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# CHINA COUNTRY PROGRAMME UPDATE

This document consists of:

- Transmittal Letter from the Government of China
- Comments and Recommendations from the Fund Secretariat
- Update of China's Country Programme for Ozone Depleting Substances Phaseout (Executive Summary)
- Update of China's of Country Programme for Ozone Depleting Substances Phaseout
- Action Plan for ODS Phaseout in China

# CHINA COUNTRY PROGRAMME UPDATE

# COMMENTS AND RECOMMENDATIONS FROM THE FUND SECRETARIAT

## COMMENTS

### A. Background

1. The China Country Programme Update (Update) was prepared through the use of national experts under the coordination of the State Environmental Protection Administration (SEPA). The update was prepared with funds approved in February 1997 to UNDP which together with UNEP provided technical assistance.

2. The Update was submitted in four parts as follows:

- Executive summary
- Update of China's Country Programme for ozone depleting substances phase out
- Action plan for ODS phase out in China
- Review of the implementation of Country Programme for ODS phase out (submitted as information document)

3. Information provided in the Update indicates that it was prepared based on the overall framework of the China Country Programme and the guidelines for preparation of country programmes. It also drew on Executive Committee decisions and sector plans for China as well as substitute technologies and national regulations and policies governing a market economic system.

### Progress of Implementation of China's Country Programme

4. China's Country Programme was approved at the 9th Meeting of the Executive Committee in March 1993. The strategy in the Country Programme was aimed at 12% phase-out of ODS consumption by 1996 and 61% by 2000, with the fastest phase-out in the aerosol sector where consumption in 2000 was expected to be 8% of the 1991 (the Country Programme's base year) levels. Halon consumption in 2000 was expected to be 23% of 1991 levels and solvents about the same level as in 1991.

5. Data from the Country Programme Update for 1997 shows that the aerosol consumption stood at 2,800 ODP tonnes or 32% of 1991 levels while halon and solvents stood at 35,731 ODP tonnes and 4,532 ODP tonnes respectively or 286% and 105% of 1991 levels respectively. The total ODS consumption excluding (methyl bromide and HCFCs) of 1997 was 87,639 ODP tonnes or 156% of the 1991 consumption of 56,052 ODP tonnes.

6. The table below shows the production and consumption of halons and the major CFCs in 1991 and 1997 (the base years for the Country Programme and its Update).

**Table 1: Production and Consumption in 1991 and 1997 of Major CFCs and Halons**

| Substance | Production ODP Tonnes | | Consumption ODP Tonnes | |
|---|---|---|---|---|
| | 1991 | 1997 | 1991 | 1997 |
| CFC-11 | 3,100 | 23,647 | 16,230 | 24,898 |
| CFC-12 | 21,900 | 22,943 | 23,012 | 22,238 |
| Total CFC-11 and CFC-12 | 26,991 | 48,587 | 41,233 | 49,133 |
| Halon 1211 | 10,500 | 34,926 | 16,000 | 32,541 |
| Halon 1301 | 100 | 10,270 | 800 | 3,190 |
| Total Halon 1211 and 1301 | 10,600 | 45,196 | 16,800 | 35,731 |

7. In the Review of the Implementation of the Country Programme for ODS Phase-out (mentioned in paragraph 2 above) the Government gives an overall appraisal of the Country Programme and indicates that by the end of 1996, significant progress had been made in ODS phase-out. With support of the Multilateral Fund and through restructuring of industry, policy implementation, and voluntary involvement of enterprises, the Government has controlled ODS production and consumption growth in China, and has started the phase-out of ODS. By the end of 1996, China overall had phased out about 23,000 ODP tonnes of ODS.

8. The Review however states that the Country Programme's target for 1996 was not achieved and identifies a number of problems that contributed to the shortfall in achieving the 1996 target. These problems were stated, among others, to be China's economic growth which was considerably greater than anticipated; high growth rate in the service sector; development of guidelines by the Executive Committee, implementing agencies and local agencies which took longer than anticipated; the flow and level of funds from the Multilateral Fund which did not meet China's expectations; and project-by-project approval which was not as effective as anticipated (as implementation period of projects was typically too long with negative impact on achievement of phase-out targets).

9. The review also identified lessons learned from implementing the Country Programme, which include, among others, the need for sufficient support from the Multilateral Fund, effective technology transfer, and for all organizations concerned to work closely together; existence of effective monitoring and supervision mechanism; and the need for education, training and communication.

**Production and Consumption Data**

10. Data on production and consumption of ODS except for 1995-1997 were obtained through surveys. Data on methyl bromide and HCFCs were not included in the Update since China is not a Party to the Copenhagen Amendment. There was neither a breakdown of the data to indicate ODS consumption due to enterprises or facilities established after 25 July 1995 nor a breakdown of the refrigeration sector data to indicate amounts used for servicing and manufacturing of refrigeration equipment.

