



**United Nations
Environment
Programme**



Distr.
LIMITED

UNEP/OzL.Pro/ExCom/19/59
3 April 1996

ORIGINAL: ENGLISH

Executive Committee of
the Multilateral Fund for the
Implementation of the Montreal Protocol

Nineteenth Meeting
Montreal, 8-10 May 1996

**REPORT OF THE SECOND MEETING OF THE EXPERT GROUP ON THE
PRODUCTION OF SUBSTITUTES
FOR OZONE-DEPLETING SUBSTANCES**

Introduction

1. The Expert Group on the Production of Substitutes for Ozone Depleting Substances (ODS), herein after referred to as the Expert Group, had its second meeting on 4-5 March 1996 in Montreal, Canada, and provided further advice to the Executive Committee on the production sector addressing, in particular, the various issues of concern to the Committee, as contained in Annex VI of the report of the Eighteenth Meeting of the Executive Committee (UNEP/OzL.Pro/ExCom/18/75). An annotated agenda for the meeting was constructed on the basis of Decision 18/24 and instructions from the Eighteenth Meeting of the Executive Committee, and the issues for further study identified at the first meeting of the Expert Group. This report presents the major conclusions and recommendations of the two-day meeting.

2. In accordance with Decision 18/24, the Chairman and Vice-Chairman of the Executive Committee nominated the following members of the Executive Committee to attend the second meeting of the Expert Group:

Chile and India (representing Article 5 countries);
Australia and the United States of America (representing non-Article 5 countries).

Background

3. The Expert Group on the Production of Substitutes for Ozone-Depleting Substances is an advisory body established in 1995 by the Executive Committee of the Multilateral Fund for the Implementation of the Montreal Protocol. As is mandated by its Terms of Reference approved by the Executive Committee at its Fifteenth Meeting, the Expert Group is to "advise on operational policies and guidelines on various technical and economic issues associated with the production of substitutes for ozone-depleting substances (ODS)" (UNEP/OzL.Pro/ExCom/15/45, Annex III).

4. The Expert Group held its first meeting on 13-14 September 1995 in Montreal, and forwarded its report to the Eighteenth Meeting of the Executive Committee (UNEP/OzL.Pro/ExCom/18/71). The report contained a set of recommendations and a number of issues for further study.

5. After discussion, the Executive Committee provided specific guidance on the future work programme of the Expert Group, and expected "to consider the results of the work of the Expert Group at its Nineteenth Meeting" (UNEP/OzL.Pro/ExCom/18/75, Decision 18/24 and Annex VI). In this context, it is also important to recall the decision of the Seventh Meeting of the Parties in December 1995 that:

"The Executive Committee should consider a report on incremental costs for the production of CFC-substitutes and establish firm compensation policies with a view to completing incremental cost guidelines for the production of CFC-substitutes by mid-1996." (UNEP/OzL.Pro.7/12, Action 5, (c)).

6. Consequently, the Expert Group was reconvened on 4 and 5 March 1996 to produce:

- specific recommendations on preparing a national phase out plan for each ODS producing country; and
- specific recommendations that can be adopted as initial guidelines by the Executive Committee at its Nineteenth Meeting for processing production sector projects before the completion of the sectoral phase-out plan.

7. The presentation of the discussion follows the order of the Recommendations in Annex VI of the Report of the 18th Meeting of the Executive Committee (UNEP/OzL.Pro/ExCom/18/75) and tries to address the questions raised under each Recommendation.

Recommendation 1

On sectoral phase out plans

8. A sectoral plan is a prerequisite for an Article 5 producer country to receive funding from the Multilateral Fund for projects in the production sector. Its preparation should, however, proceed by a two step approach.

Step One: Reporting of preliminary sector data by each producer country

9. The purpose of step one is to enable the Executive Committee to size the magnitude of the phase-out task in each producer country with the emphasis on data collection on the macro level. This step should be completed by the relevant government as soon as possible, according to the format attached as Annex I.

