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REPORT ON THE INTERMEDIATE EVALUATION OF CFC PRODUCTION SECTOR PHASE-OUT AGREEMENTS

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List of Abbreviations

AHF	Anhydrous Hydro Fluoric Acid
CFC	ChloroFluoroCarbon
CNAO	China National Audit Office
CTC	Carbon Tetrachloride
HCFC	HydroChloroFluoroCarbon
HFC	HydroFluoroCarbon
ktpa	Thousand (metric) ton per year (generally used for annual capacity of chemical plants)
mt, ton	Metric ton (1000 kilogram)
NCCE	National Coordinating Committee for the Environment (in DPR Korea)
NOU	National Ozone Unit
ODP	Ozone Depletion Potential
ODS	Ozone Depleting Substances
PMU	Project Management Unit (in India)
REGMA	Refrigerant Gas Manufacturers' Association (in India)
RMB	Renminbi (currency in China)
Rs.	Indian Rupee
SEPA	China State Environmental Protection Administration
SME	Small and medium enterprise
TA	Technical Assistance
TCA	Methylchloroform or 1.1.1 Trichloroethane
UNEP	United Nations Environment Programme
UNIDO	United Nations Industrial Development Organization
WB	World Bank

Executive Summary

Findings

1. This report is a synthesis of reports of evaluation missions regarding CFC production sector phase-out agreements in three Article 5 countries (PR China, DPR Korea and India). The phase-out of CFC production in these countries is generally proceeding according to the schedules indicated in the respective agreements.

2. The sector approach adopted by the Executive Committee for these agreements has worked well. Because of the large number of plants (37) in PR China and the competition between the 4 companies producing CFCs in India, a plant-by-plant approach would have been much more cumbersome if not impossible to negotiate, implement and monitor. The combination of sector approach and the flexibility clause improves the capabilities of the NOUs, in cooperation with the affected enterprises, to manage and consequently own the process, which ultimately leads to increased sustainability.

3. The quota systems adopted in PR China and India to gradually reduce CFC-production in exchange for compensations provided to the enterprises performed generally well. The two largest producers interviewed in China complained, however, about the change, at short notice, to a proportional quota reduction for each producer compared to the earlier formula where all producers had to reduce by the same volume, which affected the smaller more than the larger companies. SEPA changed the reduction scheme to the same percentage of each producer's quota in order to maintain an adequate competition in the market.

4. For China, planning and verification of CFC-production was always done in ODP tonnes although the agreement stipulates metric tonnes (MT). This should be clarified, as production has been higher than the maximum allowed during the last five years when measured in metric tonnes. In ODP tonnes, however, it always stayed below the maximum allowable limit.

5. In India, CFC production stayed under the maximum allowable level when counting net saleable production but slightly above in terms of gross production which includes handling losses of between 0.5% to 1%. The concept of net saleable production came up in January 2001 and was agreed between the association of CFC producers (REGMA), the Ozone Cell and the auditors and has since been applied but has no basis in the agreement nor in the sector plan nor had it been used in the first two verification audits for 1999 and 2000.

6. For China and India, CFC-production data reported under Art. 7 differ frequently from those in the verification reports.

7. Policies regulating production, sales and foreign trade of CFCs are in place in the three countries as well as the institutional arrangements to implement the policies. As far as the evaluation team could ascertain, there seems to be an adequate control of illegal production and trade. In several instances, small illegal production plants have been detected and dismantled in China, and in India, some quantities of illegally imported CFC were confiscated by customs and distributed to the CFC-producers.

8. The company visits have confirmed the reliability of reported and audited production figures and reports on closed and dismantled plants. The international verification missions organized by the Implementing Agencies were supplemented in China and India by national audits. While working generally well, some adjustments to the audit and verification mechanisms are suggested and described in the recommendations below.

9. Technical assistance (TA) has been allocated in each annual programme for India and China. This allocation has been normally under spent. A sizeable portion of the expenditures relate to the administration and oversight of the phase down process. Interest in and impact of TA activities at the enterprise level has been limited, except in China for studies and a workshop on market prospects for alternative productions and the assistance for the new production facility in Xi'an for HFC-134a.

10. In the case of India, the enterprises do not seem to be interested in common research activities. They prefer a maximization of direct disbursements to themselves. In the Chinese enterprises, there are presently varying degrees of interest in a number of research directions.

11. In India and China there has not been a significant upward movement in prices of CFCs. This is due to the fact that users of CFCs, who have been kept well informed of the phase-out process, have moved away to alternatives broadly at the pace at which CFCs were being withdrawn, thus reducing the demand. In addition, the prices of alternatives, in particular HCFC-141b, HCFC-22 and HFC-134a have come down significantly, facilitating conversion of CFC users to substitutes.

12. The process of phase-out set in motion seems to be sustainable and on track to achieve the full elimination of CFC production planned for the end of 2009. In each case the Government has the power to impose significant penalties for any transgressions. Auditing plus third-party supervisors in China and quarterly on-line reporting in India provide good control measures. Furthermore, the market evolution for CFCs is such that in export markets the returns are very marginal. There is the risk that reduced availability from the EU may drive export prices higher, but probably not to the extent that transgressions will happen.

Recommendations

13. The Executive Committee might consider:

(a) Clarifying whether the maximum allowable CFC production in China should be planned and verified in metric tonnes (MT) as stipulated in the agreement, or in ODP tonnes, as calculated in the original sector plan and the following annual work programmes and verification reports.

(b) Requesting the Government of India, in cooperation with the World Bank, to plan and verify allowable CFC production in India as so-called gross production, that means without deducting handling and filling losses.

(c) Requesting the Government of China and India to clarify, in cooperation with the Ozone Secretariat, differences of CFC-production data reported under Art. 7 to the Ozone Secretariat and in the verification reports.

(d) Requesting the Secretariat, in cooperation with the World Bank and UNIDO, to review the verification guidelines adopted by the 32nd meeting of the Executive Committee, with respect to the following:

(i) Movements of CTC to and from CFC producers and internal transfers of CTC in CFC producing companies should be included in the verification reports, annual progress reports and work programmes, in view of the intense pressure on CTC management in the enterprises caused by the phase–out of CFC-11 and CFC-12. Verification of Anhydrous Hydro Fluoric Acid (AHF) consumption and its ratios to CFC production on the other side may receive less attention, because it does not allow sufficiently precise conclusions for the volume of CFC-production.

(ii) Where plants co-produce CFC-11 and CFC-12, it may be necessary to determine whether the practice of counting unit ratios of CTC and AHF and comparing them with previous years is needed. Unit ratios are being counted against the two variables of CFC-11 and CFC-12: one of these must always be an assumed number for the other number to be derived or both are an estimate. The comparison of the unit ratios may give directional information but does not allow precise assessments. If less CFC-11 is produced, for instance, then the variances against CFC-12 might look better.

