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Third National Limits/Levels regarding the "first" and "second" points above.

2. When this has been done:

- (a) A country should be asked to freeze and then reduce its activities if it has, in fact, exceeded its national "red" line.
- (b) A country could be allowed an increased quota if it was below its national "red" line.

3. A review system will assure that through the reductions and the quotas allowed, the activities of countries will not exceed the critical line in the first instance and that they will be phased out at a later stage according to an agreed schedule.

4. It is also understood that exempted countries should do their best to avoid using CFCs whenever this proves feasible.

ANNEX B TO THE REPORT OF THE WORKING GROUP ON
THE SPECIAL SITUATION OF DEVELOPING COUNTRIES

1. Room to be allowed for developing countries for activities controlled by this protocol

(Working paper prepared by the sub-group and amended by the working group on developing countries)

I. Basic principles and objectives

1. Developing countries' needs should be recognized and accommodated in the scheme of the Protocol to ensure full participation in international efforts to reduce the risk to the ozone layer.

2. Such needs are essential and vital to the economic growth and goals of national developments which are associated with the production and use of CFCs and other ozone modification substances.

3. Identification of these needs should be based upon the concept of the essential use of the substances and their relationship to the important interests of the country.

4. In order for developing countries to respond fully to the responsibility under the Protocol, provisions must be made for developing countries' access to the availability of substitute chemical substances during transition to new technologies.

II. Considerations

In order to put the above-mentioned principles into practice in the form of special provisions, it is imperative that the following must be done:

1. Identification of developing countries' need.

The following factors should be identified:

- (a) The level of the industrial development associated with the production and use of CFCs and other substances;
- (b) Expectation of the planned development within the time-frame to be set by the protocol for regulatory purposes;
- (c) Effects on their foreign trade in connection with the production and use of CFCs and substances intended to be covered by the Protocol.

2. Adoption of control measures

In adopting any control measures, provisions must be made to accommodate all those factors that have been identified as the needs of the developing countries, bearing in mind the principle objective of the protocol aimed at the protection of the ozone layer.

III. Options

At the moment, identification of the developing countries' needs is yet to be done. What can be done to find whether there is any room left for

developing countries to satisfy their needs is only to examine the several proposals tabled for adoption as control measures under the protocol, as well as other options. The proposals already tabled include among other things:

1. The establishment of maximum permissible volumes of annual consumption of CFCs shall not be extended to developing countries.
2. The developing countries will be permitted to have growth in use up to the current average per capita/use in the world.
3. Any developing country which does not produce the regulated substances is entitled to produce an amount which does not exceed its aggregate 1986 consumption level.
4. During a first phase of reduction any party whose emissions do not exceed the average per capita consumption in the world should be exempted from reduction requirements.

These options for the developing countries are to be analyzed. So long as their needs are not identified, it is very difficult indeed to ascertain if each option has taken full account of their needs under the circumstances.

ANNEX C TO THE REPORT OF THE WORKING GROUP ON
THE SPECIAL SITUATION OF DEVELOPING COUNTRIES

2. Assistance to be received by developing countries

- A.(i) Add a new Article V 1. bis to UNEP/WG.151/2, 26 September 1986,
Fifth Revised Draft Protocol on Chlorofluorocarbons* as follows:

1. bis

The Parties, individually, jointly or through competent international bodies, shall cooperate in promoting public awareness of the environmental effects of the emissions of CFCs and other ozone modifying substances.

- (ii) Change the title of Article V to "Research, Development, Exchange of Information and Public Awareness".

- B. Add a new Article VII 2. bis to Article VII: "Meetings of the Parties" in Annex II to UNEP/WG/151/L.4. Draft (sic) Report of the Ad Hoc Working Group on the Work of the First Session, 15 January 1987.

* As a sixth revised draft protocol has been prepared and issued as a working paper by the Chairman of the Vienna Group - see Annex I to the Report of the Ad Hoc Working Group on the Work of its Second Session (UNEP/WG.167/2) of 27 February 1987, the above recommendations have been incorporated into the text of the sixth revised draft protocol and not the fifth as recommended.

4. bis

At their first meeting, the Parties shall begin deliberations on the ways and means of fulfilling the obligations set out in Articles V and VI above, including the preparation of work plans in this regards. Such work plans shall pay special attention to the needs and circumstances of the developing countries. Non-parties to the protocol should be encouraged to participate in activities outlined in such work plans.

- C. Add a new sub-paragraph (e) bis and (f) bis to Article VIII:
"Secretariat" of Annex II to UNEP/WG.151/L.4, 15 January 1987.

VIII (e) bis

Where possible, encourage non-parties to attend the meetings of the Parties, as observers, and to act in accordance with the provisions of the protocol;

(f) bis

Where possible, provide the information referred to in sub-paragraphs (b), (c) and (d) above to such non-party observers.

ANNEX D TO THE REPORT OF THE WORKING GROUP ON THE
SPECIAL SITUATION OF DEVELOPING COUNTRIES

FINANCIAL QUESTIONS

1. The Working Group recalled Resolution No.2 of the Plenipotentiaries Conference on the Vienna Convention on Protection of the Ozone Layer which drew attention to the need for special considerations to be given to the particular situation of the developing countries and also the relationship between a state's level of industrialization and its responsibilities for the protection of the ozone layer.
2. It was noted that, in Geneva the Working Group on Institutional and Financial Matters made provision in Article IX for the Financial Rules of the Protocol (including rules for assessing contributions from the parties) to

3. The Working Group, in agreeing with this approach, did not consider it necessary to provide in detail for Financial Rules in the Protocol itself. The matter could appropriately be left to the parties at their first Meeting.
4. The Working Group considered that when the Financial Rules were drawn up it would be most important not to place undue financial burden on the developing countries whose contribution to depletion of the ozone layer is minimal.
5. It concluded that the report of the present Expert Session should include a clear statement emphasising the importance of the special situation of the developing countries as mentioned in paragraph 4, above.

IV. REPORT OF THE WORKING GROUP ON CONTROL MEASURES

The Working Group on Control Measures held extensive discussions on the merits of the various control measures proposed. On the basis of the discussions of the Working Group and through informal discussions between the Chairman, and a number of delegates, Mr. Lang reported the following information to the Vienna Group:

- He noted some degree of flexibility of approach by the proponents of different control strategies;
- The Chairman said that he understood that any solution achieved in respect of control measures had to be closely linked to trade regulations, for example the idea that trade with non-parties would have to be limited or possibly prohibited;
- The Chairman said he also understood that special provisions for developing countries had to be included so that it became possible for those countries to implement the regulations specified in the protocol and to establish, eventually, their own production. This requires that the reduction phase starts as early as possible, to avoid any overall increase of global emissions. He said that it was also understood that whatever emission concessions are to be given to developing countries. They would have to be compensated for by lower consumption by the industrialized states.

The Chairman then introduced a draft text for the section on control measures in the proposed Protocol on the control of chlorofluorocarbons combining the common elements of the strategies on "production plus imports" and "adjusted production", previously submitted to the Vienna Group giving several alternatives for strategies for consideration by the experts of the Vienna Group. The Chairman said that informal consultations had indicated some degree of flexibility among delegations' positions. This related to the establishment of a single freeze system, which might be based mainly on the adjusted production formula but would also include exports of some manufactured products containing CFCs. It also related to the undertaking of a first, almost automatic, step towards reduction, it being understood that this reduction would depend on various variables:

1. substances covered
2. number of years
3. percentage of reduction
4. types of manufactured products included.