Step Two: Preparation of the sector plan

10. The sector plan should map out the most cost-effective strategy and implementation schedule to phase out the ODS production capacity in the country. This should incorporate the results from the technical audit, which would be conducted to provide input for the preparation and review of the sector plan. While the sector plan should proceed in tandem with the technical audit, the timing of its preparation is at the discretion of the Article 5 country concerned. The time required for completing such a plan is estimated at eight months. The plan should be prepared by the government with funding made available from the Multilateral Fund; the Expert Group may assist the Executive Committee in processing these sector plans in the way the Committee deems necessary. The form for preparation of the sector plan is attached as Annex II.

11. In this context, the Expert Group reiterated its preference for using plant shut-down costs for the calculation of the entire sector phase out cost. In this way, it could avoid many of the complex issues related to the calculation of incremental costs of converting ODS production to the production of substitutes and it leaves the choice to the Article 5 country to determine how to

deploy the resources from the Fund to meet its needs for ODS substitutes, in accordance with its national industrial strategy.

On interim guidelines

12. In view of the fact that some Article 5 producer countries may wish to proceed now with the preparation of their sectoral plans and the associated audits, the Expert Group recommends, pending completion of the sector plans, that the Executive Committee could focus on closure projects which could be considered according to interim guidelines with the understanding that guidelines on other types of projects, like conversions and erecting ODS substitutes production, should be developed at a later date.

ODS supply to consumer Article 5 countries

13. The projections on the supply of ODSs to Article 5 countries made in the Report of the Executive Committee on Meeting of the Needs of Article 5 Parties for Controlled Substances during the Grace and Phase-Out Periods took into consideration the interim phase-out targets established by the Montreal Protocol. These projections were also confirmed by TEAP in its 1995 Report on Economic and Financial Implications of Trade in Annex A and Annex B Substances for Article 5 (1) countries after 1995. The Expert Group was not in a position to provide any insight on the likely impact of an accelerated phase-out of ODS production capacity from Article 5 countries on the global ODS supply to Article 5 countries.

Recommendation 2

On technical audits

14. Technical audits are necessary and should be conducted with financing from the Multilateral Fund in tandem with the preparation of the sector plan when an Article 5 country is ready to move ahead to prepare the sector plan. The estimated completion time for a technical audit is six months from the time the audit is about to begin. The results of such audits will provide input for the preparation and review of the sector plan. It is recognized by the Expert Group that data from the technical audits should be handled in a confidential manner.

15. The Expert Group confirmed the validity of the Terms of Reference for the technical audit, which were attached to the Report of the First Meeting of the Expert Group (UNEP/OzL.Pro/ExCom/18/71) and which are attached as Annex III to the current report, but believed, however, that it should be supplemented by a detailed questionnaire at the time when the technical audit takes place.

16. On the composition of the audit team, it is recommended that such teams should include a combination of local and international experts. The Expert Group also discussed the role of the implementing agencies in such audits, but decided that this should be left to the decision of the Executive Committee.

Recommendation 3

Capacity Verification

17. It is believed that the capacity verification could be carried out as part of the technical audit to reduce the potential overlapping of the tasks, however it could be handled separately if the Committee needs to satisfy the decision of the Meeting of the Parties, specifically:

“That the Executive Committee should as a priority agree on modalities to calculate and verify production capacity in Parties operating under Article 5;” (UNEP/OzL.Pro/7/12, Decision VII/9, para. 6).

18. On the modality to calculate production capacity, the Expert Group discussed several possibilities including installed capacity, capacity previously used to produce controlled substances, and other definitions of capacity, but did not reach a conclusion.

19. However, for shut-down projects, the Expert Group recommended that the calculation of production capacity eligible for financing should be based on the average of the actual production levels of a three-year period. The Group did not agree on which three years should be used, the average of three years immediately preceding the submission of a shut-down project, or the average of the three highest productive years.

Recommendation 4

Transfer of Technology

20. The Expert Group learned that the European Transnational Corporation (TNC), which was reportedly considering making available to Article 5 countries, at no cost, the production technology for HFC-134a, was involved in a business takeover, and therefore is no longer in a position to make this offer. The Expert Group also learned that this technology could be made available if the supplier and the recipient of the technology could negotiate a deal to meet their own terms, and that the availability of funding is only one of the terms in this negotiation.