11. The update shows that China produced 10 controlled substances including all Annex A, CFC-13 of Annex B, carbon tetrachloride and methyl chloroform. China also produced methyl bromide and HCFCs including HCFC-22 and HCFC-141b.

12. China's consumption of ODS in 1997 excluding methyl bromide and HCFCs was 87,618 ODP tonnes of which about 4% was imported. Its production for the same year was 95,761 ODP tonnes. The baseline consumption of Annex A Group I and Annex A Group II controlled substances was reported (by the Ozone Secretariat) to be 57,819 and 34,187 ODP tonnes respectively.

13. The Update describes current status of ODS production and consumption for those ODS covered in it including consumption by sector and the structure of the ODS industry based on 1997 data. The description of industry structure includes production of ODS substitutes, its installed capacity and production output in 1997. It however does not include ODS consumption of the servicing sector, the SME sector, process agents and sterilants. The production capacities of HCFC-22 and HCFC-141b was reported to be 55,000 tonnes and 10,000 tonnes respectively with the production of HCFC-22 reaching 40,000 tonnes in 1997.

**Industry Structure**

14. The Update describes the various ODS producing and consuming sectors indicating the scope of activity as of August 1998. This also does not include description of the servicing and SME sectors, methyl bromide, process agent and sterilants. The description also did not include the agreements reached on the halon and CFC production as well as other sector strategies under development.

**Phase-out Strategy**

15. The phase-out strategy describes the control targets applicable to Article 5 countries as well as the Government's own strategy. The strategy sets goals to be achieved until complete phase-out, identifies measures that the Government will adopt generally and in each sector to achieve such goals and conditions and requirements that would have to be met in order to successfully achieve the goals.

16. The phase-out strategy establishes ODP control limits under the Montreal Protocol. However the control limits of CFC production in China as indicated in this section are not consistent with the limits set in the agreement China has reached with the Executive Committee on CFC production phase-out.

17. ODS phase-out plan and substitute production plan have also been outlined which establish estimated consumption or production for the years 1999 to 2010 for CFCs, halons, carbon tetrachloride and methyl chloroform as well as ODS consumption phase-out targets by substance and by sector for the period 1999-2000.

18. The ODS phase-out plan also indicates the following:

- China is planning to build recycling capacity to meet the servicing requirements for CFC-12 and provides estimated amounts of recycled CFC-12 from 2006 to 2020.

- The estimated amounts of substitutes that would be produced between the period 1999 and 2010 based on the strategic consideration that ODS substitutes will gradually be met by domestic production.

- 11 technical assistance activities for which China will request funding.

**Incremental Cost**

19. The amount of funding required by China from 1999-2000 was estimated by means of a computer model to be US $541 million. This amount does not include US $207.2 million alrealy agreed for funding of CFC production, halon sector and MAC projects. It also does not include the cost of the phase-out of methyl bromide, HCFCs, carbon tetratchloride production closure, process agents, sterilants and essential uses of aerosol and solvents for which no funding estimates were made due to uncertainties of alternative technologies, strategies and absence of guidelines. With regard to the future cost of HCFC phase out UNDP was reminded to take account of the relevant Executive Committee decisions on the use of transitional substances as ODS substitutes in Multilateral Fund projects.

20. The US $541 million is broken down as follows:

| **Sector** | **Cost US $** |
|---|---|
| Foam | 154,839,000 |
| Tobacco | 40,000,000 |
| Industrial and Commercial Refrigeration | 24,737,000 |
| Domestic Refrigeration | 8,513,000 |
| Solvent | 92,292,000 |
| Production of TCA | 5,635,000 |
| Production of substitutes | 156,000,000 |
| Recycling | 32,856,000 |
| Technical Assistance | 25,744,000 |
| TOTAL | 540,616,000 |

21. The assumptions and parameters used in the computer model included:

- 1999 prices are considered to be the same as in 1997.
- 7% discount rate.
- 2.5% inflation rate after 1999.
- Higher cost-effectiveness in the foam, refrigeration and solvent sectors than average.
- Cost-effectiveness of US $42/kg for the tobacco sector.
- Inclusion of ODS consumption already phased out.

- In the case of closure of TCA production, incremental cost of setting-up capacity of substitute production adopts the suggestion of "Production Sector Phase-out Strategy", 1995.

**Policy, Monitoring and Enforcement**

22. Instruments for facilitating the implementation of the Country Programme Update have been elaborated under this chapter. This includes institutional framework, arrangement of responsibilities of state organizations, policies and monitoring and supervision systems in place or to be put in place. Policy documents issued by the Government of China to date have also been listed.