Several experts responded by congratulating the Chairman for his work and asked that the draft text be included in a sixth revised draft protocol on the control of chlorofluorocarbons and annexed to the report of the Second Session of the Working Group for further consideration before the convening of a third meeting of the Vienna Group to finalize the protocol on chlorofluorocarbons, it being understood that in annexing the draft protocol, it did not imply its endorsement by any of the delegations participating in the meeting of the Vienna Group.

ANNEX I

SIXTH REVISED DRAFT PROTOCOL ON CHLOROFLUOROCARBONS*

PREAMBLE

THE PARTIES TO THIS PROTOCOL,

Being Parties to the Vienna Convention for the Protection of the Ozone Layer, opened for signature at Vienna on 22nd March 1985,

Mindful of their obligation under the Vienna Convention to take appropriate measures to protect human health and the environment against adverse effects resulting or likely to result from human activities which modify or are likely to modify the ozone layer,

Recognizing the possibility that world-wide emissions of fully halogenated chlorofluorocarbons and other chlorine containing substances can significantly deplete and otherwise modify the ozone layer, resulting or likely to result in adverse effects on human health and the environment,

Recognizing also the potential climatic effects of chlorofluorocarbons emissions,

Determined to protect the ozone layer by taking precautionary measures to control total global emissions of chlorofluorocarbons,

Mindful of the precautionary measures for controlling emissions of chlorofluorocarbons that have already been taken at the national and regional levels,

* - issued under the responsibility of the Chairman

Aware that measures taken to protect the ozone layer from modifications due to the use of chlorofluorocarbons should be based on relevant scientific and technical considerations,

Mindful that special provision needs to be made in regard to the production and use of chlorofluorocarbons for the benefit of developing countries,

Considering the importance of promoting international co-operation in the research and development of science and technology on the control and reduction of chlorofluorocarbons emissions, bearing in mind, in particular, the needs of developing countries,

HAVE AGREED AS FOLLOWS:

ARTICLE I: DEFINITIONS

For the purposes of this Protocol,

1. "Convention" means the Vienna Convention for the Protection of the Ozone Layer;
2. "Parties" means, unless the text otherwise indicates, Parties to this Protocol;
3. "secretariat" means the secretariat of the Convention;
- (4. "Chlorofluorocarbon" or "CFC" means any fully halogenated chlorofluoroalkane.)

ARTICLE II: CONTROL MEASURES*

1. Each party, under jurisdiction of which substances referred to in Annex A are produced shall ensure that within [1 - 3] years after the entry into force of this Protocol the [annual production and imports] [adjusted annual production] of these substances does (do) not exceed its (their) 1986 level.

2. Each party, under the jurisdiction of which substances referred to in Annex A are not produced at the time of the entry into force of this Protocol, shall ensure that within [1 - 3] years hereinafter [its annual production and imports] [its adjusted annual production] do not exceed the level of imports in 1986.

3. Each party shall ensure, that within [..] years after the entry into force of this Protocol levels attained in accordance with paragraphs 1 and 2 will be reduced by [10 - 50] percent [unless the parties by a two-thirds majority otherwise decide] [if the parties confirm this obligation by a two-thirds majority].

Option A

4. Parties shall decide not later than [..] years after the entry into force of this Protocol by a two-thirds majority on

- new substances to be included in Annex A
- further reductions of 1986 levels.

These decisions shall be reviewed in intervals of [..] years.

Option B

4. Each party shall ensure that within [..] years after the entry into force of this Protocol levels attained in accordance with paragraph 3 will be reduced by [] unless parties by a two-thirds majority otherwise decide if parties confirm this obligation by a two-thirds majority .

*- Numbers used are only illustrative.

- This Article has to be reconsidered in the light of any provisions related to trade.

ARTICLE III: REVIEW OF CONTROL MEASURES

The Parties shall regularly at their meetings reassess the control measures provided for in article II, on the basis of the scientific, environmental and economic information available, and shall take all appropriate action.

ARTICLE IV: REPORTING OF INFORMATION

1. Within one year after the entry into force of this Protocol each Party shall inform the Secretariat about the implementation of this Protocol.
2. The Parties, either individually or jointly, shall submit annually to the secretariat;
 - (a) Information on national laws, regulations, policy directives and other measures adopted to implement this Protocol;
 - (b) Any other information to indicate their implementation of this Protocol.

ARTICLE V: RESEARCH, DEVELOPMENT, EXCHANGE OF INFORMATION

1. The Parties shall co-operate in promoting, directly and through competent international bodies, bearing in mind the needs of developing countries, research, development and exchange of information on:
 - (a) Best practicable technologies;
 - (b) Possible alternatives to CFCs and CFC products;
 - (c) Costs and benefits of relevant control strategies.
2. Each Party shall submit to the Secretariat a summary of activities conducted pursuant to the present article on a biennial basis.

ARTICLE VI: TECHNICAL ASSISTANCE

1. The Parties shall co-operate, taking into account in particular the needs of developing countries, in promoting, in the context of the provisions of article 4 of the Vienna Convention, technical assistance to facilitate participation in and implementation of this Protocol.
2. Any Party or Signatory to this Protocol in need of technical assistance in implementing it may submit a request to the Secretariat.

ARTICLE VII: MEETINGS OF THE PARTIES

1. The Parties shall hold meetings at regular intervals. The secretariat shall convene the first meeting of the Parties not later than one year after entry into force of this Protocol and in conjunction with a meeting of the Conference of the Parties to the Convention, if a meeting of the latter is scheduled within that period.

2. Subsequent ordinary meetings of the Parties shall be held, unless the Parties otherwise decide, in conjunction with meetings of the Conference of the Parties to the Convention. Extraordinary meetings of the Parties shall be held at such other times as may be deemed necessary at a meeting of the Parties, or at the written request of any of them, provided that, within six months of such a request being communicated to them by the Secretariat, it is supported by at least one third of the Parties.

3. The Parties shall by consensus adopt rules of procedure for their meetings.

4. The functions of the meetings of the Parties shall be:

- (a) To review the implementation of this Protocol;
- [(b) To establish, where necessary, guidelines or procedures for reporting of information as provided for in articles IV and V;]
- (c) To review requests for technical assistance provided for in article VI;
- (d) To review requests received from the Secretariat pursuant to article VIII;
- [(e) To reassess, pursuant to article III, the control measures provided for in article II;]
- (f) To consider and adopt proposals for amendment of this Protocol (in conformity with articles 9 and 10 of the Convention);
- (g) To consider and adopt the budget for implementation of this Protocol;
- (h) To consider and undertake any additional action that may be required for the achievement of the purposes of this Protocol.

5. The United Nations, its specialized agencies and the International Atomic Energy Agency, as well as any State not party to this Protocol, may be represented at meetings of the Parties by observers. Any body or agency, whether national or international, governmental or non-governmental, qualified in fields relating to the protection of the ozone layer which has informed the secretariat of its wish to be represented at a meeting of the Parties as an observer may be admitted unless at least one-third of the Parties present object. The admission and participation of observers shall be subject to the rules of procedure adopted by the Parties.

