197 tons in 1979, or 8.1%.

- The decline in sales for aerosols amounting to 40,362 tons has been substantially offset by increases in sales for foam plastics and miscellaneous uses, so that the net reduction over the period is 26,400 tons.

- Although sales within the EEC for aerosols have fallen from 54% of total (EEC and export) sales in 1976 to 45.3% in 1979, this is still a high proportion and any new measures which rapidly and substantially eroded these sales would obviously have a major impact on the CFC manufacturing industry. The fact that these

has been discussed between the FEA and the Commission and it is generally accepted to be a matter which must be treated as a separate issue from CFC regulation. A first step would be to obtain quantitative evidence about the inequalities imposed on industry, but this would be a major exercise and not one which trade federations are likely to have the internal resources to attempt in the short term.

At the 3rd Meeting of National Experts a view was expressed that a special review should be made of all non-CFC propellants and solvents which might be used in aerosols, in order to evolve a 'positive list' of acceptable substances.

5.6 Conclusions

5.6.1 Hydrocarbon (propane/butane) propellants are proving to be the principal substitutes for F-11/F-12, with many fillers preferring to make gradual changes by using CFC/hydrocarbon blends. In Germany there is some use of CFC/carbon dioxide blends.

5.6.2 Dimethylether (DME) has potential as an alternative to hydrocarbons because of better solvent properties and miscibility with water. DME is mainly being used in Belgium and the Netherlands; fillers in other countries have a more cautious attitude towards adopting DME pending a fuller examination of its toxicological and environmental properties and research on these aspects is being supported by the Netherlands Government. Results to date are said to be very encouraging.

5.6.3 No fluorocarbon alternatives for F-11 and F-12 acceptable for large scale general use have yet emerged.

5.6.4 No recent quantitative data or estimates relating to the socio-economic impact of F-11/F-12 propellant usage reduction and substitution has been put forward by any Member State.

5.6.5 There is substantial capital investment entailed in converting to the principal CFC substitute - hydrocarbons - because of the extensive safety precautions required. In urban areas it may be impracticable to comply with local regulations, so that a filler may have the options of moving that part of his operations to another site, ceasing to produce aerosols, or employing a contract filler.

5.6.6 The cost and other problems attaching to conversion bear more heavily on the smaller fillers, and it is expected that the overall effect of reduced F-11/F-12 usage will be that some large fillers will expand their businesses and some small fillers will cease operation. In countries where there is a spectrum of aerosol business size the transfer of trade will reduce the net socio-economic disturbance, but there could be a greater net effect in countries such as Denmark and Ireland where all the fillers are comparatively small.

5.6.7 Any reduction in overall CFC production adversely effects the fluorspar mining industry and this is of special concern in Italy. A reduction of F-11/F-12 usage in aerosols going much beyond 30% is also likely to cause socio-economic problems in the CFC producing and allied industry sectors, because there is already an over-capacity situation and sales of CFCs for aerosols in the EEC in 1979 accounted for 45% of production.

8.3.5 Contracts between Governments and Industry

An alternative to governmental ordinance is some form of contract or convention between government and industry. It might be supposed that another option is a voluntary undertaking on the part of the aerosol industry but this is most unlikely to be politically acceptable in all member states, especially those with a leaning towards regulation, and a firm contractual agreement is considered to be the only realistic alternative.

The principal advantages of the convention approach are speed and flexibility. Most governments have already enacted environmental control legislation under which regulations on CFCs could be issued, but while it is easy to specify a ban it takes much longer to devise restrictions having a limited effect. Each government would have to obtain data on the amounts of CFCs being used in the various product sectors and extensive discussions with industry could be involved in arriving at fair and practicable measures. Bearing in mind the desirability of harmonising these measures as mentioned in Section 8.3.3, the administrative processes could be so lengthy as to be incompatible with the timescale of the Decision. Conventions requiring an overall reduction would be less burdensome to industry and provide more scope for competitive ingenuity in re-formulation.

It is concluded that for the purpose of the present Council Decision the convention concept is the better approach, and it is developed in the next Section.