**Observations**

23. The Secretariat made the following observations on the Country Programme Update. Detailed comments including those of technical nature based in part on these observations have been sent to UNDP.

(a) The Country Programme Update takes on added significance in view of China's stituation as currently the largest producer as well as consumer of ODS in the world. Consequently a certain level of accuracy in the presentation of relevant data and estimate of funding requirements is to be expected.

(b) The Update provides calculated consumption and production data for 1995-1997 but does not make any reference to China's baseline data. The baseline data for Annex A controlled substances establish the point of reference for Article 5 countries' compliance with the Montreal Protocol with respect to these substances. In the case of China the significance of this group of substances is underlined by the fact that Annex A controlled substances is made up 95% of its 1997 ODS consumption and 98% of its production. Since there are some inconsistencies in the data reported by the Ozone Secretariat and that reported in the Update determination of applicable baseline could pose difficulties.

(c) The time that has elapsed between the time of the preparation of the Update and its submission has made significant parts of the document obsolete. For instance, the base year of August 1998 which has been used for estimating the ODS to be phased out and the corresponding funding requirement is no longer valid as the data for 1999 was based on projections that have proven to be inaccurate. This is further explained in the following paragraph.

(d) In the foam sector, the period between August 1998 (the reference point for the Country Programme Update) and December 1999 the amount of US $35.79 million (including provisionally approved projects) has been allocated to phase out 5,200 ODP tonnes of CFC. For 1999 alone the amount allocated was US $30.44 million for the phase out of 4,414 ODP tonnes. This amount is about 20% of the projected NPV of US $154.84 million for the foam sector and

800% of the projected resources for 1999 (of US $3.76 million) based on the computer model. The projects and activities approved in 1999 for all sectors represent about 21% of the total number of projects approved to date, 26% of total funds, 14% and 38% of total ODP to be phased out in the consumption and production sectors respectively. These figures are not captured in the incremental cost estimate based on data up to August 1998.

(e) Therefore the calculation of incremental cost based on August 1998 does not reflect the true situation with regard to ODS left to be phased out or funding needed to do so. In order to rectify this and establish the best estimate of funds required for 2000-2010, it is necessary to determine the ODS left to be phased out based on 1999 production and consumption data and funds approved for China up to end of 1999.

(f) With regard to the estimated cost of US $156 million for the production of CFC substitutes, the agreement for the China Production Sector adopted at the 27th Meeting of the Executive Committee provided the funding of US $150 million for the phased reduction and closure of the entire CFC production capacity in China. It was for the total permanent closure and dismantling of all capacity for the production of Group I of Annex A and Group I of Annex B CFCs and/or development of capacity to produce alternatives to these CFCs. Consequently, the substitute production activity is not eligible for funding by the Multilateral Fund. Therefore, if it is included in the Update it should be appropriately described as cost not to be borne by the Multilateral Fund.

(g) The Country Programme Update did not appear to take into consideration either the technical assistance approved for development of sectoral phase out strategies in all sectors or assistance not linked to a specific sector before proposing new ones at the level of US $25.7 million. So there appears to be duplication of some approved technical assistance activities. Furthermore there appears to be duplications within the list of activities proposed. No basis for estimating the level of funding of US $25.7 million was provided.

(h) Other observations made by the Secretariat include the following:

- There is the need to provide a breakdown of the refrigeration sector consumption data into manufacturing and servicing.
- There is also the need to segregate and indicate consumption data due to plants established after 25 July 1995.
- Several assumptions or parameters used in the computer model to calculate incremental cost may not be valid.
- There was the need to take account of global trends in the prices of ODS and their substitutes when estimating the funding requirement.
- The Action Plan for ODS Phase-out in China was inadequate, particularly as a stand-alone document.

**RECOMMENDATIONS**

24. The Executive Committee may wish to take note of the China Country Programme Update with appreciation and request UNDP and the Government of China to revise the document taking account of the comments made by the Secretariat.

国 家 环 境 保 护 总
**CHINA STATE ENVIRONMENTAL PROTECTION ADMINISTRAT**

28 January, 20(

Chief Officer
Secretariat of the Multilateral Fund
for Implementation of the Montreal Protocol
1800 McGill College Ave.,
27th Floor, Montreal, Quebec,
Canada H3A 3J6

**Subject: Update of China's Country Program for ODS Pha**

Dear Sir,

I have the honor on behalf of State Environmental I Administration, the head of the Leading Group for Ozone Layer I in China, to submit herewith the Update of China's Country Pro Ozone Depleting Substances Phase-out for the consideration and ap the Executive Committee of the Multilateral Fund for the Impleme the Montreal Protocol.

Under the leadership of SEPA and the support of MLF, a natio team has formulated the Update of Country Program with the assistance of UNDP and UNEP.