ARTICLE VIII: SECRETARIAT

The secretariat shall:

- (a) Arrange for and service meetings of the Parties provided for in article VII;
- (b) Distribute to the Parties information on each Party's year of maximum use of CFCs by sectors and the total amount of its use in that year, as reported by the Parties in accordance with article IV;
- (c) Prepare and distribute to the Parties regularly a report based on information received pursuant to articles IV and V;
- (d) Notify the Parties of any request for technical assistance received pursuant to article VI so as to facilitate the provision of such assistance to the extent possible;
- (e) Perform such other functions for the achievement of the purposes of the Protocol as may be assigned to it by the Parties.

ARTICLE IX: FINANCIAL PROVISIONS

1. The funds required for the operation of this Protocol, including those for the functioning of the secretariat related to this Protocol, shall be charged exclusively against contributions from the Parties.
2. The Parties shall by consensus adopt financial rules for the operation of this Protocol, including rules for assessing contributions from the Parties.

ARTICLE X: RELATIONSHIP OF THIS PROTOCOL TO THE CONVENTION

The provisions of the Convention relating to its protocols shall apply to this Protocol.

ARTICLE XI: SIGNATURE

This Protocol shall be open for signature at from to

ARTICLE XII: ENTRY INTO FORCE

1. The Protocol shall enter into force on the same date as the Convention enters into force, provided that at least nine instruments of ratification, acceptance, approval or accession to the Protocol have been deposited. In the event that nine such instruments have not been deposited by the date of entry into force of the Convention, this Protocol shall enter into force on the thirtieth day following the date of deposit of the ninth instrument of ratification, acceptance, approval or accession to the Protocol.
2. For the purposes of paragraph 1, any instrument deposited by a regional economic integration organization as referred to in Article 12 of the Convention shall not be counted as additional to those deposited by member States of such organizations.
3. After the entry into force of this Protocol, any state or regional economic integration organization as referred to in Article 12 of the Convention shall become a Party to it on the thirtieth day following the date of deposit of its instrument of ratification, acceptance, approval or accession.

ARTICLE XII bis: RESERVATIONS

(No reservations may be made to this Protocol)

ARTICLE XIII: AUTHENTIC TEXTS

The original of this Protocol, of which the Arabic, Chinese, English, French, Russian and Spanish texts are equally authentic, shall be deposited with the Secretary-General of the United Nations.

IN WITNESS WHEREOF THE UNDERSIGNED, BEING DULY AUTHORIZED TO THAT EFFECT HAVE SIGNED THIS PROTOCOL,

DONE AT THIS DAY OF

X X X

ARTICLE ON CONTROL OF TRADE

1. Within [] years after entry into force of this Protocol, each Party shall ban the import of the controlled substances in bulk from any state not party to this protocol [, unless such state is in full compliance with Article [] and this Article and has submitted information to that effect as specified in Article []].
2. Within [] years after entry into force of this Protocol, each Party shall [restrict] [ban] imports of products containing substances controlled by this Protocol from any state not party to this Protocol [, unless such state is in full compliance with Article [] and this Article, and has submitted information to that effect as specified in Article []]. At least one year prior to the time such measures take effect, the Parties shall elaborate in an annex a list of the products to be [restricted] [banned] and standards for applying such measures uniformly by all Parties.
3. The Parties shall jointly study the feasibility of restricting or banning imports of products produced with substances controlled by this Protocol from any state not party to this Protocol [, unless such state is in full compliance with Article [] and this Article and has submitted information to that effect as specified in Article []].
4. Within [] years after entry into force of this Protocol, each Party shall [ban] [restrict] [discourage] the export of technologies [to non-parties] for the production and use of the controlled substances [, unless such state is in full compliance with Article [] and this Article and has submitted information to that effect as specified in Article []].
5. The Parties shall not provide [to non-parties] bilateral or multilateral subsidies, aid, credits, guarantees, or insurance programs for the export of products, equipment, plants, or technology for the production or use of the controlled substances [, unless such state is in full compliance with Article [] and this Article and has submitted information to that effect as specified in Article []].

- [6. The provisions of paragraphs 4 and 5 shall not apply to products, equipment, plants or technologies which contribute to the protection of the ozone layer.]

X X X

ASSISTANCE TO BE RECEIVED BY DEVELOPING COUNTRIES

- A.(i) Add a new Article V 1. bis to UNEP/WG.151/2, 26 September 1986, Fifth Revised Draft Protocol on Chlorofluorocarbons* as follows:

1. bis

The Parties, individually, jointly or through competent international bodies, shall cooperate in promoting public awareness of the environmental effects of the emissions of CFCs and other ozone modifying substances.

- (ii) Change the title of Article V to "Research, Development, Exchange of Information and Public Awareness".

- B. Add a new Article VII 2. bis to Article VII: "Meetings of the Parties" in Annex II to UNEP/WG/151/L.4. Draft (sic) Report of the Ad Hoc Working Group on the Work of the First Session, 15 January 1987.

4. bis

At their first meeting, the Parties shall begin deliberations on the ways and means of fulfilling the obligations set out in Articles V and VI above, including the preparation of work plans in this regards. Such work plans shall pay special attention to the needs and circumstances of the developing countries. Non-parties to the protocol should be encouraged to participate in activities outlined in such work plans.

- C. Add a new sub-paragraph (e) bis and (f) bis to Article VIII:
"Secretariat" of Annex II to UNEP/WG.151/L.4, 15 January 1987.

VIII (e) bis

Where possible, encourage non-parties to attend the meetings of the Parties, as observers, and to act in accordance with the provisions of the protocol;

(f) bis

Where possible, provide the information referred to in sub-paragraphs (b), (c) and (d) above to such non-party observers.

26 February 1987

Ad Hoc Working Group of Legal and Technical
Experts for the Preparation of a Protocol
on Chlorofluorocarbons to the Vienna
Convention for the Protection of the
Ozone Layer (Vienna Group)

Second Session
Vienna, 23-27 February 1987

ARTICLE II - Control Measures

✓ 1. Each party, under jurisdiction of which substances referred
✓ to in Annex A are produced, shall ensure that within [one to
[annual production and imports] [adjusted annual production] of
these substances does [do] not exceed their [its] 1986 level.

2. Each party, under the jurisdiction of which substances
referred to in Annex A are not produced at the time of the
entry into force of this Protocol, shall ensure that within
[one to three] years hereinafter [its annual production and
imports] [its adjusted annual production] do [does] not exceed
the level of imports in 1986.

✓ 3. Each party shall ensure, that within [blank] years after
the entry into force of this protocol, levels attained in
accordance with paragraphs 1 and 2 will be reduced by [10 to
✓ 50] percent, [unless the parties by a two-thirds majority
✓ otherwise decide] [if the parties confirm this obligation by a
two-thirds majority].

Option A

- ✓ 4. Parties shall decide not later than [blank] years after the entry into force of this protocol by a two-thirds majority on
- new substances to be included in Annex A
 - further reduction of 1986 levels.

These decisions shall be reviewed in intervals of [blank] years.

Option B

4. Each party shall ensure that, within [blank] years after the entry into force of this protocol, levels attained in accordance with paragraph 3 will be reduced by [blank] [unless parties by a two-thirds majority otherwise decide] [if parties confirm this obligation by a two-thirds majority].