(iii) The inspection and verification of the daily log books should continue to serve mainly as a back-up to clarify inconsistencies observed. Reported measurements of CFC-production should be rounded to the nearest 100 kg. The production figures should then as usual be compared with financial and sales records which are more accurate.

(e) Requesting the World Bank and Governments of China and India to revise the presentation of technical assistance activities in future annual reports and work programmes for the CFC production sector by:

(i) Showing separately activities to maintain the national administrative infrastructure to manage the process, activities for awareness building, and technical advice of direct interest to the enterprises (either individually or collectively).

(ii) Specifying clearly the objectives, related outputs and inputs including planned and actual expenditures.

14. The Governments of China and India might consider, in cooperation with the World Bank:

(a) Reducing the number of production sector audits by combining the national and international audits in January, and possibly by abolishing the July national audit in India, which can only generate preliminary trend figures for the on-going year.

(b) Preparing a scenario for financing the closure before 2009 of any of the remaining plants in China and India. There is at present no particular incentive for any given producer to stop. There may be a consequence for the disbursement schedule if one producer concedes all his future production allowance at one time, or all producers would agree to an earlier phase-out date with an advanced disbursement of the remaining funding tranches.

15. The Government of China might consider, in cooperation with the World Bank:

(a) Using future technical assistance for research on the evolution of chemical intermediate applications for CTC on a global basis, as well as disposal capabilities and needs for CTC.

(b) Funding market research into the evolution of global markets for alternative fluorocarbons and alternatives to fluorocarbons to complement the research efforts and guide the investment of enterprises.

(c) Making results of the above-proposed research available free or at low cost to interested parties.

(d) Releasing nationally developed (and perhaps TA-funded) technology to individual investors combined with soft loans to fund investments of individual producers of substitutes rather than to provide grant funding to them, in order to provide more equal opportunities for all competitors.

(e) Determining the quota for each CFC producer at least one year before applying it to allow some medium-term planning for the enterprises.

1 Purpose and Scope of the Evaluation

(a) Terms of Reference

16. The TOR followed the recommendations for further analysis in the "Desk Study on the Evaluation of the Implementation of the CFC-Production Sector Agreements" (doc UNEP/OzL.Pro/ExCom/40/9), submitted to and noted by the 40th Meeting of the Executive Committee (decision 40/5 (b)). The desk study identified the following issues for further analysis:

(a) How is the flexibility clause handled in practice? Does it facilitate implementation of the agreements?

(b) Compare annual reports and work programmes with information obtained from plants to be visited.

(c) Review guidelines and mechanisms for Annual Verification Reports, with respect to the following:

(i) Analyze experiences gained with verification methods at plant level

(ii) Check destruction/disposal of equipment and compare with records.

(iii) Check HCFC-22 production in swing plants

(iv) Analyze data from in-plant monitoring, if applicable

(v) Inquire about usefulness and impact of TA activities at enterprise level

(vi) Information on CTC production from verification reports of CTC phase-out agreements and additional sources of information, if necessary.

(d) Analyze the functioning of quota and bidding systems, and lessons learnt in their operations.

(e) Analyze import/export and supply/demand balance, including impact on local CFC prices and availability.

(f) Collect information on implementation and impact of TA activities.

(g) Describe the impact of projects to increase supply of CFC-substitutes funded by the sector plan in PR China on the sustainability of the CFC phase-out.

(h) Assess perspective for continued compliance with phase-out schedules as per agreements.

17. Members of the Sub-Committee of Monitoring, Evaluation and Finance and the Executive Committee added the following tasks:

(a) To include the inspection of plants with the ability to return to producing CFCs and visits to plants where CFC production equipment was reported to have been dismantled, in order to make sure that they had in fact stopped CFC production completely.

(b) To examine sector and plant data closely for indications of activity contrary to the production agreements.

(c) To look at implementation of the agreements within the larger context of issues such as the balance between reduction of production and demand for CFCs in Article 5 countries and growing concern over the purity of CFCs available on the market.

(d) To analyze also the agreements themselves in order to pass on the lessons learned to other countries entering into production sector agreements.

(e) To focus on broader lessons learnt rather than on specific issues related to circumstances in individual countries.

18. The above TOR show that in contrast to the national and international audits which focus on immediate results and compliance with annual targets, the emphasis of this evaluation is on overall results achieved so far, policies, sector developments, reliability and appropriateness of audit procedures, perspectives for further phase-out, and adjustments proposed to successfully continue implementation of the agreements.

(b) Methodology and Timing

19. The two evaluators chosen had never been involved in previous stages of planning and implementation of the CFC production sector phase-out agreements. The consultants were Oscar Gonzalez from Portugal for policies, TA and report coordination, and David Sherry from the UK for the technical part.

20. During December 2003 the consultants were supplied with all documentation relevant to the preparation, implementation and monitoring of the three agreements. Of particular relevance for the evaluators were the agreements themselves, annual verification reports, work programmes and the desk study on the evaluation cited above. On the basis of this documentation, lists of questions for the NOUs and the enterprises were prepared and sent in advance to them. A work plan was prepared.

21. The evaluators appreciated the co-operation and openness in the discussions with the NOUs and enterprises and were thankful for the logistical arrangements made.

22. The evaluation mission fieldwork lasted from 5 to 23 January 2004. The itinerary is included in Annex II. The evaluation team was joined by the Deputy Chief Officer of the Fund Secretariat from 6 to 17 January 2004 and the Senior Monitoring and Evaluation Officer from 9 to 20 January 2004. The evaluation team was assisted in its mission in China by staff from SEPA who participated in visits to companies along with a national technical consultant of the World Bank. In India, the team had the benefit of the presence of the Chief of the Ozone Cell and the acting secretary of the PMU in two of the factory visits. In DPR Korea, the Ozone Officer and the responsible programme officer of UNIDO participated in the visit to the company and other discussions of the team. Comments on the draft evaluation reports were received by SEPA, the World Bank and UNIDO and were taken into account in finalizing the documents.

23. Four of the six remaining CFC producers, plus one closed factory and the new HFC-134a plant were visited in China, as well as all 4 CFC-producers in India and the recently closed facility in DPR Korea. The country evaluation reports are available on request and on the Secretariat’s web site.

2 CFC Production Phase-out Agreements and Results Achieved

(a) Overview

24. CFC-Production Sector Phase-out agreements have been concluded to date with China, India, DPR Korea, Argentina and Mexico. Table 1 below summarizes the funding committed and approved, the maximum allowable production at the start of the agreement and the latest production figures. Details for each country and related Decisions of the Executive Committee are provided in Annex 1.