The Update of Country Program is designed to fulfi commitment to Montreal Protocol regarding phase-out targets f ODS. The Update of Country Program addresses the strategies

take to realize the phase-out targets while minimizing the adversely affection of economic growth and employment. The Update of Country Program stresses a flexible, cost-effective and policy-based approach for ODS phase-out. It will act as a guideline for China's ODS phase-out activities. I hope that the Executive Committee will continue to support China to achieve the ODS phase-out targets of 50% reduction in 2005, and 100% phase-out in 2010.

China's State Council has approved the Update of Country Program in November 1999.

Accept, sir, the assurance of my highest consideration.

Yours Sincerely,

Wang Jinrong
Vice Minister
State Environmental Protection Administration

CC: 001-212-906-6947
Mr. Frank Pinto, Principal Technical Adviser and Chief,
Montreal Protocol Unit, UNDP New York

# UPDATE OF CHINA'S COUNTRY PROGRAMME FOR OZONE DEPLETING SUBSTANCES PHASEOUT

## EXECUTIVE SUMMARY

*State Environmental Protection Administration*
*The People's Republic of China*

# UPDATE OF CHINA'S COUNTRY PROGRAMME FOR OZONE DEPLETING SUBSTANCES PHASEOUT

# EXECUTIVE SUMMARY

## Objectives

The objectives of the Country Programme (CP) Update are to: a) reformulate China's strategy and action plan to more effectively meet realistic ODS phaseout targets consistent with Montreal Protocol (MP) limits; b) assess and adjust policy actions and strategies to support effective phaseout; c) develop a more flexible approach to phaseout management and action plan; and d) benefit from lessons learned in the early years of CP implementation.

## Current Status

China has made significant achievements in ODS phaseout. However, CP implementation is facing new challenges as well as changes in management and guidelines by ExCom and Implementing Agencies. Within China there have also been changes including improved management, recognition of the important role of policy and strategy, need for national level monitoring and enforcement, and increased emphasis on local implementation. The CP Update will be an effective guide for future ODS phaseout activities including a more flexible approach to managing the CP Action Plan.

During 1993-97, China's principal task was to contain growth in ODS use, primarily through controlling consumption following MLF guidelines, while during 1998-2010, the principal task and approach will be to control and reduce production as well as consumption. China's policy is to i) meet or exceed MP targets, ii) minimize cost of ODS phaseout, iii) minimize adverse impact on economic growth, and iv) establish production of ODS substitutes (in parallel with phaseout of ODS production and consumption) to ensure self sufficiency in low cost supply from local facilities.

Of the 20 controlled substances in Annex A and B under the Montreal Protocol (London Amendment), the following ten are produced and used in China:

Annex A Group I: CFC-11, CFC-12, CFC-113, CFC-114, CFC-115

Annex A Group II: Halon-1211 and Halon -1301

Annex B Group I: CFC-13

Annex B Group II: Carbon tetrachloride (CTC)

Annex B Group III: Methyl chloroform (TCA)

China also produces and consumes other ODS which are listed in Annex C and E under the Copenhagen Amendment. China has not yet ratified the Copenhagen Amendment, thus measures to control these chemicals and the CP Update does not consider their phaseout strategies. These chemicals are:

Annex C Group I HCFC-22, HCFC141b, and etc.

Annex E Group I Methyl Bromide

Therefore, ODS mentioned hereinafter refer only to the ten ODS listed in the first paragraph above.

China's ODS consumption in 1997, in ODP, was around 87,600 tons, and ODP production was around 95,800 tons. The charts below show the percentage of ODS production and consumption by substance and by sector (Figure 1 and Figure 2). In ODP, halon (or fire protection) sector is the largest user accounting for 40.8% of total consumption, followed by foam at 27.2%, refrigeration at 22.4%, solvent at 5.2%, aerosol at 3.2%, and tobacco at 1.2%.