21. In an effort to clarify the relationship between leaving the negotiation of deals to the enterprises and the aim of achieving a single deal for a complete sector, the Expert Group stated that the lump sum of funding that could be agreed upon with any producer country for a commitment to phase out the entire sector would give the producer country the freedom to pursue the option of acquiring the technology from the lump sum funding from the Multilateral Fund. The negotiations for the technology transfer would, of course, have to be conducted by the enterprises involved in the transaction.

Recommendation 5

Development of indigenous technology

22. On the development of indigenous technologies by Article 5 countries, the Expert Group felt that ownership of the technologies so developed should depend on the modality of funding. Under the lump sum arrangement, which would permit the Article 5 country to pursue various options for the supply of ODS substitutes, including the development of local technologies, the technologies should be owned by the Article 5 developer, either the government or any other institution.

Recommendation 6

On feedstock production

23. The Expert Group discussed the most prominent feedstocks used in the production of CFCs, i.e. carbon tetrachloride (CTC) and hydrofluoric acid (HF). For CTC, there was a consensus among the Group that the production capacity could easily be redirected to produce Tetrachlorethylene and therefore probably will not require any assistance from the Multilateral Fund either for conversion or for shut down of ODS production. Concerning HF there was little discussion which amounted to treating it as part of the cost calculation in the shut down of ODS production facilities. Otherwise the HF production capacity would still be used in the production of ODS substitutes in case of conversions.

Recommendation 7

Shut-down of ODS production facilities

24. The Expert Group reviewed a checklist for assessing incremental costs for the shut-down of ODS production facilities, which is attached as Annex IV. The Expert Group also looked at two possible approaches which could be used for the calculation of incremental costs under the shut-down scenario:

- (a) Approach One is based on business acquisition and proposes to reflect the current value of the ODS producing facility. The Expert Group had a discussion on the approach and its criteria based on an oral exposé, which was later expanded into a full elaboration of the business acquisition approach to the calculation of incremental costs for the shut-down of ODS production plants. This document is attached as Annex V.

- (b) Approach Two proposes to use historical pricing data (1987) to reflect the disturbance in the market by the Montreal Protocol and work out from there the foregone production and lost profit as a result of plant shut-down. The Expert Group was briefed on how the approach has been used to prepare and evaluate projects for the shut-down of ODS production facilities funded by the Multilateral Fund. An elaboration of this approach is attached as Annex VI.

25. While considering these two approaches, the Expert Group also considered cost issues related to environmental clean up and assumptions for the calculation of profit levels:

- (i) Environmental clean up: Clean up of contaminated plant area is part of the baseline cost and therefore should not constitute an incremental cost. The Expert Group felt, however, that plant decommissioning should be done in an environmentally responsible manner.
- (ii) Assumptions about profit levels: The Expert Group believed that under each of the two approaches, assumptions have to be made about pricing, sales, and profit margins. The difference is in the kind of pricing and standards to be used, i.e. international vs. local, historical or future. If local pricing is used, it might be necessary to net out tariffs and other transfer payments. The Expert Group considers this a policy issue which should be left to the decision of the Executive Committee.

Other Issues

Enforced idleness

26. The Expert Group was requested by some members of the Executive Committee attending the meeting to deal with the issue of enforced idleness. However, the Group felt that the term of enforced idleness should first be clarified and defined by the Executive Committee.

Net incremental benefits and technology upgrade

27. The Expert Group stated that these issues would have to be considered when developing guidelines on other types of projects, such as conversions and erecting of ODS substitute production, with the understanding that they could be circumvented by the sectoral lump sum settlement deal.

Actions Expected of the Executive Committee

28. This section summarizes the results of the Expert Group discussions into two categories. Category One consists of recommendations for a possible decision by the Executive Committee. Category Two includes those points where guidance from the Committee is required before further work can be continued by the Expert Group.