1. Sixth Revised Draft Protocol Text
2. Trade Article
3. Controls Article
4. U.S. Proposed text
5. U.S. Proposed trade article



United Nations Environment Programme



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Ad Hoc Working Group of Legal and Technical
Experts for the Preparation of a Protocol
on Chlorofluorocarbons to the Vienna
Convention for the Protection of the
Ozone Layer (Vienna Group)

Second Session
Vienna, 23-27 February 1987

*Agreed that
Trade Article
will be incorp'd
in text of 3rd
Revised Draft
"Chairman's"
Also on control
measures Article*

DRAFT REPORT OF THE AD HOC WORKING GROUP ON THE WORK OF ITS
SECOND SESSION
(continued)

SIXTH REVISED DRAFT PROTOCOL ON CHLOROFLUOROCARBONS
PREAMBLE

THE PARTIES TO THIS PROTOCOL,

Being parties to the Vienna Convention for the Protection of the Ozone Layer,

Mindful of their obligation under the Vienna Convention to take appropriate measures to protect human health and the environment against adverse effects resulting or likely to result from human activities which modify or are likely to modify the ozone layer,

Recognizing the possibility that world-wide emissions of fully halogenated chlorofluorocarbons and other chlorine containing substances can significantly deplete and otherwise modify the ozone layer, resulting or likely to result in adverse effects on human health and the environment,

Recongizing also the potential climatic effects of chlorofluorocarbons emissions,

Determined to protect the ozone layer by taking precautionary measures to control total global emissions of chlorofluorocarbons,

Mindful of the precautionary measures for controlling emissions of chlorofluorocarbons that have already been taken at the national and regional levels,

Aware that measures taken to protect the ozone layer from modifications due to the use of chlorofluorocarbons should be based on relevant scientific and technical considerations,

Mindful that special provision needs to be made in regard to the production and use of chlorofluorocarbons for the benefit of developing countries,

Considering the importance of promoting international co-operation in the research and development of science and technology on the control and reduction of chlorofluorocarbons emissions, bearing in mind, in particular, the needs of developing countries,

HAVE AGREED AS FOLLOWS:

ARTICLE I: DEFINITIONS

For the purpose of this Protocol,

1. "The Convention" means the Vienna Convention for the Protection of the Ozone Layer;
2. "Parties" means, unless the text otherwise indicates, Parties to this Protocol;
3. "The Secretariat" means the Secretariat of the Convention;
4. "Chlorofluorocarbon" or "CFC" means any fully halogenated chlorofluoroalkane.)

ARTICLE II: CONTROL MEASURES

ARTICLE III: REVIEW OF CONTROL MEASURES

The Parties shall regularly at their meetings reassess the control measures provided for in article II, on the basis of the scientific, environmental and economic information available, and shall take all appropriate action.

ARTICLE IV: REPORTING OF INFORMATION

1. Within one year after the entry into force of this Protocol each Party shall inform the Secretariat about the implementation of this Protocol.
2. The Parties to this Protocol, either individually or jointly, shall submit annually to the Secretariat;
 - (a) Information on national laws, regulations, policy directives and other measures adopted to implement this Protocol;
 - (b) Any other information to indicate their implementation of this Protocol.

ARTICLE V: RESEARCH, DEVELOPMENT AND EXCHANGE OF INFORMATION

1. The Parties shall co-operate in promoting, directly and through competent international bodies, bearing in mind the needs of developing countries, research, development and exchange of information on:
 - (a) The best practicable technologies;
 - (b) Possible alternatives to CFCs and CFC products;
 - (c) Costs and benefits of relevant control strategies.
2. Each Party shall submit to the Secretariat a summary of activities conducted pursuant to the present article on a biennial basis.

ARTICLE VI: TECHNICAL ASSISTANCE

1. The Parties shall co-operate, taking into account in particular the needs of developing countries, in promoting, in the context of the provisions of article 4 of the Vienna Convention, technical assistance to facilitate participation in and implementation of this Protocol.
2. Any Party of Signatory to this Protocol in need of technical assistance in implementing it may submit a request to the Secretariat.

ARTICLE VII: MEETINGS OF THE PARTIES

1. The Parties shall hold meetings at regular intervals. The Secretariat shall convene the first meeting of the Parties not later than one year after the entry into force of this Protocol and in conjunction with a meeting of the Conference of the Parties to the Convention, if a meeting of the latter is scheduled within that period.
2. Subsequent ordinary meetings of the Parties shall be held, unless the Parties otherwise decide, in conjunction with meetings of the Conference of the Parties to the Convention. Extraordinary meetings of the Parties shall be held at such other times as may be deemed necessary at a meeting of the Parties, or at the written request of any of them, provided that, within six months of such a request being communicated to them by the Secretariat, it is supported by at least one third of the Parties.
3. The Parties shall by consensus adopt Rules of Procedure for their meetings.
4. The functions of the meetings of the Parties shall be:
 - (a) To review implementation of this Protocol;
 - [(b) To establish where necessary guidelines or procedures for reporting of information as provided for in article IV and V;]
 - (c) To review requests for technical assistance provided for in article VI;
 - (d) To review requests received from the Secretariat pursuant to article VIII;
 - (e) To reassess, pursuant to article III, the control measures provided for in article II;
 - (f) To consider and adopt proposals for amendment of this Protocol (in conformity with articles IX and X of the Convention);
 - (g) To consider and adopt the budget for implementation of this Protocol;
 - (h) To consider and undertake any additional action that may be required for the achievement of the purposes of this Protocol.
5. The United Nations, its specialized agencies and the International Atomic Energy Agency, as well as any State not party to this Protocol, may be represented at meetings of the Parties by observers. Anybody or agency, whether national or international, governmental or non-governmental, qualified in fields relating to the protection of the ozone layer which has informed the secretariat of its wish to be represented at a meeting of the Parties as an observer may be admitted unless at least one-third of the Parties present object. The admission and participation of observers shall be subject to the rules of procedure adopted by the Parties.

ARTICLE VIII: SECRETARIAT

The Secretariat shall:

- (a) Arrange for and service meetings of the Parties provided for in article VII;
- (b) Distribute to the Parties information on each Party's year of maximum use of CFCs by sectors and the total amount of its use in that year, as reported by the Parties in accordance with article IV;
- (c) Prepare and distribute to the Parties regularly a report based on information received pursuant to articles IV and V;
- (d) Notify the Parties of any request for technical assistance received pursuant to article VI so as to facilitate the provision of such assistance to the extent possible;
- (e) Perform such other functions for the achievement of the purposes of the Protocol as may be assigned to it by the Parties.

ARTICLE IX: FINANCIAL PROVISIONS

- 1. The funds required for the operation of this Protocol, including those for the functioning of the Secretariat related to this Protocol shall be charged exclusively against contributions from the Parties.
- 2. The Parties shall be consensus adopt Financial Rules for the Operation of this Protocol, including rules for assessing contributions from the Parties.

ARTICLE X: RELATIONSHIP OF THIS PROTOCOL TO THE CONVENTION

The provisions of the Convention relating to its protocols shall apply to this protocol.

ARTICLE XI: SIGNATURE

This Protocol shall be open for signature at from
..... to

ARTICLE XII: ENTRY INTO FORCE

- 1. The Protocol shall enter into force on the same date as the Convention enters into force, provided that at least nine instruments of ratification, acceptance, approval or accession to the Protocol have been deposited. In the event that nine such instruments have not been deposited by the date of entry into force of the Convention, this Protocol shall enter into force on the thirtieth day following the date of the ninth instrument of ratification, acceptance, approval or accession to the Protocol.
- 2. For the purpose of paragraph 1 any instrument deposited by a regional economic integration organization shall not be counted as additional to those deposited by member States of such organizations.
- 3. After the entry into force of this Protocol, any state or regional economic integration organization shall become a Party to this Protocol on the thirtieth day following the date of deposit of its instrument of ratification, acceptance, approval or accession.