Table 1: Overview of Production Sector Agreements

Sector	Date of Approval	Total Funding Committed (US $ million)	Funding Approved to Date (US $ million)	Maximum Allowable Production at Start of Agreement (Metric Tonnes)	Verified Actual Production in 2003 (Metric Tonnes)[2]
India	November 1999	82.0	46.0	22,588	15,104
China	March 1999	150.0	72.0	44,931	30,535
DPR Korea	March 2002	2.56	1.34	1,650[1]	587
Argentina	December 2002	8.3	0.5	3,020	3,015[4]
Mexico	July 2003	31.85	5.3	12,355[3]	8,694
Total		**274.71**	**125.14**	**84.544**	

[1] This figure is not mentioned in the agreement with DPR Korea, but in UNIDO's business plans (400 t for CFC-113 to be phased-out in 2001 and 1250 t of CFC-11 and CFC-12 to be phased-out in 2003).

[2] Based on verification reports and evaluation results for 2003.

[3] For 2003; Mexico remained under the maximum level for the first year of the agreement. Total production maximum for 2003-2005 is 22,000 mt.

[4] For 2002 reported as Art. 7 data; no data are yet available for Argentina for 2003.

(b) PR China

25. In PR China, 14 CFC producers with a production capacity of 22,630 tons of CFC had already stopped production at the start of the agreement and received a limited compensation. Thereafter, in 1999-2001, a process of bidding was initiated, by which CFC producers could bid up to a SEPA-proscribed maximum value per ton of discontinued or reduced CFC production. A further 18 companies were closed down in this process. In 2002 SEPA ordered the reduction of a fixed amount of CFC-11 and CFC-12 that was identical for each of the four remaining producers, the other CFCs produced (CFC-13/113/114/115) being much smaller remained untouched. In 1999, the compensation was less than US $2/kg, the bidding process was in place and enterprises bids were less than US $2/kg. In 2000 and 2001, the compensation was valued at US $2/kg, in 2002 around US $1.8 /kg and in 2003 US $1.40/kg. In 2004, the reduction formula changed from the same amount for each producer to a percentage of each producer's quota, thereby enabling the smaller producers to continue to produce.

26. In China, the main products are CFC-12, CFC-11 and CFC-113, with some limited production of CFC-13, CFC-114, and CFC-115. Most of the production is consumed domestically, although exports of CFC-11 and 12 picked up in 2003 due to low domestic demand. Part of the CFC-113 is used in the manufacture of the chemical intermediate CFC-113a, an isomer of CFC-113, and for other feedstock purposes, but the greater part as solvent, within the gradually declining limits as defined by the agreement on the solvent sector phase-out plan.

27. The World Bank and SEPA always planned and reported the CFC-production for China in ODP tonnes and not in ODS tonnes while the agreement defines the annual limits in MT that means usually ODS tonnes. As a consequence of substantial production in China of CFC-113 for solvent use (with an ODP value of 0.8) and of some CFC-115 (with an ODP value of 0.6), the production figures in MT are in every year above the ceiling by 721 MT on average for the last five years (see table in Annex I, p. 2).

28. Data on CFC-production in PR China reported under Art. 7 are consistently lower than those reported in the verification reports although both are in ODP tonnes (see Annex I, p. 2).

(c) India

29. In India, the four CFC producers, working within their industry association REGMA, engaged at the outset of the process management consultants to guide them in making proposals for a controlled phase-down of CFCs. After consultations with the Government and debates in the ExCom, the present quota reduction scheme and disbursement schedule was established. Quotas are reduced annually, maintaining a fixed share for each producer. The compensation amounts to just under US $3.20/kg of phased-out CFC. As in PR China, there is no separate allocation for CFC 11 and 12 since both are generally co-produced.

30. India stayed under the maximum allowable production level when counting net saleable production but slightly above in terms of gross production which includes handling losses of between 0.5% to 1% (see Annex I, p. 4). This concept came up in January 2001 and was agreed between the association of CFC producers (REGMA), the ozone cell and the auditors and has since been applied but has no basis in the agreement nor in the sector plan nor had it been applied in the first two verification audits for 1999 and 2000. While from the viewpoint of the companies it is understandable that they do not want to be held accountable for more than what they actually can sell, from an environmental point of view every ton of CFC produced will at one point end up in the atmosphere and should therefore be counted and controlled.

31. Most of the CFC-11 and CFC-12 is exported: some 25% of the production is consumed locally. Both production and exports are coming down and imports are no more allowed in order to protect the local CFC producers.

32. Art. 7 data on CFC production in India are sometimes higher, sometimes lower than those in the verification reports. While taking into account that Art. 7 data are in ODP and those in the verification reports for India in MT, there seems to be no apparent logical explanation for these differences.

(d) DPR Korea

33. In DPR Korea, the phase-out has not been gradual but instead the only one producer shut down production of CFC-113 in 2001 and CFC-11 and CFC-12 in December 2003. Production of the CFC-113 plant was very small and did not exceed 36 tons in any year since 1996. Production of CFC-11/12 did not exceed 300 tons in the period 1996-2002. In 2003, the year of closure, the output is recorded as just under 600 tons, partly to be used for stock piling. In contrast to the other countries, compensation was based on plant replacement cost rather than lost profits.

(e) The World-Wide Context

34. Table 2 displays the significance of the CFC phase-out programmes of the countries visited in the global context. China remains the largest producing country (36% of global total in 2002) for CFCs, with EU as a region (32% of total) the second largest producing area and India (19% of total) the third largest. The three countries visited in the January 2004 mission represent nearly 83% of 2002 Article 5 country production of CFCs and just under 56% of global CFC production.

Table 2: CFC Production in Article 5 and Non-Article 5 Countries (ODP Tonnes)

Country	Baseline	1999	2000	2001	2002
Art 5					
Argentina	2,745.3	3,101.0	3,027.0	2,899.0	3,015.0
Brazil	10,182.2	11,286.0	0.0	0.0	0.0
China	47,003.9	44,739.4	39,962.8	36,167.2	32,269.0
India	22,632.4	22,498.6	20,403.8	18,689.2	16,883.7
DPR Korea	403.3	106.0	77.0	290.8	299.0
Mexico	11,042.3	5,530.0	7,546.0	6,636.0	5,653.0
Romania	10.0	0.0	0.0	0.0	0.0
Venezuela	4,786.9	2,859.1	2,281.0	2,721.7	1,637.4
Total Art. 5	**98,806.3**	**90,120.1**	**73,297.6**	**67,403.9**	**59,757.1**
Non-Art. 5					
EU[1]	443,445.8	30,678.6	26,449.2	25,643.5	28,750.0
Russian Fed	105,296.0	18,416.7	25,535.9	0.0	0.0
USA	311,021.2	436.2	461.4	495.2	500.0
Others[2]	156,465.0	(109.8)	(49.4)	(53.8)	(87.4)
Total Non-Art. 5	**1,016,228.0**	**49,421.7**	**52,397.1**	**26,084.9**	**29,162.6**
Grand total	**1,115,034.3**	**139,541.8**	**125,694.7**	**93,488.8**	**88,919.7**
China, India, DPR Korea as % of grand total		**48.3**	**48.1**	**59.0**	**55.6**
China, India, DPR Korea as % of total Art. 5		**74.7**	**82.5**	**81.8**	**82.8**

[1] The figures provided by the EU on the EU website are in MT while those provided as Article 7 data are in ODP tonnes. EU website data are as follows: 30,631 tons (1999); 29,383 tons (2000); 24,604 tons (2001). The EU figure given for 2002 is from the EU website as Article 7 data are not available.