<u>Category One:</u>	<u>Recommendations for a possible decision by the Executive Committee</u>
----------------------	---

1. Each Article 5 producer country should complete the Preliminary Sector Data form in Annex I and submit it to the Fund Secretariat by 31 August 1996.
2. The Article 5 producer country should inform the Executive Committee eight months before it is ready to submit its sector phase out plan according to the format provided in Annex II. The Executive Committee should commission a technical audit of the production sector of the country concerned in conjunction with the preparation of the sector plan. This will enable the results of the technical audit to be incorporated into the sector plan and serve as a reference point for reviewing the sector plan. The Executive Committee should approve funding for the preparation of the sector plan and the technical audit.
3. The technical audit should follow the TOR provided in Annex III of this report, and include a detailed questionnaire/check list to be developed prior to the commencement of the audit.
4. The technical audit should be conducted by a combined team of local and international experts.
5. Pending the completion of sector plans, the Executive Committee should focus on closure projects which could be considered according to interim guidelines with the understanding that guidelines on other types of projects, e.g. conversions and erecting ODS substitutes production, should be developed at a later date.
6. For ODS plant shut-down, the calculation of production capacity eligible for financing should be based on the average of actual production levels of a three-year period, subject to guidance from the Executive Committee on the appropriate three year period to be used.
7. In general, the cost of dismantling the old plant should be offset by the scrap value of the old plant. However, this should be examined on a case-by-case basis.
8. The environmental clean up of the ODS producing facility should not constitute an incremental cost; however, it should be done in an environmentally responsible manner.

Category Two: Guidance required from the Executive Committee

1. Should the implementing agencies be involved in the conducting of the technical audits? Who should supervise the audit team?
2. Should the capacity verification be covered by the technical audits or should it be conducted separately on a more urgent basis to satisfy Decision VII/9 (b) of the Parties? Who should pay for the capacity verification?
3. On closure projects
 - Of the two approaches to the calculation of shut-down costs, which approach should be followed?
 - Should the checklist provided in Annex IV serve as the basis for developing guidelines for the calculation of shut-down projects?
 - For the calculation of production capacity eligible for financing, which three years should be used for the calculation of the average; the average of three years immediately preceding the submission of a shut-down project, the average of the three highest productive years, or a different approach?
 - What pricings and standards should be used, local vs. international, historical or future in the calculation of shut-down costs?
4. Should guidelines for conversion projects and erecting ODS substitute production projects be developed now?
5. What guidance, especially with regard to the definition, would the Executive Committee give the Expert Group on the issue of enforced idleness?

ANNEX I

PRELIMINARY DATA ON THE PRODUCTION SECTOR

1. List of plants in the country

Name	Location	Product List	Nominal Capacity	Date of Construction	Name of Proprietors

2. Effective production of ODS substances country-wide

Tonnes/Yr.						
	CFC-11	CFC-12	CFC-113	Others*	Halon 1211	Halon 1301
1993						
1994						
1995						
1996 (est.)						

* To be specified.

3. Effective production of ODS substances plant by plant

Data for a plant "X" (one table for one plant**)

Tonnes/Yr.						
	CFC-11	CFC-12	CFC-113	Others*	Halon 1211	Halon 1301
1993						
1994						
1995						
1996 (est.)						

* To be specified.

** If it is a swing plant, please complete the corresponding columns.

- 3.1 Industry turn over as % of GNP
as % of Chemical industries

- 3.2 Quantities of imported CFCs (Nation-wide)

	Tonnes/Yr.					
	CFC-11	CFC-12	CFC-113	Others*	Halon 1211	Halon 1301
1993						
1994						
1995						
1996 (est.)						

* To be specified.

- 3.3 Quantities of exported CFCs

	Tonnes/Yr.					
	CFC-11	CFC-12	CFC-113	Others*	Halon 1211	Halon 1301
1993						
1994						
1995						
1996 (est.)						

* To be specified.

4. Total employees in the CFC industry

- a) In the production sector (Direct labour + overheads + maintenance)
- b) In the packaging sectors

4.1 Total employees per CFC plant (one table per plant)

Number of employees in the plant "...XY..."					
	Direct labour	Overhead	Labs	Maintenance	Packaging
1993					
1994					
1995					
1996 (est.)					