ARTICLE XII bis: RESERVATIONS

(No reservations may be made to this Protocol)

ARTICLE XIII: AUTHENTIC TEXTS

The original of this Protocol, of which the Arabic, Chinese, English, French, Russian and Spanish texts are equally authentic, shall be deposited with the Secretary-General of the United Nations.

IN WITNESS WHEREOF THE UNDERSIGNED, BEING DULY AUTHORIZED TO THAT EFFECT HAVE SIGNED THIS PROTOCOL,

DONE AT

THIS
DAY OF

26 February 1987

Ad Hoc Working Group of Legal and Technical
Experts for the Preparation of a Protocol
on Chlorofluorocarbons to the Vienna
Convention for the Protection of the
Ozone Layer (Vienna Group)

Second Session
Vienna, 23-27 February 1987

ARTICLE II - Control Measures

1. Each party, under jurisdiction of which substances referred to in Annex A are produced, shall ensure that within [one to three] years after the entry into force of this protocol the [annual production and imports] [adjusted annual production] of these substances does [do] not exceed their [its] 1986 level.

1-3 yrs =
freeze

2. Each party, under the jurisdiction of which substances referred to in Annex A are not produced at the time of the entry into force of this Protocol, shall ensure that within [one to three] years hereinafter [its annual production and imports] [its adjusted annual production] do [does] not exceed the level of imports in 1986.

3. Each party shall ensure, that within [blank] years after the entry into force of this protocol, levels attained in accordance with paragraphs 1 and 2 will be reduced by [10 to 50] percent, [unless the parties by a two-thirds majority otherwise decide] [if the parties confirm this obligation by a two-thirds majority].

X yrs
↓ 50%

Option A

4. Parties shall decide not later than [blank] years after the entry into force of this protocol by a two-thirds majority on

- new substances to be included in Annex A
- further reduction of 1986 levels.

X yrs
> 4's

These decisions shall be reviewed in intervals of [blank] years.

Option B

4. Each party shall ensure that, within [blank] years after the entry into force of this protocol, levels attained in accordance with paragraph 3 will be reduced by [blank] [unless parties by a two-thirds majority otherwise decide] [if parties confirm this obligation by a two-thirds majority].

RESULTS OF TRADE SUB-GROUP:

Article on Control of Trade

1. Within () years after entry into force of this Protocol, each Party shall ban the import of the controlled substances in bulk from any state not party to this protocol (, unless such state is in full compliance with Article () and this Article and has submitted information to that effect as specified in Article ()).
2. Within () years after entry into force of this Protocol, each Party shall (restrict) (ban) imports of products containing substances controlled by this Protocol from any state not party to this Protocol (unless such state is in full compliance with Article () and this Article, and has submitted information to that effect as specified in Article ()). At least one year prior to the time such measures take effect, the Parties shall elaborate in an annex a list of the products to be (restricted) (banned) and standards for applying such measures uniformly by all Parties.
3. The Parties shall jointly study the feasibility of restricting or banning imports of products produced with substances controlled by this Protocol from any state not party to this Protocol (, unless such state is in full compliance with Article () and this Article and has submitted information to that effect as specified in Article ()).
4. Within () years after entry into force of this Protocol, each Party shall (ban) (restrict) (discourage) the export of technologies (to non-parties) for the production and use of the controlled substances (, unless such state is in full compliance with Article () and this Article and has submitted information to that effect as specified in Article ()).
5. The Parties shall not provide (to non-parties) bilateral or multilateral subsidies, aid, credits, guarantees, or insurance programs for the export of products, equipment, plants, or technology for the production or use of the controlled substances (, unless such state is in full compliance with Article () and this Article and has submitted information to that effect as specified in Article ()).
6. The provisions of paragraphs 4 and 5 shall not apply to products, equipment, plants or technologies which contribute to the protection of the ozone layer.)

United States Proposed Protocol Text

UNEP Negotiations on an Ozone Layer Protocol

December 1-5, 1986
Geneva, Switzerland

The United States believes that the potential risks to the stratospheric ozone layer from certain man-made chemicals require early and concerted action by the international community. Since the adoption in Vienna in March 1985 of the Ozone Layer Convention, an intensive scientific research and technical analysis effort has been carried out and is continuing, as reflected in the recent series of UNEP-Sponsored workshops. The results continue to indicate the emergence of a serious environmental problem of global proportions.

The United States further believes that governments should pursue three broad objectives during the course of the negotiations, to be embodied and elaborated in the final protocol. These are:

- A. Agreement on a meaningful near-term first step to reduce significantly the risk of stratospheric ozone depletion and associated environmental and human health impacts.
- B. Agreement on a long-term strategy and goals for coping with the problem successfully.
- C. Agreement on a carefully-scheduled plan for achieving the long-term goals, including periodic reassessment and appropriate modification of the strategy and goals in response to new scientific and economic information.

In response to UNEP's invitation, the U.S. has prepared for discussion purposes a draft text based on the U.S. views statement which we recently circulated. This text is for the operative articles only, and is designed for incorporation into the protocol text developed during the previous round of negotiations (i.e., it would replace Articles II through V of the fourth revised draft text).

*Who prepared?
are'd to whom?*

The United States believes that what is required is a straightforward, cost-effective approach that will provide technology incentives and clear targets to governments and industry for developing and introducing new technologies for chemical conservation, recycling and substitution. The U.S. believes that its proposed text provides such an approach.

U.S. DRAFT PROTOCOL TEXT: OPERATIVE ARTICLES

Article II: Control Measures

1. Within [] year after entry into force of this Protocol, each Party shall ensure that its aggregate annual emissions of fully-halogenated alkanes does not exceed its 1986 level.
2. Within [] years after entry into force of this Protocol, each Party shall ensure that its aggregate annual emissions of fully-halogenated alkanes is reduced by [20] percent from its 1986 level.
3. Within [] years after entry into force of this Protocol, each Party shall ensure that its aggregate annual emissions of fully-halogenated alkanes is reduced by [50] percent from its 1986 level.
4. Within [] years after entry into force of this Protocol, each Party shall ensure that its aggregate annual emissions of fully-halogenated alkanes is reduced by [95] percent from its 1986 level.
5. The right of any Party to adopt control measures more stringent than contained herein is not restricted by this Article.

Article III: Calculation of Aggregate Annual Emissions

1. For the purposes of Article II, each Party shall calculate its aggregate annual emissions by taking its:
 - a. aggregate annual production;
 - [b. plus aggregate annual bulk imports;]
 - [c. minus aggregate annual bulk exports to other Parties;]
 - [d. minus aggregate annual amount of fully-halogenated alkanes which have been destroyed or permanently encapsulated.]
2. To calculate the aggregate amounts specified in the subparagraphs of paragraph 1, each Party shall multiply the amount of each fully-halogenated alkane by its ozone depletion weight, as specified in Annex A, and then add the products.

Article IV: Assessment and Adjustment
of Control Measures

1. The Parties shall cooperate in establishing an international monitoring network for detecting, or aiding in the prediction of, modification of the ozone layer.
2. At least one year before implementing the reductions specified in paragraphs 2, 3, and 4, respectively, of Article II, the Parties shall convene an ad hoc panel of scientific experts, with composition and terms of reference determined by the Parties, to review advances in scientific understanding of modification of the ozone layer and the potential health, environmental, and climatic effects of such modification.
3. In light of such scientific review, the Parties shall jointly assess and may adjust the stringency, timing, and scope of the control measures in Article II and the ozone depletion weights in Annex A.
4. Any such adjustment shall be made by amending Article II and/or Annex A as provided in Article 9 of the Convention, except that such amendment would not be subject to the six month advance notice requirement of paragraph 2 of that Article.