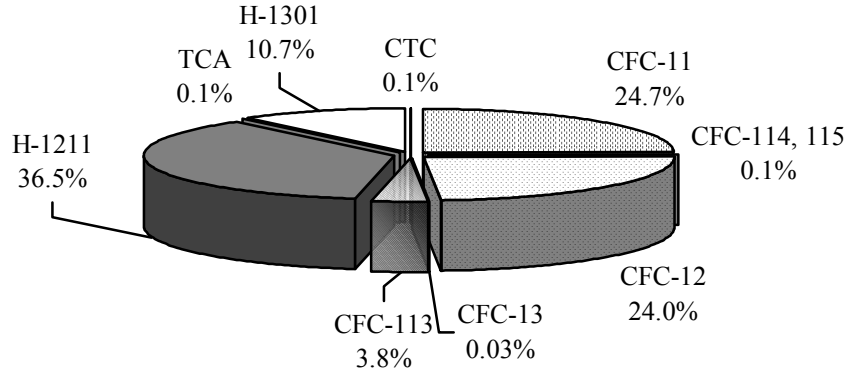


Figure 1 1997 ODS Production (in ODP Value) in China

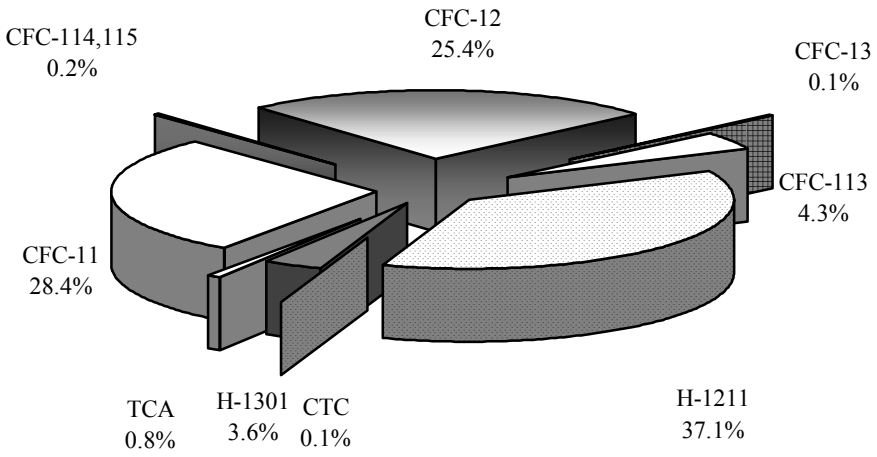


Figure 2 1997 ODP Consumption in China by Chemicals

## ODS Phaseout at Sector Level

ODS Consumption Sectors. By August 1998, 249 projects had received US$ 254 million in funding from MLF, with 23 projects completed with an aggregate ODP consumption phaseout of 23,898 tons by end of 1997. Substantial progress has been made on phaseout in several consumption sectors, notably aerosols, refrigeration and air conditioning, foam and halon, with the active support of the MLF. Some progress has been made in solvent sector with a lower priority assigned by MLF. Only recently has attention been given to tobacco sector. Future progress in most consumption sectors will require an increased emphasis on new phaseout approaches such as umbrella projects and sector plans with greater attention needed for actions to reach small and medium enterprises.

CFC Production Sector. There are 50 plants producing ODS (excluding Halons) in 1997. There are 37 CFC plants with a total designed annual production capacity of 122,000 tons CFC. Technology used by almost all CFC plants is liquid-phase catalytic fluorination process that was developed domestically. Domestic and imported raw materials are used in their production. Since most production facilities have been developed with local technology and designed with low operating pressure, the flexibility to switch from CFC to HCFC-22 is limited. There are about 15 CTC plants with a total production capacity of 80,000 tons, and three TCA plants with a total capacity of 2,800 tons. The production capacity of CFC-13, CFC-114 and CFC-115 in 1997 was about 660 tons. The first CFC production closure project was approved in 1999， CFC production will steadily decrease during 1999-2010 in step with reduced CFC consumption.

Halon Sector. Substantial progress has been made in the halon sector, both for consumption and production. By the end of 1996, 15 projects in Halon sector were funded by MLF with US$ 4.9 million that will phaseout consumption of 800 tons ODP. Halon sector

approach was approved by MLF in November 1997 for a total funding of US$ 62 million for phasing out Halon production and consumption, including recycling and banking. In 1997, there were nine Halon 1211 agent producers and one Halon 1301 agent producer. There were 72 Halon extinguisher manufacturers with a total production of about 4,500,000 Halon 1211 extinguishers. There were 22 enterprises producing about 8,500 units for Halon-extinguishing systems with H-1211, while the production of H-1301 system was about 2,500 units.

## Phaseout Strategy and Approach

China will phaseout its ODS production and ODS consumption in accordance with MP targets, and establish related substitutes production under the assumption that MLF will supply necessary funds and support for substitution technology transfer with favorable conditions. The MP targets, to which China has agreed to meet, are:

- freezing production and consumption of CFCs in Group I, Annex A on July 1, 1999 at average of 1995 to 1997 actual levels, then reduce to 50% of freezing level by January 1, 2005, then reduce to 15% of freezing level of consumption and production by January 1, 2007, and to stop production and consumption by January 1, 2010;

- freezing production and consumption of Halon on January 1, 2002 at average of 1995 to 1997 actual levels, then reduce to 50% of freezing level by January 1, 2005, and to stop production and consumption by January 1, 2010;

- production and consumption of CFC-13 in Annex B is reduced to 80% of the average actual level of 1998 to 2000 by January 1, 2003, then to 15% by January 1, 2007, and to stop production and consumption by January 1, 2010;

- reduce production and consumption of CTC to 15% of the average level of 1998 to 2000 by January 1, 2005, and then to stop production and consumption by January 1, 2010;

- production and consumption of TCA will be frozen by January 1, 2003 at the average actual level of 1998 to 2000, then reduce to 70% of freezing level of consumption and production by January 1, 2005, then to stop production and consumption by January 1, 2015.