5. Future demand forecasts - next five years

Tables for each of CFC-11, 12, 113, Others, Halon 1211, Halon 1301

Tonnes/Yr.						
	CFC-11	CFC-12	CFC-113	Others*	Halon 1211	Halon 1301
1997						
1998						
1999						
2000						
2001						

* To be specified.

6. Sites and capacities of production plants of raw materials
(for the information purpose)

Tonnes/Yr.				
	AHF	CCl ₄	C ₂ Cl ₄	Others
1993				
1994				
1995				
1996 (est.)				

ANNEX II

FORM FOR THE SECTOR PLAN

1. Strategy for phase out

a) Time schedule for the phase out

Name of the plant	Proposed date of shut down	Name & Quantities of CFC

b) Proposal of an action plan for phase out regarding sites

c) Strategy and action plan regarding manpower

2. Strategy for production of new substitutes

New compounds: HCFC-22, 141b, 142b, HFC-134a, Hydrocarbons, Technology and time schedule (2000/2020)					
Location of the plant	Proposed date of start up	Name and quantities of substitutes	Status of technology	Status of the plant *	Availability raw materials

* New equipment or revamping of the existing plant.

3. General Comments

ANNEX III

TERMS OF REFERENCE FOR THE TECHNICAL AUDIT

Purposes of the Field Audit

While the overall objective of the audit process is to provide all the data needed to review sectoral plans, this information will, of course, be plan specific and will further depend on decisions of the Executive Committee regarding compensation for lost profit and on funding of new production capacity. One can, however, visualize that, although preparation and initial analysis can be carried out anywhere, by such means as distribution of questionnaires, meetings with ODS production sector representatives, etc., obtaining certain information to complete the analysis will require a Field Audit. Broadly, there are three purposes to the Field Audit:

- 1) establish utilized (audited) present operating yearly capacity and potential capacity of individual plants and total country production capacity;
- 2) determine production history of individual plants and total country production history; and
- 3) other relevant technical/commercial information on country and market underlying the sectoral plan which is conveniently gathered in the Field.

Function and Responsibilities of Field Audit Team(s)

- Modality of Operation - operate country-by-country, as invited,
- Reporting - to the Chief Officer of the Multilateral Fund with input and advice from the Expert Group; and
- Composition - Total of at least three with overlapping skills in fluorine technology, process/project/operations, estimating/economics; in addition, a representative from the Expert Group and local expert, as needed.

Issues to be addressed by field audit team

Capacity

- Assess ability of each site to produce ODS under sustainable conditions, i.e. for a full year, including environmental impact;

- For CFCs, assess potential for conversion of each site to HCFC or HFC production¹;
- Assess site and national availability and cost of chlorocarbons and HF, i.e. size and location of plants.

Production History and Profitability

- Assess production history based on site production and storage records and from local/national sales records, including imports-exports; and
- Collect site cost/profitability data, including cost of labour, number of workers, selling price of products, taxes and subsidies, if any.

Other relevant information

- Collect data from national plan on project supply and demand for ODS and ODS substitutes, HF and chlorocarbons;
- Analyze transport costs for raw materials and products; and
- Evaluate status and availability of national technology for ODS substitutes, together with their estimated production costs and possible scale of production over the next five years.

Analysis of Field Data and Completion of Audit (by Expert Group, subgroup thereof or consultants)

This builds on the information from the Field Audit teams to create the framework to review sectoral plans. Some tasks may be plan specific, and technical information beyond that garnered in the Field Audit may be required, but typical issues include:

- Evaluate ODS production economics for main and/or typical sites, including distribution/transportation costs;
- Compare production data to other sources;
- Compare production data to results of “capacity audit”;
- Evaluate conversion costs, for applicable sites, to HCFC and HFC production, and the resulting production economics and achievable capacities;
- Demand estimate based on Country Programmes and downstream projects;
- Evaluate sectoral plan data for level of detail needed for costing;
- Assess technical feasibility of sectoral plans, reflecting all results of the audit; and
- Cost sectoral plans.

¹ Subject to further analysis and verification, including detailed process calculations if necessary. Field Audit should collect data for such analysis and rule out sites for expansion, conversion and/or revamp based on field factors such as, space limitations, limited access to raw materials, etc.