Article V: Control of Trade

1. Within [] years after entry into force of this Protocol, each Party shall ban the import of fully-halogenated alkanes in bulk from any state not party to this Protocol [, unless such state is in full compliance with Article II and this Article and has submitted information to that effect as specified in paragraph 1 of Article VI].
2. Within [] years after entry into force of this Protocol, each Party shall ban:
 - a. the export of technologies to the territory of non-parties
 - [b. direct investment in facilities in the territory of non-parties]for producing fully-halogenated alkanes [, unless such state is in full compliance with Article II and this Article and has submitted information to that effect as specified in paragraph 1 of Article VI].
3. The Parties shall jointly study the feasibility of restricting imports of products containing or produced with fully-halogenated alkanes from any state not party to this Protocol.

Article VI: Reporting of Information

1. Each Party shall submit annually to the Secretariat data showing its calculation of aggregate annual emissions of fully-halogenated alkanes, as specified in Article III, using the format developed by the Secretariat pursuant to paragraph 3a.
2. Each Party shall submit to the Secretariat appropriate information to indicate its compliance with Article V.
3. The Secretariat shall:
 - a. develop and distribute to all Parties a standard format for reporting such data as indicated by paragraph 1;
 - b. take appropriate measures to ensure the confidentiality of all data submitted to it pursuant to paragraph 1, except for the aggregate annual emissions figures;
 - c. compile and distribute annually to all Parties a report of the aggregate annual emissions figures and other information submitted to it pursuant to paragraph 2.

Ad Hoc Working Group of Legal and Technical Experts
for the Preparation of a Protocol on
Chlorofluorocarbons to the Vienna Convention
for the Protection of the Ozone Layer (Vienna Group)

Second Session
Vienna, 23-27 February 1987

United States Proposed Trade Article

Article V: Control of Trade

1. Within [] years after entry into force of this Protocol, each Party shall ban the import of the controlled substances in bulk from any state not party to this Protocol [, unless such state is in full compliance with Article II and this Article and has submitted information to that effect as specified in paragraph 1 of Article VI].
2. Within [] years after entry into force of this Protocol, each Party shall restrict imports of products containing substances controlled by this Protocol from any state not party to this Protocol [unless such state is in full compliance with Article II and this Article, and has submitted information to that effect as specified in paragraph 1 of Article VI]. At least one year prior to the time such restrictions take effect, the Parties shall elaborate in an annex a list of the products to be restricted and standards for applying such restrictions uniformly by all Parties.
3. The Parties shall jointly study the feasibility of restricting imports of products produced with substances controlled by this Protocol from any state not party to this Protocol.
4. Within [] years after entry into force of this Protocol, each Party shall ban the export of technologies to the territory of non-parties for the production and use of the controlled substances [, unless such state is in full compliance with Article II and this Article and has submitted information to that effect as specified in paragraph 1 of Article VI].
5. Parties shall not provide bilateral or multilateral subsidies, aid, credits, guarantees, or insurance programs for the export of products, equipment, plants, or technology for the production or use of the controlled substances.



Fluorocarbon/Ozone

Alternatives To Fully Halogenated Chlorofluorocarbons: The Du Pont Development Program



Introduction

Du Pont has been involved in the fluorocarbon industry since the earliest production of CFCs in the 1930s by Kinetic Chemicals, a joint venture with General Motors. For over fifty years, Du Pont has had a strong commitment to the CFC industry and its customers. Today, with increasing concern that these products might eventually harm the environment if growth continues without restriction,

Du Pont has renewed its commitment by undertaking a major program to develop potential chlorofluorocarbon alternatives.

Du Pont has concluded that some limitation to growth of CFC emissions is justified. We believe that future customer and environmental needs can be met by a combination of reasonable regulation, recovery/reclamation/conservation, and timely introduction of alternative products. Transition time will be required, and government regulators seem willing to consider industrial needs in managing this issue. Du Pont does not yet have commercial processes developed for alternative chlorofluorocarbon products, but this work has become a high priority. However, this effort will require time for research and applications development, and to design and install new facilities.

The process of bringing new chemical products from the concept stage to commercial availability is a lengthy one, beginning with the identification of candidates and ending with construction and start-up of production facilities. Interim phases include scouting research for commercial production processes, preparing small quantities of material, performing detailed toxicological studies, determining market potential, and building a pilot plant to demonstrate the commercial processes and to develop design data for full scale operations. When results of all of these efforts indicate that a product can be produced, sold, and used safely, and will provide an acceptable financial return, final design and construction can proceed.

Shortly after the ozone depletion hypothesis was proposed in 1974, Du Pont initiated a program to develop alternatives to the suspect chlorofluorocarbons (CFCs). As of the last published report on this subject in 1980, an investment of over \$15 million in research has served to identify a number of candidate chlorofluorocarbon alternatives and to outline the major defi-

ciencies or technical stumbling blocks associated with each. A particular deficiency was the projected higher cost for some of the most promising products. At about this time, scientific and regulatory concern over CFCs began to decrease. This, in combination with market surveys which indicated little interest in more expensive alternatives, led to a de-escalation of effort.

In 1986, however, the picture changed again. It is now expected that regulation in some form will be announced by the end of 1987. Du Pont believes that regulations could be extensive enough to limit availability of at least some existing CFCs to less than the market demand sometime within the next several years. In this new environment, Du Pont reinitiated an active effort to develop alternative products, with the aim of providing new products if and when there is a clear market demand.

This update reviews the currently marketed products and previous research efforts, and summarizes the current status of Du Pont's research program. A major aim of the update is to provide Du Pont's customers with information needed to plan their own development work and to facilitate assessment of potential market interest in Du Pont's alternative candidates. We are committed to the market and want to provide products necessary for our customers to maintain viable businesses.

Current Commercial Chlorofluorocarbons

Chlorofluorocarbons are used as working fluids in refrigeration and air conditioning; as blowing agents in the manufacture of plastic insulation, packaging, and cushioning foams; as cleaning agents in the metal-working and electronics industries; and in many other uses where their unique property combinations of low toxicity, nonflammability, compatibility with materials of construction, and heat transfer characteristics are of great value. Current Du Pont CFC products which might be affected by United States or international regulations are listed in Table 1, along with some physical property data and information on their current uses. In these varied uses, they contribute to worker and consumer safety, to equipment and

product reliability and performance, and to the world's energy conservation efforts.

All of these factors must be considered along with potential environmental impacts in choosing substitutes. The unique suitability of the current products in so many different applications makes the task a difficult one. These products provide high value at low cost and have stood the test of time for over fifty years. Ironically, the high stability of the products, one of their prized assets, is now a cause for concern.

Criteria for Alternatives

• Performance Criteria

The task of finding alternative compounds which can do the job of the existing CFCs begins with a review of basic physical properties such as boiling point, vapor pressure, and other thermodynamic factors. For each end-use application, a compilation of the reasons for selecting a given existing CFC can be compared with properties of the candidate substitutes. Properties of a large number of the candidate chlorofluorocarbons fall outside the useful range, but several survive this initial screening.