[2] The other non-Article 5 countries are: Australia; Canada; Czech Republic; Japan; Liechtenstein; Norway; Switzerland. For 2002, excepting the EU figure, non-Article 5 country figures are estimates.

3 Mechanisms to Audit and Verify CFC Production

(a) Overview

35. Both in China and India, in addition to the annual international audits foreseen by the agreements and organized by the World Bank, independent national auditors verify on behalf of the governments CFC production, sales logs and feedstocks (once per year in China, twice in India). In DPR Korea, UNIDO as implementing agency verified the plant closures. Independent national auditors verify production levels sales logs as well as feedstock inputs once (China) or twice (India) a year.

36. In China, SEPA introduced also a system (for CFC-11/12 and 113) by which third-party supervisors from other Chinese CFC producers would be installed at manufacturing plants of competitors. These are trained and paid for by SEPA and physically stay at the "third-party" CFC production unit in order to ensure that quotas are not exceeded. The evaluators found that this system is working to the satisfaction of SEPA and the companies. This is a uniquely Chinese model, given that elsewhere e.g. India, there is either a more competitive situation or single producers.

37. In view of the effective oversight established by SEPA in China and the Ozone Cell in India, and the compliance shown by CFC-producers so far, possibilities should be examined to combine national and international audits and to limit verification missions to the companies to one per year. In combination with the system of in-plant inspectors in China and quarterly on-line reporting in India, and in view of the penalties imposed in case of non-compliance, this should be sufficient to supervise the phase-out in the remaining years of the agreement.

(b) Monitoring of Feedstocks and Level of Audit Detail

38. A broader analysis of companies needs to be adopted by the audits to anticipate problems. Reduction of CFC-11 and CFC-12 production has ramifications on the feedstock (in this case CTC). The replacement product HCFC-22 requires the supply of chloroform, which necessarily entails CTC co-production. Consequently, movements of CTC should be included in the verification and annual progress reports and work programmes (see further explanations in Annex II). It would also seem appropriate to challenge the sometimes-stated opinion that CTC cannot be minimized below 13% of overall chloromethanes production. The globally leading producers operate to a factor of some 10% or less on chloroform, or around 5% of total chloromethanes.

39. The introduction of production licenses to use CTC by CFC manufacturers might be considered. Where the use of CTC is from a captive chloromethanes supply (this is the case for two Indian producers and two Chinese producers), supply can be monitored by normal internal documents. Otherwise CTC supply should be traceable back to the manufacturers, and hence import licenses should specify the original CTC manufacturer. Then, part of the audit trail might be a spot-check (or a systematic check, as resources allow) to establish that CTC produced and sold by Producer P is indeed finding its way to Consumer C.

40. It is virtually impossible to calibrate production processes such that output can be measured to three decimals (i.e. to the kilogram), and yet this is being presented. It is most likely a calculation and as such is relatively meaningless. It might be of course that the plant output is measured to the nearest ton whilst sales volumes are calculated more precisely and that the reported production reflects this balance. For instance, in India, one company that presents figures to three decimal places has no measurement of the content of a large storage tank other than a sight glass calibrated in centimeters. The level in turn is then mathematically calculated by a formula: x centimeters=yyy.zzz tons of the product it contains. This is at best haphazard. Furthermore temperature fluctuations are not taken into account. Finally, there seems little point is measuring outputs to the kilogram when fugitive and filling losses are calculated by standard percentages in tons.

41. There is some value in continuing to examine a random selection of the daily logbooks as a means of cross-checking data consistency.

42. AHF demand can be an estimate, at best, based on typical unit ratios as opposed to a real count. This is due to recycling of CFC-11 to CFC-12, absorption of unreacted AHF by water to make and sell aqueous HF and the feed by some companies of AHF from the purchasing tank or internal factory to a general fluorocarbon area, which may include other products. Also attempts to verify production of HCFC-22 in India's swing plants do not allow precise conclusions about the volume of remaining CFC-production and are not requested under the agreement. By contrast, as above recommended, it is more useful to count CTC input produced inside or brought from outside the company, since this generally has no other application in the fluorocarbons area, (although there are issues around the specificity of the unit ratios). Even so, this will be approximate rather than a precise real count. It should be remembered that CTC is in its own right an ODP, and that there are a large number of emissive uses for the product. Therefore it is more important to monitor the CTC rather than the AHF trails.

43. Several of the above suggestions would require adjustments of auditing practices and amendments of the verification guidelines as laid out in document UNEP/OzL.Pro/ExCom/32/33. This can be summarized as follows:

(a) Improve the upstream audit trails, in particular for CTC;

(b) Reduce the review of daily production logs by limiting it to sample checks for consistency with other records;

(c) Analysis of ratios (AHF and CTC to CFCs) might receive lesser emphasis since in a number of cases it is attempting to calculate two variables;

(d) All measurements should be in tons and not kilograms;

(e) Ensure that auditing of market conditions (pricing) is done on weighted average values and not on median values.

(c) Discrepancies Noted

44. A few discrepancies to work programmes, internal audits and verification reports were found by the evaluators during visits to companies:

(a) CNAO reported unusually low CFC-12 average pricing for one company in China (Changshu 3F) for 2002 and an explanation was not provided. Also median rather than average prices have been reported which is not an indication of how prices have evolved.

(b) The capacity for CFCs and HCFCs as stated in the interviews by one company in India is more than twice as large as that hitherto reported.

(c) The cylinder-filling facility at another company in India seems to display variable weights according to where the object is placed on the scale.

(d) Verification reports carried out by the national auditing team in India and issued after the return of the Evaluation Mission have identified that two of the producers appear to report gross manufactured levels of CFCs for 2003 which are in excess of their individual quotas, whilst losses in manufacturing and packaging bring their net production within the quota. The overall losses amount to 1% or slightly more of gross production, levels which are high in absolute terms; however, given the nature of the operations conducted in India they may not be abnormally high as a percentage.

(e) The unit ratio of CTC to CFC-11 (1.6:1.0) used in DPR Korea is an anomaly, which could not be clarified. However, it may be regarded as having no significant impact in the phase-out process since the disbursement was based on plant replacement cost and not lost profits calculated from production volumes foregone.