Cost and Duration

Cost and duration of a Field Audit will be country specific, depending on the number of sites to be visited. These will typically include the principal production centers as well as repositories of national data, and potentially one or more research centers.

Once the number of sites to be visited is fixed, it becomes possible to estimate the duration of the Field Audit. Given the need for access to key people, etc., it is conceivable that a Field Audit may comprise more than one mission. The duration is converted to a cost by multiplying by the Team size and the cost per manday.

Cost of analysis of the data and completion of the audit will also be plan specific, but will certainly involve at a minimum several manweeks of work. It is to be noted also that information on new plant economics and future price projections will be needed and will have to be developed or acquired at additional cost.

ANNEX IV

CHECKLIST FOR ASSESSING INCREMENTAL COSTS FOR THE SHUT-DOWN OF ODS PRODUCTION FACILITIES

Checklist required only for Approach 1

1. Data relating to local product quality, local markets, local raw materials, and local distribution costs.
2. The profit stream of the plant under future conditions.
3. Expected (future) plant capacity and plant utilization.

Checklist essential for Approach 2

Note: the first three items are plant-specific, the fourth is generic for all plants in all countries.

4. Historical output of the plant, product by product and year by year, in order to determine the three year 'baseline period' and the actual mean production in this period.
5. Historical local costs of services and actual historical local fixed costs for the three-year baseline period.
6. Age of the plant and supporting evidence regarding its residual productive life.
7. Historical (pre-Protocol) world market prices for the product(s) and baseline period world market prices for raw materials.

For the calculation of the non-recurring shut-down costs

8. Actual local costs of decommissioning, dismantling and (if eligible) environmental clean-up (incremental clean-up costs only).
9. Local residual value of plant, equipment and stocks.
10. Local human costs of shut-down - labour displacement costs.

Checklist which may provide supporting evidence

11. Data on plant capacities, and the proportion of national output/capacity represented by each plant¹.
12. Data relating to impact on raw material plants².

¹ This information is not required for calculating the incremental costs, but provides a cross-check on production figures and is also useful for sequencing shut-down projects in the context of a national plan by showing the significance of each plant.

² The Expert Group could not identify any cases where there was likely to be a significant incremental cost associated with raw material plants.

ANNEX V

APPROACH 1: THE CALCULATION OF INCREMENTAL COSTS FOR THE SHUT-DOWN OF ODS PRODUCTION FACILITIES FROM INVESTMENT BANKERS VIEWPOINT

One approach to determining the value of ODS production facilities on a national or enterprise basis is to approach the issue as investment bankers or a direct business purchase. This approach looks at the value of ODS production facilities in the light of today's actual market conditions, i.e. the Montreal Protocol does exist, CFC production will be phased out and CFC users are switching from ODS for three reasons: (1) concern for the environment; (2) ODS alternates offer lower cost than ODS; and (3) international markets demand ODS free products.

This approach should generate a realistic economic value, which will most likely be lower than the necessary value to encourage shutdown of the respective ODS producing facilities. However it provides a realistic benchmark for the Multilateral Fund to negotiate from.

Methodology to Conduct Evaluation

A small team of experts, comparable to our previously described technical assessment expert team, would be required. Individual team members would execute secrecy agreements with the enterprises they are expected to evaluate. This is a very common industrial and business practice that allows disclosure of confidential business information without loss of important confidential information to competitors or the public domain.

Following execution of the secrecy agreements, the expert team would be able to evaluate confidential business information and accurately develop the economic worth of the respective enterprises making up a country's ODS production sector. The expert team would examine actual manufacturing, sales and financial information for a three year period, presumably 1993, 1994 and 1995. These data would provide:

- typical fixed and variable manufacturing costs, cost of sales and annual net revenue;
- annual production and sales volumes for domestic markets as well as for export products, trends in the markets (increasing or decreasing);
- difference in earnings from domestic market and opportunistic export sales;
- suitability of plant reliability and product quality to serve projected future sales;

- judgement on the appropriateness of project volumes and prices for domestic and export markets.