• Environmental Criteria

Atmospheric research has identified two key factors which control the contribution of an individual CFC to potential ozone depletion. The first is the percentage by weight of chlorine in the compound, since it is chlorine which is implicated in the depletion theory. A second factor is the overall stability of the molecule in the atmosphere. Only for the very stable compounds do significant quantities survive the trip to the stratosphere, to release chlorine where it can interact with ozone. It is known that including a hydrogen atom in a chlorofluorocarbon molecule reduces the stability sufficiently to dramatically lower the ozone depletion potential without making the molecule so unstable that it contributes to ground-level smog. Therefore, the primary environmental criterion for any potential alternative is that it must either contain no chlorine atoms or include at least one hydrogen atom.

Recently expressed concern about the potential contribution of long-lived CFCs to greenhouse warming of the earth imposes additional restrictions. Atmospheric lifetime plays an important role here, so inclusion of a hydrogen atom in a chlorofluorocarbon molecule lessens this concern. However, the contribution to warming is also influenced by the heat absorbing capability of the molecule. Data on this factor are not yet readily available for many potential substitutes, so only estimates of the relative contribution can be made.

A recent reexamination of all possible fluorocarbon alternates with a view toward acceptable performance properties and minimized environmental impact identified thirteen candidates. These are listed in Table 2.

• Feasibility Criteria

Many factors contribute to the ultimate acceptability of a product in the marketplace. Foremost in many CFC applications is the need for low toxicity. In fact, this was the primary motivation in the development of the existing CFCs in the 1930s as replacements for toxic or flammable refrigerants. Unacceptable toxicity results from preliminary studies of acute effects have eliminated three of the thirteen candidates identified by Du Pont. (See Table 2.)

Flammability is an important consideration for many applications in order to avoid risks to workers, consumers, and the public. Although fire hazards can be adequately eliminated in some cases, non-flammability remains highly desirable as a product attribute. Similar considerations apply to compatibility with materials of construction and other product properties. Each of these factors must be considered on an application-by-application basis.

A final and critical criterion is the need for a manufacturing process to produce the new product at a cost which is compatible with its value to customers. As discussed below, this continues to be a major obstacle to the development of chlorofluorocarbon alternatives.

Candidate Alternative Fluorocarbons

• Existing Substitutes

Of the ten compounds remaining after environmental, toxicity, and application screening, three are already being produced commercially. Chlorofluorocarbon 22 is a major product in the worldwide market, with applications in refrigeration and air conditioning. It also is used widely

(with no atmospheric release) as an ingredient in the production of fluoropolymers. Opportunities may exist for expansion of its uses to include substitution for CFC-12 in some blowing agent applications and as a refrigerant in stationary refrigeration systems and mobile air conditioners. However, extensive equipment redesign would be required for the latter applications.

Fluorocarbons 142b and 152a are now manufactured in limited quantities, primarily for consumption in fluoropolymer production. Both have desirable thermodynamic properties, but suffer the disadvantage of being flammable. Also, product cost is significantly higher than that of the major current products.

• New Chlorofluorocarbons

From among the remaining seven products, Du Pont has concentrated its efforts on finding the best all around substitutes for the major CFCs of concern - CFC-11, CFC-12, and CFC-113. As noted in Table 2, a developmental manufacturing process exists only for fluorocarbon 141b. This product is being considered as a substitute for CFC-11 as a blowing agent and as an aerosol propellant, pending further toxicity testing. However, it is flammable and would be rather expensive if produced by the current process. Cost is estimated to be one and one half to three times that of CFC-11.

Chlorofluorocarbon 123 has properties very similar to those of CFC-11, along with very low ozone depletion and greenhouse impact. The majority of the other criteria also are met by this compound, but toxicity testing is not yet complete. There also are some production process hurdles which must be overcome. Even with success in those areas, cost is estimated to be as much as two to four times that of CFC-11. Nonetheless, this compound appears to be the most promising substitute for CFC-11 in several applications.

Fluorocarbon 134a is known to be a good candidate to replace CFC-12 because it contains no chlorine and, therefore, has zero ozone depletion potential; it is expected to have a low greenhouse potential; and it compares favorably against most other criteria. However, further toxicity testing and manufacturing process development are needed to support commercialization. Probable high cost, as much as three to five times CFC-12 at production levels equivalent to current CFC-12 production levels, is another concern. However, FC-134a appears to be the best of any of the candidate alternatives to CFC-12, and a great deal of effort continues to be devoted to process research and development.

An exhaustive search has failed to identify any single compound which matches all the desirable properties of chlorofluorocarbon 113 and hence could potentially replace it in all applications. One candidate which has received some attention is chlorofluorocarbon 132b. It appears to have some potential as a solvent; however, it is not a good all-around match for CFC-113, and manufacturing process development work is needed. A key need here is for further toxicity work. Future studies will clarify the full extent of the potential usefulness of CFC-132b. If commercialized, this compound could cost from one to two times that of CFC-113.

The remaining candidates, chlorofluorocarbons 124, 125, and 143a, all have less desirable physical properties. Toxicity testing also is incomplete and manufacturing process development hurdles are significant.

All of the possible new products are likely to be more expensive than existing CFCs. The primary reason is raw material costs for which there are only a few options for improvement. Other contributions such as manufacturing catalyst lifetime, process yields, by-product disposal, and process equipment requirements are heavily dependent upon the manufacturing routes chosen. In any case, it will be difficult to be price competitive with current compounds which have the benefit of over 50 years of operating experience to improve the efficiency of production and optimize the cost. The estimates discussed in this report are based on best available current knowledge of process options and assume large-scale production. A major goal of the current research efforts is to overcome some of the costly disadvantages of the process technology under consideration for the new chemicals.

Current Development Program and Timetable

• Process Research

Du Pont's active research and development effort is focused on identifying the best processes for commercial manufacture of attractive alternatives for CFC-11, CFC-12, and CFC-113. Based on the results of this work, as well as feedback from customers on market interest, pilot-plant development for alternative products is expected to begin by late 1987. After start-up, the pilot plants will provide sufficient quantities of the products to begin long-term toxicity testing and product for applications testing, which will commence in 1988. This work will require at least two years.

If the toxicity results and pilot plant evaluations are favorable, and the busi-

ness climate is encouraging, design and construction of commercial facilities would follow, beginning at the earliest in 1990. Another two years would be required to bring such plants on line. This path forms the basis of Du Pont's estimate of roughly five to six years as the total time required to bring commercial products to the marketplace. The timetable, however, is an optimistic one. It assumes favorable toxicology, successful process research, and strong market interest. Additional time will almost certainly be required for customers to make a transition, and this is a critical factor that must be considered by regulators.

• Applications Testing

In the course of the process scouting now in progress, limited quantities of some of the candidate fluorocarbons will be produced. Du Pont will conduct a variety of applications studies in collaboration with interested customers. Before the end of 1987, some of the candidate materials also will be made available to customers in very limited quantities for further applications testing. Such studies will include foam manufacture with alternative CFC blowing agents, investigations of materials and lubricant compatibility for refrigeration applications, and cleaning agent trials.

Conclusion

The chlorofluorocarbon industry has entered a period of major uncertainties. Du Pont, however, remains committed to serving its customers as well as preserving the environment. Existing CFCs are valuable to the markets they serve. However, some limitations to growth appear to be justified. If a market opportunity exists for alternative materials, Du Pont intends to be prepared. The major research efforts now underway are evidence of that commitment. As discussed above, the task is a difficult one, but the goal is simple: to maintain an ongoing supply of safe, effective products which meet the needs of the marketplace.