4 Sustainability

45. The evaluators are of the opinion that continued compliance with the phase-out schedule as defined in the agreements can be expected in all three countries visited. Mechanisms to control illegal production are in place. There is practically no chance that CFC production can be resumed if the plant was destroyed. The potential fines are high, and if a company, which continues CFC-production on a reduced scale, transgresses its annual quota, it would receive no production quota for the following year. Furthermore, all market signs indicate that domestic demand for CFCs is declining faster than expected earlier on and competition on export markets is very tough, allowing sales with very small profit margins only, thus reducing interest in CFC-production. In DPR Korea, because of the central planning mechanism and the verified destruction of the only plant, it is unlikely that the production of CFC would be resumed.

46. Both in India and PR China there has not been the significant upward movement in CFC prices that some observers had expected with the advancing phase-out of CFC-production. This is due to the fact that domestic markets, which have been kept well informed of the phase-out schedule, have moved away from CFCs to alternatives broadly at the pace at which CFC production declined. The increasingly competitive international prices of alternatives such as HCFC-22, HCFC-141b and HFC-134a and their growing local production in China, are additional factors. This has a positive bearing on the sustainability of the phase-out process.

47. Nevertheless, a number of illegal producers have been found by SEPA in recent years, usually denounced by legal producers who noted market disturbances. The illegal plants, with small production capacities of 100 to 200 tpa, were closed down and dismantled by SEPA. The evaluation mission was not informed of any illegal production in India, where inspections are the responsibility of the Pollution Control Boards at State level.

5 Foreign Trade with CFCs

(a) PR China

48. The National Management Office of ODS Import & Export, based in SEPA, monitors foreign trade to prevent illegal trade in ODS. Imports of all ODS are subject to import quotas. Exports of ODS are not subject to quotas but to export licenses.

49. Through the system of quotas and licenses, the foreign trade of CFCs in China seems to be well controlled. In order to prevent illegal sales of CFCs, SEPA is developing a related regulation, to be issued in 2004.

(b) India

50. The Ministry of Commerce issues an import/export policy document every year. Import/export of ODS is subject to licensing after clearance by the Ozone Cell.

51. The Ozone Cell is informed of seizures by customs. In the last two years, when more accurate checks have been undertaken, there have been about 3 or 4 seizures by year said to total 40 to 50 tons of CFCs per year, which are auctioned off to the CFC producers. 5 pieces of equipment to detect CFCs are being purchased under TA for use by Customs.

(c) DPR Korea

52. Legislation on control of imports of ODS is in place.

6 Substitutes

(a) PR China

53. Several companies in PR China invested in the development of fluorocarbon-based alternatives to CFCs, and some of the larger CFC producers have also invested in feedstocks such as AHF or chloromethanes. The most dramatic and visible case is that of HCFC-22, where Chinese capacities now exceed 200 ktpa. Around 50% of this is in the hands of four existing CFC producers, while the largest plant with a further 50 ktpa, or perhaps more, is operated by a former CFC producer who chose an early closure.

54. There has also been a large investment in HCFC-141b capacity by at least three producers, and some of this entails HCFC-142b production, which is used in closed-cell foams but more importantly as a chemical intermediate for advanced engineering polymers.

55. For HFC-152a, which has some use in Chinese refrigerant blends but is also important in aerosol formulations, 3-4 producers have, or are expanding to, capacities in the 5-15 ktpa range. HFC-32 has 3-4 identified producers making up to 5 ktpa, and the SEPA-sponsored investment in 5 ktpa of HFC-134a production capacity was just preceded by a smaller 1.5 ktpa capacity plant at one site, and is followed by an announced 6 ktpa plant elsewhere in China. Other identified HFC projects that already have semi-commercial plants up to 1 ktpa include HFC-125 (2 plants), HFC-143a (1 plant), HFC-227ea (3 plants), and HFC-236fa (2 plants).

56. The funding of a 5 ktpy HFC-134a plant built by Xi'an Jinzhu Modern, with some USD17 million from the CFC production sector agreement was successful in creating a high quality production facility but might be seen also as causing disadvantages for potential competitors. One of two other bidding companies, with considerable fluorocarbon production experience, had been handicapped by the fact that the manufacturing technology had to be acquired at a high price (US$20 million was mentioned) from third parties. Another one's technology was locally developed but evaluated by SEPA as being less advanced than the process developed by Xi'an Jinzhu. The evaluators suggest that another bidding takes place before further funds are granted to the company for the planned expansion to 10 ktpa, with the aim to create a competitive environment rather than a monopoly.

(b) India

57. In India, apart from the HCFC-22 that all four CFC producers are already manufacturing, there has been less obvious development activity. One producer has announced that it has the technology and Board approval to construct a manufacturing unit for HFC-32, but that this will be delayed pending proper market conditions. HCFC-141b cannot be produced in India as a single product since the necessary feedstock is not made domestically and cannot be imported, as it is unstable. It may be possible to co-produce it with HCFC-142b, based on a different feedstock (methyl chloroform or TCA) if the market evolves sufficiently. One manufacturer has moved ahead with plans to construct a semi-commercial 500 tons/year unit for HFC-134a for which the economics will have to be reviewed as the market evolves. Imported HFC-134a is presently being sold to India at around USD3500/ton free on board (FOB). One other CFC producer, looking at the present import price, has decided not to build capacity at present. Methylene chloride is domestically available in India for foam blowing applications.

(c) DPR Korea

58. In DPR Korea, stated plans to manufacture methylene chloride (for foam-blowing) and trichloroethylene (as metal-cleaning solvent) will probably not be viable due to the large plant sizes required for economic production, the technology acquisition cost involved, as well as the volume of co-products which are inevitably co-manufactured (including CTC in the case of methylene chloride). There is no appropriate substitute for the CFCs (and in the longer term, from 2005 for CTC), except to import products, which DPR Korea has been trying to avoid. CTC has been used as a substitute in recent years, for the discontinued production of methyl bromide, CFC-113, and methyl chloroform or TCA, all of which have smaller ODP values than the CTC that replaced them.

59. HFC-134a has been selected as the product suitable for replacing CFC-12 in refrigeration applications. A new refrigerant, said to be derived from propylene and with the code-name "Moran", has been referred to in a number of previous verification and update reports, but no more is known about the technology or its status.

60. There have been projects tabled to review methylene chloride production for foam-blowing use, and trichloroethylene production as a feedstock to HFC-134a. The economics of such plants were reviewed during the visit and it was noted that methylene chloride production would entail the necessary co-production of chloroform and CTC. Building such plants at an economic scale would necessitate capacities far in excess of domestic market demand.

7 Technical Assistance (TA)

(a) Overview

61. India earmarked as part of the production sector phase-out agreement US $2 million for TA which have been consistently under-used. China has no amount defined in the agreement, and there was no TA foreseen in DPR Korea.