Factors for Evaluating Future Market Value

So far, the analyses is directed at developing a credible financial picture for the most recent three year's operation. This period should presumably represent an attractive picture from the plant or enterprise owner's view for these reasons:

1. The investments and business are mature since it has been several years since they were built and started up.
2. The CFC markets are well defined and historical business relationships established.
3. Relative value of domestic vs. Export markets has been quantified.
4. Any nation's specific policies aimed at favouring domestic production is fully reflected in profits or margins.

The next critical task in the investment banker's approach is to establish the future revenue and profit stream which will be influenced by these key factors:

1. Historical data will clearly reflect local prices and local margins which may have been influenced by the countries' past efforts to "protect local or indigenous industry".
2. The choice of pricing for future revenues is critical and will include domestic volumes and margins plus export volumes and margins. The Multilateral Fund Executive Committee must provide guidance in this area, however, the Expert Group (EG) recommends using "international" rather than "local" pricing.
3. Export volumes can only be valued at "international" price levels since there is no ability to impose domestic pricing policies on international markets.
4. A major factor in world pricing, since 1994 has been the increasing and very significant international illegal trade that has flooded the global market with very low priced product. While the original sources of the material are open to debate, there is no reason to believe that the supply will dry up as the world's illegal trade network is in place and has tasted the profit potential.

5. Future domestic markets (volume and prices) will be strongly influenced by using industry market practices as well as national policies to protect the stratospheric ozone layer:

- There are already several significant country plans that are projecting much earlier CFC phaseout than allowed by the Montreal Protocol (Brazil, Mexico, Indonesia, and China, just to mention a few).
- Hydrocarbon technologies have taken over most of the world's aerosol propellant plus the insulating foam blowing markets; and hydrocarbons are lower cost than the CFCs they replace.
- Hydrocarbon technologies may capture a significant share of the rapidly growing small appliance market.

6. Under the Montreal Protocol, the developed countries have the obligation and right to ensure that Article 5 countries have access to required ODS supplies post developed world phaseout for their basic domestic needs. The 15 per cent of their 1986 base could theoretically satisfy total Article 5 countries' needs as outlined in a November 1995 TEAP report to the Parties. This fact will have bearing on the future value of any continuing CFC production.

Agreeing to Future Business Worth

Using the above information, it will be necessary to arrive at realistic volumes and margins for the specific market segments of future ODS sales.

The Multilateral Fund must decide on the appropriate future revenue stream timeframe, however, for purposes of describing this approach, an eight-year period is assumed.

Data from the primary enterprises that comprise at least 80 per cent of the country's stated production should be accumulated in a similar fashion. At this point we will assume that 80 per cent of the production covers all facilities that are a significant factor in the nation's production capability; and the small plants could be dealt with by suitable factoring or estimating.

All of the country data would be aggregated to create a country picture that would allow the Multilateral Fund Executive Committee to see cumulative information such as:

- annual country production for past three years;
- sales for basic domestic needs for last three years;
- export sales for last three years;

- appropriate profit margin for country's full production sector as an average of the past on agreed to base of three years;
- country total sector projection for domestic sales and export sales as an aggregate eight year period; individual years would not be broken out so as to avoid providing significant competitive information.

The projected eight years of future production earnings would be subjected to a discounted cash flow to arrive at the country's future business value for the country's ODS sector. This figure would aid the Fund's Executive Committee in arriving at a fair figure for shutdown of the country's total production sector for ODS materials like CFC-11/12.

Issues that can represent hurdles in this process

- Acceptance that confidential business information will be protected from competition;
- agreement on reasonableness of future sales assumption, i.e. prices, volumes, cost of manufacture, difference in selling prices for domestic vs. export markets;
- estimated unusual (not occurring every year) maintenance expenses necessary to ensure reliable production for the eight year future period;
- acceptance that an eight year future discounted cash flow basis is a fair representation of residual value of the country's production sector;
- disputes over historical records for cost of sales (are all items honestly included);
- disputes over causes for any significant production variance in three year baseline period (what caused drop in production - market changes or plant reliability);
- are future production volumes within plants' realistic production capability;
- what data will be released to the public domain via disclosure to the Multilateral Fund.