China will also ensure that halon production and consumption will be phased out in accordance with the Halon Sector Plan.

## Baseline for Montreal Protocol Phaseout Targets

The MP has set intermediate targets for CFC consumption and production based on the average of 1995, 1996 and 1997 levels. Based on MP targets, and actual consumption and production in 1995, 1996 and 1997; the maximum allowed consumption and production for China in 1999, 2005, 2007 and 2010 are shown in Table 1 and Table 2.

Table 1 Control Limits for CFC Consumption in China (ODP tons)

| | | | | MP Control Limits | | | |
|---|---|---|---|---|---|---|---|
| | 1995 | 1996 | 1997 | 1999 | 2005 | 2007 | 2010 |
| CFCs of Annex A | 69,221 | 46,976 | 51,056 | 55,751 | 27,876 | 8,363 | 0 |
| CFC-13 | 136 | 193 | 50 | | | 19 | 0 |

Table 2 Control Limits for CFC Production in China (ODP tons)

| | | | | MP Control Limits* | | | |
|---|---|---|---|---|---|---|---|
| | 1995 | 1996 | 1997 | 1999 | 2005 | 2007 | 2010 |
| CFCs of Annex A | 40,592 | 43,878 | 50,323 | 49,424 | 26,959 | 11,232 | 0 |
| CFC-13 | 35 | 17 | 27 | | | 4 | 0 |

Note: *10 percent of base level production allowed to be produced additionally to meet the basic domestic needs of parties operating under Article 5 (1)

To achieve the control target for CFC production and consumption, China will adopt a series of control measures.

Phaseout Plan for Consumption Sectors. Based on each sector's phaseout strategy and activities, estimated consumption of ODS in China can be determined. To reach these targets, China will increasingly rely on policy based, sector wide approaches that will emphasize sector plans and umbrella approaches. China will promote recycling in refrigeration sectors to minimize use of CFC, as well as to reduce emission of CFC. The Action Plan for each sector will reflect this more flexible and efficient approach. The estimate in Table 3 shows that CFC consumption in 1999, 2005 and 2007 will be well under the control limit and that 1999, 2005, 2007 and 2010 MP targets are reasonable for China to reach.

Table 3 Estimate of CFC Consumption ( tons )

| | 1999 | | 2005 | | 2007 | | 2010 | |
|---|---|---|---|---|---|---|---|---|
| | ODS | ODP | ODS | ODP | ODS | ODP | ODS | ODP |
| CFC-11 | 22,850 | 22,850 | 10,345 | 10,345 | 4,590 | 4,590 | 0 | 0 |
| CFC-12 | 19,128 | 19,128 | 7,590 | 7,590 | 3,770 | 3,770 | 0 | 0 |
| CFC-113 | 5,125 | 4,100 | 688 | 550 | 0 | 0 | 0 | 0 |
| CFC-114 | 20 | 20 | 10 | 10 | 0 | 0 | 0 | 0 |
| CFC-115 | 300 | 180 | 167 | 100 | 0 | 0 | 0 | 0 |
| Subtotal | 47,423 | 46,278 | 18,800 | 18,595 | 8,360 | 8,360 | 0 | 0 |
| CFC-13 | 70 | 70 | 50 | 50 | 0 | 0 | 0 | 0 |
| TOTAL | 47,493 | 46,348 | 18,850 | 18,645 | 8,360 | 8,360 | 0 | 0 |
| Foam | 21,064 | 21,064 | 9,655 | 9,655 | 4,370 | 4,370 | 0 | 0 |
| ICR | 10,410 | 10,290 | 4,257 | 4,190 | 2,120 | 2,120 | 0 | 0 |
| DR | 5,344 | 5,344 | 400 | 400 | 200 | 200 | 0 | 0 |
| MAC | 2,150 | 2,150 | 1,200 | 1,200 | 670 | 670 | 0 | 0 |
| Aerosol | 2,400 | 2,400 | 2,500 | 2,500 | 1,000 | 1,000 | 0 | 0 |
| Solvent | 5,125 | 4,100 | 688 | 550 | 0 | 0 | 0 | 0 |
| Tobacco | 1,000 | 1,000 | 150 | 150 | 0 | 0 | 0 | 0 |
| Total | 47,493 | 46,348 | 18,850 | 18,645 | 8,360 | 8,360 | 0 | 0 |