62. Most TA activities aim at establishing and maintaining the relevant national infrastructure to manage and monitor implementation of the agreements and to promote awareness building, but do not in most cases, directly support the CFC producers. In China, enterprises view TA as a possible source of funding for individual or common R&D. In this context, certain TA activities have had an impact such as the ones supporting the HFC-134a plant at Xi'an. In India, the CFC producers view technological know how as their individual realm and consider the TA component as "government business". They would not like to see TA diminish their compensations. While TA was not foreseen in the agreement with DPR Korea, TA for substitute development would have been welcome.

(b) PR China

63. TA undertaken under the CFC production sector agreement for PR China comprises 32 projects with a total disbursement of US $1.63 million. This excludes the TA provided in connexion with the construction of the HFC-134a plant.

64. Most TA projects originate at SEPA. While SEPA claims that technical assistance is implemented in close cooperation with the enterprises, these reportedly feel insufficiently consulted and involved.

(c) India

65. TA in India was subcontracted by the World Bank to UNEP. TA is subject to annual plans and reports but financial information regarding individual TA projects was not provided. Financial details for 2002 to 2003 only show objects of expenditure (rent, travel, professional fees, etc) totalling US $444,000. Annual budgets for TA have been regularly under spent. The evaluation team could not obtain details on the outcomes of the TA. Annual verification reports do not cover TA and annual work programmes only list the status of implementation of individual projects.

(d) DPR Korea

66. No TA was foreseen in the agreement for the closure of the plants.

Annex I

OVERVIEW OF PRODUCTION SECTOR AGREEMENTS

Argentina

Year	Maximum Allowable Production as per Agreement (Metric Tonnes)	Verified Actual Gross Prod. (Metric Tonnes)	Production in Excess of Agreement (Metric Tonnes)	A7 Data – CFC Production (ODP Tonnes)	Annual Funding Tranches as per Agreement (US$)	Approved Funds (US$)	Funds Disbursed (US$)[1]
2002	3,020.0			3,015.0	500,000	500,000	0
2003	3,020.0				3,500,000		
2004	3,020.0				0		
2005	1,647.0				300,000		
2006	1,647.0				2,000,000		
2007	686.0				0		
2008	686.0				1,000,000		
2009	686.0				1,000,000		
2010	0.0						
Total	**14,412**				**8,300,000**	**500,000**	**0**

[1] According to 2002 Progress Report

Chronology

Event	Timing	Description
Approval of Agreement	38th Meeting (Decision 38/73)	Approved in principle a total of $8.3 million in funding and US $727,000 as support cost for the phased reduction and closure of the entire CFC production capacity in Argentina. US $500,000 plus US $20,000 as support cost were approved as first tranche.

China

Year	Maximum Allowable Production as per Agreement (Metric Tonnes)	Verified Actual Gross Prod. (Metric Tonnes)	Production in Excess of Agreement (Metric Tonnes)	Verified Actual Prod. (ODP Tonnes)	A7 Data – CFC Production (ODP Tonnes)	Annual Funding Tranches as per Agreement (US$)	Approved Funds (US$)	Funds Disbursed (US$)[2]
1999	44,931.0	45,667.4[1]	736.4	44,739.0	44,739.4	20,000,000	20,000,000	20,000,000
2000	40,000.0	40,969.5	969.5	39,990.5	39,962.8	13,000,000	13,000,000	13,000,000
2001	36,200.0	36,941.9	741.9	36,196.1	36,167.2	13,000,000	13,000,000	13,000,000
2002	32,900.0	33,521.0	621.0	32,895.5	32,269.0	13,000,000	13,000,000	7,000,000
2003	30,000.0	30,535.4	535.4	29,985.7	n.a.	13,000,000	13,000,000	
2004	25,300.0					13,000,000		
2005	18,750.0					13,000,000		
2006	13,500.0					13,000,000		
2007	9,600.0					13,000,000		
2008	7,400.0					13,000,000		
2009	3,200.0					13,000,000		
2010	0.0							
Total	**261,781**	**187,635.2**	**3,604.2**	**183,806.8**		**150,000,000**	**72,000,000**	**53,000,000**

[1] Assuming that in one factory (Jiangsu Changsu 3F Refrigeration Co. Ltd.) where CFC-114 and 115 production is lumped together in the verification report (150 mt), 50% is CFC-115.

[2] According to 2002 Progress Report

Chronology

Event	Timing	Description
Proposal and Agreement	27th Meeting (Decision 27/82)	Approved the proposed Agreement for the China Production Sector; Request the Sub-Committee on PR to monitor the implementation of the Agreement in accordance with its terms and report any discrepancies to the ExCom, on the basis of the annual work programmes and the requests for funding by the World Bank; approved for the 1999 annual work programme initial funding of US $10 million plus US $10 million as adjustment at the 28th meeting of the Executive Committee.
1999 Verification Report	30th Meeting	Approved the 2000 annual programme at the level of funding of $13,000,000+$1,170,000 (support costs).
2000 Annual Programme	30th Meeting (Decision 30/50)	
2001 Annual Programme	32nd Meeting (Decision 32/62) & 33rd Meeting (Decision 33/44)	Approved the 2001 annual work programme for the CFC production sector phase-out in China with funding to be considered at the 33rd Meeting of the ExCom, pending the submission of the verification report on the implementation of the 2000 AP for the CFC production phase-out in China.
2000 Verification Report	33rd Meeting (Decision 33/44) The complete verification of the 2000 production was submitted inter-sessionally in June 2001 and the 50% funding for 2001 AP was released after the complete report in July 2001.	Approved the release of 50 per cent of the requested total of US $13 million for 2001 (and approve the associated support costs for the World Bank) corresponding to the reduction from the five plant closures. Authorize the Secretariat to approve the transfer, inter-sessionally, of the balance of the funds requested, after receiving from the World Bank information which was fully responsive to the following: the verification report encompassing the implementation of the full 2000 work programme of the China CFC production sector in compliance with the guidelines, approved in decision 32/70; information on the operation and management of the quota system in China; to note that the World Bank would further streamline the