ANNEX VI

APPROACH 2: THE CALCULATION OF THE INCREMENTAL COSTS FOR THE SHUT-DOWN OF ODS PRODUCTION FACILITIES

1. The INCREMENTAL COST for the shut-down of an ODS production facility may be expressed as:

$$\text{Recurring Incremental Costs} + \text{Non-Recurring Incremental Costs}$$

2. The RECURRING INCREMENTAL COSTS may be equated to the FOREGONE PROFIT STREAM of the production facility, i.e. the profits forfeited as a result of the shut-down.

The FOREGONE PROFIT STREAM is expressed as the Net Present Value (NPV) of the foregone profit stream in each eligible year. The Net Present Value is calculated at the agreed discount rate - currently set by the Executive Committee at 10 per cent per annum (or 12 per cent for China). The Executive Committee will need to advise on the length of the eligible period. At the maximum it may be set at the agreed residual plant life. However, cash flows for projects in other sectors are not currently calculated for periods greater than four years. As the cash flow is discounted at a high discount rate, later years will contribute little to the Net Present Value. Thus after about eight years, the NPV for different eligible periods does not change much. The foregone profit stream in any given year is calculated as:

$$\text{Income} - \text{Fixed Costs} - \text{Variable Costs}$$

where,

- INCOME is the total sales income (i.e. tonnes sold multiplied by price per tonne) plus any other income, e.g. license fees and royalties. For simplicity, the tonnage sold should be based on *either* the average of the previous three full years' audited production *or* the average of the best three full years' of audited production. The Executive Committee will need to decide which alternative to use as the 'baseline period' (*Historical Local Basis*). As we are calculating an incremental cost, i.e. making a comparison with a *non*-Protocol scenario, the price used should be the historical (pre-Protocol) world market price. This can be objectively determined as ODSs were traded internationally as commodity chemicals, and avoids the complexities of any local tariffs and subsidies (*Historical International Basis*).
- FIXED COSTS include all eligible manufacturing costs, administrative costs and overheads (but *not* depreciation). Fixed costs should be calculated on the basis of audited costs over the same three-year 'baseline period' as used in setting the sales volume. Any *major* deviations from international norms will require justification (*Historical Local Basis*).

- VARIABLE COSTS include all the variable costs of manufacture and distribution (i.e. tonnes manufactured multiplied by costs per tonne). The tonnage manufactured should be set at the same figure as used in setting the sales volume. Note: plant *capacity* figures which are not used as true capacity figures are difficult to determine and it is the actual historical performance that best describes what could in fact be produced and sold (*Historical Local Basis*). Variable costs per tonne will be dominated by (i) raw material costs, and (ii) cost of services such as water, steam and electricity:
 - raw material costs should be set on the basis of average world market prices over the three-year 'baseline period'. As all raw materials are internationally traded commodity chemicals, these figures can be objectively determined (*Historical International Basis*).
 - costs of services should be set on the basis of the average local costs over the three-year 'baseline period'. This basis is used as there may be major local influences on these cost elements (*Historical Local Basis*).

They will be dominated by the costs of raw materials and services (electricity, steam, water, etc.)

3. The NON-RECURRING INCREMENTAL COSTS may be expressed as:

Physical Costs + Human Costs - Residual Plant Value

where,

- PHYSICAL COSTS include eligible decommissioning, dismantling and environmental clean-up costs. *Incremental* environmental clean-up costs are unlikely to be significant. Physical shut-down costs should be calculated on a *Historical Local Basis*.
- HUMAN COSTS include labour displacement costs such as redundancy, retraining and relocation. Human shut-down costs will need to reflect local norms, although major deviations from international norms may require justification and/or audit (*Historical Local Basis*).
- RESIDUAL PLANT VALUE includes the *negative* costs associated with the re-use, recycling or scrap value of plant and equipment, and of residual stocks of products, feedstocks and intermediates. In many cases, residual values of plant and stocks are likely to be about equal to the physical shut-down costs. It may often therefore be possible to agree that the only non-recurring shut-down costs are the *human* costs.