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Products Division of Du Pont,
Editorial Office
Room 13221, Brandywine Building
Wilmington, DE 19898

TABLE 1
MAJOR COMMERCIAL CHLOROFLUOROCARBONS

NUMBER	FORMULA	B.P. °C	REFRIGERANT	BLOWING AGENT	CLEANING AGENT	OTHER (a)	OZONE DEPLE. POTEN. (e)	GREENHOUSE POTENTIAL (f)
CFC-11	CClF ₃	23.8	Yes	Yes	Limited	-	1.0	0.4
-12	CCl ₂ F ₂	-29.8	Yes (b)	Yes	-	(c)	0.9	1.0
-113	CCl ₂ FCClF ₂	47.6	Yes	Yes	Yes	-	0.8	.3 to .8 ^(g)
-114	CClF ₂ CClF ₂	3.6	Yes	Yes	-	-	0.6	.5 to 1.5 ^(g)
-115	CClF ₂ CF ₃	-38.7	Yes (b)	Limited	-	-	0.3	1 to 3 ^(g)
Halon 1301	CBrF ₃	-57.8	Limited	-	-	(d)	~10 (Estimate)	0.8

(a) Excludes minor uses not discussed in this update
(b) Also component of refrigerant azeotropic mixtures
(c) Direct contact liquid food freezant and inerting agent for ethylene oxide sterilant gas
(d) Fire extinguishant (Halon 1301)

(e) Compared to CFC-11 with a value of 1.0 on a per pound basis
(f) Compared to CFC-12 with a value of 1.0 on a per pound basis
(g) Estimated range; the data required for a complete analysis are not available

TABLE 2
CHLOROFLUOROCARBON ALTERNATIVES

NUMBER	FORMULA	B.P. °C	POTENTIAL APPLICATION	FLAMMABLE	MFG. PROCESS	TOXICOLOGY	OZONE DEPLE. POT. (a)(g)	GREENHOUSE POT. (b)(g)
Existing Commercial Products								
FC-22	CHClF ₂	-40.8	Refrigerant, Blowing Agent	No	Yes	Low	0.05	0.07
-142b	CH ₂ CClF ₂	-9.2	Propellant	Yes	Yes	Low	<0.05	<0.2
-152a	CH ₃ CHF ₂	-24.7	Propellant, Refrigerant	Yes	Yes	Low	0	<0.1
Under Consideration								
FC-123	CHCl ₂ CF ₃	28.7	Blowing Agent, Refrigerant	No	CD (d)	Low	<0.05	<0.1
-124	CHClFCF ₃	-12	Refrigerant, Blowing Agent	No	CD (d)	Low	<0.05	<0.1
-125	CHF ₂ CF ₃	-48.5	Refrigerant	No	CD (d)	Unknown	0	<0.2
-132b	CH ₂ ClCClF ₂	46.8	Cleaning Agent	No	No	Incomplete	<0.05	<0.1
-134a	CH ₂ FCF ₃	-26.5	Refrigerant	No	CD (d)	Incomplete	0	<0.1
-141b	CH ₃ CCl ₂ F	32	Propellant, Blowing Agent	Yes	Yes (f)	Incomplete	<0.05	<0.1
-143a	CH ₃ CF ₃	-47.6	Refrigerant	Yes	NC	Incomplete	0	<0.3
Disqualified - Toxic								
FC-21	CHCl ₂ F	8.9	Blowing Agent	No	Yes	Toxic (c)	<0.05	<0.1
-31	CH ₂ ClF	-9.1	Propellant	Yes	NC (e)	Toxic (c)	<0.05	<0.1
-133a	CH ₂ ClCF ₃	6.1	Refrigerant, Blowing Agent, Propellant	No	NC (US)	Embryotoxin (c)	<0.05	<0.1

(a) Compared to CFC-11 with a value of 1.0
(b) Compared to CFC-12 with a value of 1.0
(c) Work discontinued principally for this reason
(d) CD = Catalyst Deficiency
(e) NC = Not Commercialized

(f) Developmental only
(g) Estimates based on preliminary or incomplete data except for CFC-22, which is reliable, as for values quoted as zero which are non-chlorine containing molecules



United States Department of State

*Bureau of Oceans and International
Environmental and Scientific Affairs*

Washington, D.C. 20520

March 20, 1987

MEMORANDUM

TO: Office of the Vice President - Ms. Linda Swacina
Agriculture - Dr. Orville Bentley
Commerce - Mr. Michael T. Kelley
Council of Economic Advisers - Mr. Steve DeCanio
Council on Environmental Quality - Mr. Alan Hill
Defense - Mr. David Parbell
Domestic Policy Council - Mr. Ralph Bledsoe
Energy - Ms. Mary Walker
EPA - Mr. Bill Long
Interior - Mr. Martin Smith
Justice - Mr. Thomas Hookano
NASA - Mr. Shelby Tilford
NOAA - Mr. Joseph Fletcher
Office of Policy Development - Mr. Jan Mares
Office of Science & Technology Policy -
Mr. Richard Johnson
OMB - Mr. David Gibbons
Treasury - Mr. Stephen Entin
USTR - Ms. Marian Barell Nelson
E - Mr. Martin Bailey
EB - Mr. Dennis Lamb
L/OES - Ms. Debbie Kennedy
L/EBC - Mr. Gerald Rosen

From: OES/E - Richard Elliot Benedick *REB*

Subject: Interagency Meeting on UNEP Negotiations to
Control Ozone-Depleting Chemicals:
Friday, March 27, 1987, 10:30 a.m., Room 7835

In preparation for the next round of negotiations on a protocol to control ozone-depleting chemicals (Vienna April 27-30), representatives of interested agencies are invited to a meeting on Friday, March 27, 1987, at 10:30 a.m., in Room 7835 at the Department of State. Please inform all interested offices within your agency. I hope you and/or other representatives of your agency will be able to attend.

Before the meeting, EPA will circulate analyses of the environmental and economic impact of various timing and stringency options under consideration. Drawing on this analysis, we need to refine the U.S. position in order to be able to address specific control measures at Vienna. Any other agencies having material to contribute to this process should also circulate the material before the meeting.

We also need to decide on the U.S. delegation for the April 27-30 meeting. At the February session, the U.S. delegation consisted of six accredited and three nonaccredited individuals, from the State Department, EPA, NASA, Commerce, and NOAA. Other major countries typically sent 3-4 delegates. The Office of International Conferences will pay for only one delegate beyond the head of delegation. Against this background, I would appreciate it if agencies wishing to nominate someone for the delegation would provide, by Thursday, April 2, a letter from a policy-level official of your agency to Ambassador John Negroponte, Assistant Secretary of State for Oceans and International Environmental and Scientific Affairs, (with copy to me) explaining why participation of the individual is essential to the international negotiations. On the basis of those submissions, we will formulate a delegation list on April 6, for transmission to our Missions in Vienna and Nairobi.

Representatives of State, EPA, Commerce and USTR will meet on Monday, March 23 at 3:30 p.m. in Room 7835 to discuss trade among parties (production vs. "adjusted production" vs. the Chairman's draft or other hybrids). If a representative of your agency wishes to participate, please phone Suzanne Butcher at 647-9312.

Attachment: 1. Draft texts
2. Benedick testimony, March 12, 1987