Event	Timing	Description
		implementation procedure to coordinate better the annual work programme and the timing of the verification exercise.
2002 Annual Programme	35th Meeting (Decision 35/49) & 36th Meeting (Decision 36/47)	Approved the 2002 annual work programme of China CFC production closure programme and to note that the funding request would be submitted by the WB, to the 36th Meeting, together with a verification report on the implementation of the 2001 annual work programme.
2002 Annual Programme & 2001 Verification Report	36th Meeting (Decision 36/47)	Approved support cost (7%) per year until the ExCom should decide otherwise. Request WB to report on how the support cost for this specific project were to be used and to prepare a paper showing, *inter alia*, how sectoral and national phase-out plans were implemented, indicating the support cost that had been incurred in the past and would be incurred in the future and how those related to support costs charged for other WB activities. Approve funding of US $13 million plus US $910,000 for agency support costs for implementation of the 2002 work programme of the China CFC production closure programme. Request the World Bank to provide information on the financial oversight exercised over the technical assistance programme, specifically the frequency of the financial reporting and the institution carrying out the audit.
2003 Annual Programme	38th Meeting (Decision 38/44)	Approved the 2003 work programme of the China CFC production closure programme and withheld the requested funding until the World Bank submitted to the 39th Meeting a satisfactory verification report on the implementation of the 2002 annual programme. Applied 7.5 per cent as agency support cost for the funds to be approved from the 2003 work programme, consistent with Decision 38/68.
2003 Annual Programme & 2002 Verification Report	39th Meeting (Decision 39/47)	Approved US $13 million for the implementation of the 2003 annual programme of the China CFC production sector phase-out programme and US $975,000 as support costs for the World Bank. To note the undertaking in the agreement that funding could be used in a flexible manner, and on that basis, acknowledge China's request, through the World Bank, to use a portion of the funding for the 2003 annual programme of the CFC production sector, to establish a national compliance centre to assist China to meet its Montreal Protocol obligations.
2004 Annual Programme	41st Meeting (Decision 41/63)	Approved the 2004 work programme of the China CFC production closure programme, noting that the requests for funding and support costs would be submitted to the 42nd Meeting by the World Bank, together with a verification report on the implementation of the 2003 annual programme.
2004 Annual Programme and 2003 Verification Report	42nd Meeting	

India

Year	Maximum Allowable Production as per Agreement (Metric Tonnes)	Verified Actual Gross Prod. (Metric Tonnes)	Production in Excess of Agreement (Metric Tonnes)	Verified Net Saleable Prod. (Metric Tonnes)	A7 Data – CFC Production (ODP Tonnes)	Annual Funding Tranches as per Agreement (US$)	Approved Funds (US$)	Funds Disbursed (US$)[1]
1999	22,588.0	22,411			22,498.6	12,000,000	12,000,000	12,000,000
2000	20,706.0	20,407			20,403.8	11,000,000	11,000,000	10,819,398
2001	18,824.0	18,939	115	18,691	18,689.2	11,000,000	11,000,000	9,657,000
2002	16,941.0	17,078	137	16,890	16,883.7	6,000,000	6,000,000	5,850,000
2003	15,058.0	15,104	46	15,015		6,000,000	6,000,000	
2004	13,176.0					6,000,000		
2005	11,294.0					6,000,000		
2006	7,342.0					6,000,000		
2007	3,389.0					6,000,000		
2008	2,259.0					6,000,000		
2009	1,130.0					6,000,000		
2010	0.0							
Total	**132,707**	**93,939**	**298**			**82,000,000**	**46,000,000**	**38,326,398**

[1] According to 2002 Progress Report

Chronology

Event	Timing	Description
Approval of Agreement	Nov 1999, 29th Meeting	US $12 million signing bonus.
2000 annual work programme	Submitted Mar 2000	Intersessional approval procedure requested by decision 30/51, but did not happen and postponed to 31st meeting.
Approval 2000 annual work programme and 99 verification	31st meeting July 2000, decision 31/41	Decision 31/41 to develop guidelines for ODS phaseout and to approve 2000 work programme.
Submission of 2001 annual work programme and 2000 verification report	33rd meeting March 2001	Decision 33/47 to approve 2001 work programme.
Submission of 2002 annual work programme and 2001 verification report	36th meeting March 2002	Decision 36/48 approved of 2002 work programme and requests standardized procedure for China and India.
Submission of 2003 annual work programme and 2002 verification report	39th Meeting March 2003	Decision 39/50 approved US $6 million plus US $450,000 support costs for the 2003 annual work programme and requests to submit future verification reports in time and provide additional info on the financial oversight over the technical assistance programme in accordance with Decision 36/48.
Submission of 2004 annual work programme and 2003 verification report	42nd Meeting March 2004	

Korea, DPR

Chemical	Year	Phase-Out as per Agreement (ODP Tonnes)[1]	Verified Actual Gross Prod. (Metric Tonnes)	Production in Excess of Agreement (Metric Tonnes)	Verified Actual Prod. (ODP Tonnes)	Actual Production (ODP Tonnes)[2]	Annual Funding Tranches as per Agreement (US$)	Approved Funds (US$)	Funds Disbursed (US$)[3]
CFC-113	2001	400.0				28.8	687,700	687,700	687,700
TCA	2001	100.0				7.0	656,650	656,650	656,650
CFC-11/12	2003	1,250.0				587.4	733,700		
CTC	2005	2,530.0				2,027.3	488,750		
Total		**4,280.0**				**2,650.5**	**2,566,800**	**1,344,350**	**1,344,350**

[1] These figures do not come from the agreement which does not contain any but from UNIDO's business plans.
[2] Data from CP; for CFC-11/12 and CTC data for 2002.
[3] According to 2002 Progress Report.

Chronology

Event	Timing	Description
Amended Agreement	36th Meeting (Decision 36/55)	Approval of amendment and first tranche US $1,344,350 and support cost of US $67,217 for 2001 work programme.
Verification Report for CFC closure and request for second tranche	42nd Meeting	

Mexico

Year	Maximum Production Levels Agreed (Metric Tonnes)	Verified Actual Gross Prod. (Metric Tonnes)	Production in Excess of Agreement (Metric Tonnes)	A7 Data – CFC Production (ODP Tonnes)	Annual Funding Tranches as per Agreement (US$)	Approved Funds (US$)	Funds Disbursed (US$)[2]
2003	22,000[1]	8,694			5,300,000	5,300,000	0
2004					10,700,000		
2005					4,000,000		
2006	0				11,850,000		
2007	0				0		
2008	0				0		
2009	0				0		
2010	0				0		
Total	**22,000**				**31,850,000**	**5,300,000**	**0**

[1] Total maximum production for the years 2003 to 2005 is 22,000 mt. It is understood that Mexico may not exceed its allowable production limit during any one year.

[2] According to 2002 Progress Report.

Chronology

Event	Timing	Description
Approval of Agreement	July 2003 (40th Meeting)	Approved in principle US $31.85 million and US $2.38 million of support cost for the closure of the entire CFC production capacity in Mexico, and US $5,300,000 as first tranche plus US $387,500 as support cost.

Annex II
Inter-linkages between the Phase-out of CFC Production and CTC Production

1. The production of CFC-11 and CFC-12 needs CTC as a feedstock and as a result, the monitoring of the CFC production phase-out is partly dependent upon the validation of the level of CTC production.

2. At the same time, CTC itself is a controlled substance under the MP and follows an even faster phase-out schedule than CFC-11 and 12. Both India and China have concluded with the Executive Committee sector phase-out plans for CTC production and consumption. Efforts to design monitoring systems for implementation of the CTC sector plans are underway.