Note: ICR, Industrial and Commercial Refrigeration
DR, Domestic Refrigeration

Table 4 Estimate of Halon Consumption (tons)

| Annex A Group II | 1999 | | 2005 | | 2010 | |
|---|---|---|---|---|---|---|
| | ODS | ODP | ODS | ODP | ODS | ODP |
| H-1211 | 5,370 | 16,110 | 1,890 | 5,670 | 0 | 0 |
| H-1301 | 300 | 3,000 | 150 | 1,500 | 0 | 0 |
| Subtotal | 5,670 | 19,110 | 2,040 | 7,170 | 0 | 0 |

Table 5 Estimate of CTC and TCA Consumption (tons)

| | 1999 | | 2005 | | 2010 | |
|---|---|---|---|---|---|---|
| | ODS | ODP | ODS | ODP | ODS | ODP |
| CTC* | 100 | 110 | 0 | 0 | 0 | 0 |
| TCA | 7,405 | 741 | 5,188 | 519 | 0 | 0 |

Note: * Does not include feedstock and process agent.

Production Plan for CFC Substitutes. At present, CFC substitutes consumed by China are mainly imported, except HCFC-22. Based on the strategic consideration that the ODS substitutes will gradually be met by domestic production, the demand on major

substitutes, HCFC-22, HCFC-141b, HFC-134a, isobutane and cyclopentane was estimated, and a substitute production plan was developed, see Table 6.

Table 6 Estimate of Substitutes Production (tons)

| | 1999 | 2005 | 2010 |
|---|---|---|---|
| HCFC-22* | 15,000 | 33,000 | 45,000 |
| HCFC-141b* | 2,500 | 5,200 | 12,000 |
| HFC-134a | 2,000 | 11,000 | 20,000 |
| HFC-152a* | 130 | 160 | 200 |
| Isobutane | 80 | 100 | 120 |
| Cyclopentane | 1,100 | 1,400 | 1,800 |
| Butane | 850 | 3,300 | 4,400 |
| Pentane | 400 | 2,700 | 9,500 |
| Dichloride methane | 650 | 4,600 | 44,000 |
| Propane/butane blends | 60,000 | 70,000 | 80,000 |

Note: * Excluding feedstocks

## Phaseout Approach

Phaseout Plan for ODS Production Sector. ExCom has approved the sector plan for CFCs and Halon Production. The annual production has been determined by the sector plans. China will strictly follow the sector plan to control the CFCs and Halon production. Table 7 and Table 8 show that the ODS production in 1999, 2005, and 2007 is lower than the control target set by MP, it shows that China can comply with the control targets of MP. Table 9 summarizes the ODS production and annual phaseout plan.

Table 7 Production Estimate of CFCs (tons)

| | 1999 | | 2005 | | 2007 | | 2010 | |
|---|---|---|---|---|---|---|---|---|
| | ODS | ODP | ODS | ODP | ODS | ODP | ODS | ODP |
| CFC-11 | 22,850 | 22,850 | 10,345 | 10,345 | 4,590 | 4,590 | 0 | 0 |
| CFC-12 | 17,781 | 17,781 | 7,590 | 7,590 | 3,770 | 3,770 | 0 | 0 |
| CFC-113 | 5,125 | 4,100 | 688 | 550 | 0 | 0 | 0 | 0 |
| CFC-114 | 20 | 20 | 10 | 10 | 0 | 0 | 0 | 0 |
| CFC-115 | 300 | 180 | 167 | 100 | 0 | 0 | 0 | 0 |
| Subtotal | 46,076 | 44,931 | 18,800 | 18,595 | 8,360 | 8,360 | 0 | 0 |
| CFC-13 | 70 | 70 | 50 | 50 | 0 | 0 | 0 | 0 |
| TOTAL | 46,146 | 45,001 | 18,850 | 18,645 | 8,360 | 8,360 | 0 | 0 |

Table 8 Production Estimate of Other Controlled Substances (tons)

| | 1999 | | 2005 | | 2010 | |
|---|---|---|---|---|---|---|
| | ODS | ODP | ODS | ODP | ODS | ODP |
| Halon-1211 | 5,970 | 17,910 | 1,990 | 5,970 | 0 | 0 |
| Halon-1301 | 618 | 6,180 | 600 | 6,000 | 0 | 0 |
| Subtotal of Halons | 6,588 | 24,090 | 2,590 | 11,970 | 0 | 0 |
| CTC* | 100 | 110 | 0 | 0 | 0 | 0 |
| TCA | 1,150 | 115 | 922 | 92 | 0 | 0 |
| Total | 7,838 | 24,315 | 3,512 | 12,062 | 0 | 0 |

Note: * Excluding the quantity of feedstock and processing agent.