APPENDIX 2

EXTRACTS FROM 'AEROSOL REVIEW - 1979'

Abbreviations

The following is a list of abbreviations used in the tabular guide. The first entry, under company, usually gives a 'shorthand' version of the company name; thus, Balmain stands for Les Parfums Pierre Balmain which is included in the list of suppliers under the letter B

A	Aluminium
A_2	Aluminium 2-piece
A_3	Aluminium 3-piece
Am	Aluminium monobloc
amp	2-Amino-2-methyl-1-propanol
AR	Aerosol Research
Atb	Aluminium tinplate base
B	Butane
BCF	Bromochlorodifluoromethane
BK	Bespak
Br	Brass
C	Contract filled
CBM	Chlorobromomethane
CTAB	Cetyl trimethyl ammonium bromide
DHA	Dihydroxyacetone
DMHF	Dimethyl hydantoin formaldehyde
DPV	Deutsche Prazisions Ventil
EP	Extreme pressure
F	Filled by
f	Fill
Fc	Fluorocarbon (unspecified)
F/g	Frosted glass
G	Glass
GinA	Glass in aluminium outer
Gp	General purpose
hd	High density
ims	Industrial methylated spirits
Intro	Date introduced
ipa	Isopropyl alcohol
ipm	Isopropyl myristate
iu	International units
MAFF	Ministry of Agriculture, Fisheries & Food (UK)
Mod	Modified
Mp	Melting point
NHS	National Health Service (UK)
oba	Optical brightening agent
OEL	Oil Equipment Laboratories
P	Propane
P&C	Propellant & container
Pe	Polythene
P/g	Pvc coated glass
Pp	Polypropylene
Prof	Professional use only
PSPS	Pesticides Safety Precautions Scheme (UK)
QAC	Quaternary ammonium compound
QB	Quick break
S	Self filled
SOA	Sucrose octa acetate
Ss	Stainless steel
Syn	Synergised (pyrethrum) Synthetic (resins, etc)
T	Tinplate
t	Tall
TEA	Triethanolamine
V	Valve
VA	Vinyl acetate
VCA	Valve Corp of America
VPT	Vapour phase tap

'Aerosol Review - 1979' - Specimen Page.