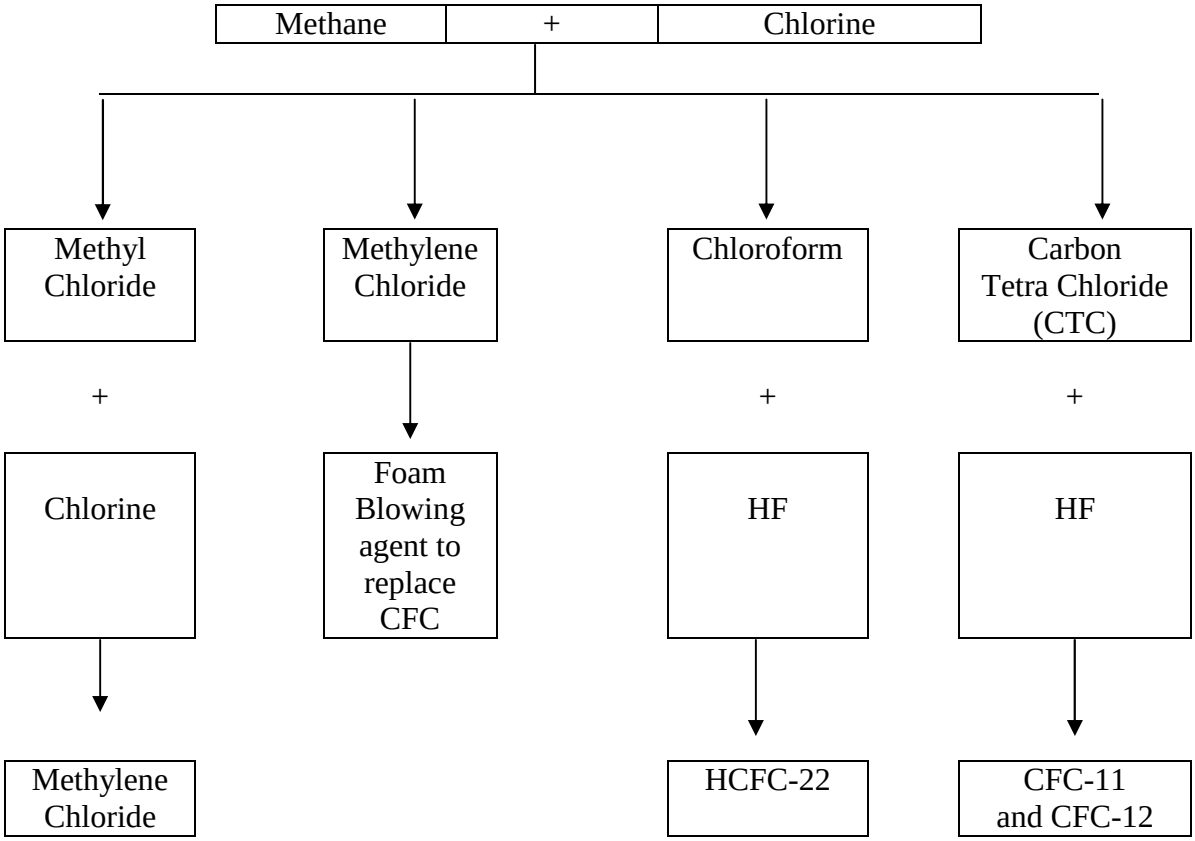
3. The main challenge to CTC monitoring systems is the way to distinguish CTC production between feedstock applications (mainly for fluorocarbons, and historically most important for CFC-11 and CFC-12) which are not controlled, and the controlled uses.

4. The CFC producers in China and India are moving to the production of HCFC-22. There has been significant expansion of HCFC-22 production capacity in China and the 4 CTC producers in India have the capacity to swing to HCFC-22 production and have been doing that all along. The HCFC-22 production needs chloroform as a feedstock. The complicating factor is that the production of chloroform inevitably means the co-production of CTC, so that as HCFC-22 grows, so does chloroform demand and so does the co-production of CTC. In order to better understand this, a short explanation of the chemical process is presented below.

The chloromethane products

5. While there is more than one route to produce chloromethane products, for simplicity reasons, the discussion here describes one route only, that is reacting methane with chlorine. This is the smallest of the available routes but is nevertheless illustrative. This reaction – as do all chloromethane reactions -- generates 4 products – methyl chloride, methylene chloride (or dichloromethane), chloroform (or trichloromethane), and carbon tetrachloride (tetrachloromethane, perchloromethane, CTC). It is possible to vary the mix of the 4 products by varying the proportions of methane and chlorine. However, the presence of all 4 products is always there, and the proportion of CTC will always be greater the more chloroform is produced.

6. When CFC is being produced, all the 4 products find an outlet. Methyl chloride is used mainly to make silicone products or is further processed to become methylene chloride; methylene chloride is, among other uses, a blowing agent for foam production to replace CFC-11 and is the feedstock to make HFC-32,; chloroform is reacted with HF to produce HCFC-22; and carbon tetrachloride is reacted with HF to produce CFC-11 and CFC 12. Presented in a diagram it looks as follows:



The Dilemma with CTC as By-product

7. While the phase-out of CFC production should reduce the demand for CTC, the increased production of HCFC-22 increases the need for chloroform and as a result of the chloromethane production process, increases the co-production of CTC as an unwanted by-product. It might be noted that historically, chloromethanes plants were specifically run to generate high levels of CTC, and that chloroform at one stage might have been regarded as the co-product.

8. Ideally, the generation of CTC can be managed such that it is totally absorbed by CFC production as feedstock, by other chemical intermediate uses such as in DV Acid Chloride (India) and by new HFCs such as HFC-245fa, HFC-365mfc, and HFC-236fa. However, as CFC production is reduced, there is a challenge to the CTC sector plan to monitor where the unwanted CTC from HCFC-22 production goes and to ensure that it does not enter the market for controlled CTC uses.

9. One route to produce CTC is by the perchlorination of hydrocarbons and chlorocarbons. This is NOT a chloromethanes process: it co-produces perchloroethylene and CTC in varying proportions, and can convert one to the other with appropriate investment. *It is therefore a process that can chemically convert CTC to perchloroethylene.* This process is widely in use in USA and W Europe, but not elsewhere.

10. The other alternative to CTC management is destruction, a costly process similar to the one for CFC's.

Conclusion

11. The above requires to closely coordinate the monitoring and verification of the implementation of the CFC production phase-out and CTC production phase-out agreements.

12. Claims about the impossibility of managing CTC to less than 13% of the overall of chloromethanes production should be treated with circumspection since most chloromethanes producers in non-Article V countries have managed this to 10% of chloroform or less, say 5-7% of the overall mix.