COSMETICS & TOILETRIES : . . continued

Company	Brand	Purpose	Ingredients	P & C	V	F	Intro.	Notes
Faberge	20 : 21 Creme Shave	Creme shave foam	Creme shave concentrate; perfume	12/114 : A 57 : 43		S	1978	150 ml £1.95
Faberge	Brut 33 Creme Shave	Creme shave foam	Creme shave concentrate, perfume	P/B : T		C	1978	209 g
Faberge	Macho Creme Shave	Creme shave foam	Creme shave base, perfume	P/B: A	AR74	C	1977	170 g £2.50
Max Factor	Fresh Amber Lazy Shave	Brushless shaving foam	Triethanolamine soaps, lubricants, foam stabilisers	12/114 : T202	AR KN38	S	May 1972	8 oz (200 g *f*) 83p
Max Factor	Lazy Shave	Brushless shaving foam	Triethanolamine soaps, lubricants, foam stabilisers	12/114 : T202	AR KN38	S	Oct 1956	8 oz (200 g *f*) 83p
Gillette	Foamy Regular	Shaving cream	Triethanolamine soaps	B: T202	AR	S	May 1966	8 oz (200 g *f*) 61p
Gillette	Foamy Tanker	Shaving cream	Triethanolamine soaps	B: T211	AR	S	1970	12 oz (395 g *f*) £1.01 Regular & Lemon/lime
Gillette	Foamy Lemon/Lime	Shave cream		B : T202	AR	S	1970	8 oz (200 g *f*) 61p
Gillette	Foamy Deluxe Regular	Shaving cream	Potassium stearate, peanut oil, isobutane laureth 23, sorbitol, mineral oil, stearic acid	B : A202		S	May 1979	200 g 75p
Gillette	Foamy Deluxe Lemon/Lime	Shaving cream	Potassium stearate, peanut oil, isobutane laureth 23, sorbitol, mineral oil, stearic acid	B : A202		S		200 g 75p
Givenchy	Monsieur de Givenchy	Shave foam	Base, essential oil	12/114 : A 40: 60	Valois		1970	160 g £2.25
Givenchy	Givenchy Gentleman	Shave foam	Base, essential oil	12/114 : A	Valois	C	July 1974	160 g £2.35
Goya	Cedar Wood Foam Shave	Shaving foam	Soap, humectants, perfume	12/114 : T211	AR KN38	S	1970	16 oz (300 g *f*)
Goya	Zendiq	Shave foam	Soap, humectants, perfume	12/114 : A	AR KN 38	S	May 1977	185g £1.35
E. R. Holloway	Sabre Shave Foam	Shaving foam	Shave cream	12/114 : T211	Precision foam or AR foam	S	Nov. 1977	16 oz (350 g *f*)
Houbigant	Monsieur Houbigant	Shave foam		—: —				£2.00
Marks & Spencer	Shave Foam	Shave foam						
Roberre	Denim	Shave foam		12/114 : T202	Precision	S	1975	10 oz (200 g *f*) 45p
Rochas	Monsieur Rochas Shaving Cream	Shaving cream				C		174 g £3.60
Rochas	Moustache Shaving Cream	Shave cream		—: —				£3.60
Sainsbury	Shave Foam	Shave foam		B : T202	AR PKN 38			200 g
Shulton	Old Spice Smooth Shave	Shave foam	Soap base	B: T211	Precision foam	S	Jan 1968	24 oz (600 g *f*)
Shulton	Blue Stratos Smooth Shave	Shave cream	Soap base	12/114: T202	Precision foam	S		8 oz (200 g *f*)
Vanda Beauty Counselor	Vanda for Men Shave Foam	Shaving foam	Shave foam	12/114 : T202 40 : 60	AR BKN38	C	1975	85g, 86p
Victor of Milan	Shaving Foam	Shaving foam		114 : A	Precision	C	1969	8 oz (198 g *f*) 99p
Yardley	Black Label Creme Shave	Shaving foam	Shaving foam base	12 : A	Precision	S	Jan 1975	200 g £1.10
Yardley	Sven Creme Shave	Shaving foam	Shaving foam base	12 : A	Precision	S	1976	£1.75

Sun tan preparations

Boots	No7 Instant Tan Foam	Tanning foam		12 : A	Precision	C	June 1977	103 g *f*
Charles of the Ritz	Ritz Bronze Self Tanning Foam	Sun tan products		CO_2			March 1979	4 oz £3.95
Estee Lauder	Sun Spree	Sun protection		—: T202		S	1968	6 oz £2.50
Plough	QT Speed Foam	Tan colourant foam & sunburn protective	Dihydroxy acetone, homomenthyl salicylate	12 : Am	Precision	C	April 1968	(125 g) £1.75 Coppertone Corp formula
Plough	Sudden Tan	To bronze and tan	Dihydroxyacetone homomenthyl salicylate	12 : A	Precision	C		(100 g) £1.95
Plough	Coppertone Tanning Butter Spray	Tans & protects	Homo-menthyl salicylate	12/11 : T202	Seaquist NS-31	C	Jan 1977	6 oz (115 g *f*) £1.95

Talcum powder

Dana	Canoe Royale Talc Spray	After bath talc	Talc, perfume	B: T202		C	June 1973	8 oz (196 g *f*) £1.20
Dana	Tabu Spray Bath Powder	After bath talc		12/11 : T202	AR PKN 39PV	C	July 1969	8 oz (196 g *f*) £1.35
Givenchy	Givenchy III	Powder spray	Talc, essential oil, Irgasan DP 300	—: Am	Powder valve	S	July 1974	£3.95
Houbigant	Monsieur Houbigant Spray Talc	Spray talc	Essence, talc	12/11 : T202		C	May 1971	£2.10
Estee Lauder	Youth Dew Cool Spray Bath Powder	After bath powder	Talc, perfume	12/11 : T202	AR PKN39PV	S	1966	6 oz £3.25
Estee Lauder	Azuree Cool-Spray Bath Powder	After bath talc	Talc	12/11 : T202	AR PKN39PV	S	1970	6 oz £2.40
Worth	Je Reviens Talc Glace	Talc	Talc, perfume	12/114 : Am	AR PKN 39PV	C	1968	£1.75