Table 9 ODS Production Phaseout Plan in China (ODP tons)

| | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CFC-11 | 797 | 3,950 | 2,225 | 340 | 1,370 | 1,877 | 2,743 | 2,880 | 2,875 | 1,040 | 3,410 | 140 |
| CFC-12 | 5,162 | 156 | 1,005 | 2,540 | 1,030 | 2,203 | 3,257 | 2,040 | 1,780 | 690 | 520 | 2,560 |
| CFC-113 | 0 | 800 | 600 | 500 | 500 | 600 | 550 | 550 | 0 | 0 | 0 | 0 |
| CFC-114 | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 0 | 10 | 0 | 0 | 0 |
| CFC-115 | 0 | 0 | 0 | 0 | 0 | 0 | 80 | 0 | 100 | 0 | 0 | 0 |
| CFC-13 | 0 | 0 | 0 | 0 | 50 | 0 | 0 | 0 | 50 | 0 | 0 | 0 |
| Halon 1211 | 5,970 | 5,970 | 1,989 | 1,992 | 1,992 | 0 | 0 | 5,970 | 0 | 0 | 0 | 0 |
| Halon 1301 | 4,090 | 0 | 0 | 180 | 0 | 0 | 0 | 4,500 | 0 | 0 | 0 | 3,000 |
| CTC | 0 | 0 | 0 | 0 | 55 | 55 | 0 | 0 | 0 | 0 | 0 | 0 |
| TCA | 0 | 0 | 0 | 0 | 0 | 0 | 35 | 0 | 0 | 0 | 0 | 92 |
| **Total** | 16,019 | 10,876 | 5,819 | 5,552 | 4,997 | 4,735 | 6,675 | 15,940 | 4,815 | 1,730 | 3,930 | 5,792 |

## Incremental cost to phaseout ODS

Incremental cost for phasing out remaining ODS in China is shown Table 10. From 1999 to 2010, China needs additional US$ 541 million to achieve the phaseout targets, excluding the incremental costs approved for Halon, MAC, and CFCs Production Sectors.

Table 10 Incremental cost of ODS phaseout in different sectors of China (US$1,000, 1997 Price)

| | FPV | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Foam | 154,839 | 3,756 | 762 | 1,621 | 8,187 | 18,597 | 18,734 | 25,103 | 20,713 | 22,230 | 8,476 | 26,660 | 0 |
| Tobacco | 40,000 | | 9,500 | 9,500 | 9,500 | 9,500 | 1,000 | 1,000 | 0 | 0 | 0 | 0 | 0 |
| Industrial and commercial refrigeration | 24,737 | 0 | 6,919 | 14,183 | 3,635 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Domestic Refrigeration | 8,513 | 0 | 2,768 | 2,837 | 2,908 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Solvent | 92,293 | 3,810 | 9,188 | 9,883 | 10,165 | 14,147 | 13,655 | 13,699 | 4,274 | 4,380 | 4,490 | 4,602 | 0 |
| Production of TCA | 5,635 | 0 | 0 | 0 | 257 | 273 | 227 | 1,404 | 233 | 232 | 229 | 222 | 2,558 |
| Production of Substitutes | 156,000 | 28,000 | 27,000 | 26,000 | 25,000 | 25,000 | 25,000 | 0 | 0 | 0 | 0 | 0 | 0 |
| Recycling | 32,856 | 3,598 | 3,438 | 2,478 | 4,678 | 8,200 | 5,260 | 5,200 | 4 | 0 | 0 | 0 | 0 |
| TA | 25,744 | 1,958 | 2,979 | 3,325 | 3,216 | 3,786 | 3,194 | 2,320 | 1,261 | 1,342 | 660 | 1,574 | 128 |
| **TOTAL** | 540,616 | 41,122 | 62,554 | 69,827 | 67,546 | 79,502 | 67,070 | 48,726 | 26,485 | 28,185 | 13,855 | 33,058 | 2,686 |
| MAC* | 7,700 | | | | | | | | | | | | |
| Halon* | 49,510 | 9,700 | 10,600 | 4,500 | 3,700 | 5,900 | 1,200 | 1,800 | 11,400 | 400 | 300 | 10 | 0 |
| CFC Production* | 150,000 | 20,000 | 13,000 | 13,000 | 13,000 | 13,000 | 13,000 | 13,000 | 13,000 | 13,000 | 13,000 | 13,000 | 0 |

Note: * Sector Plan for CFC Production, Halon and MAC have been approved by ExCom, therefore, they are not included in the total fund required.

## Policy Framework

China is rapidly moving toward a policy based approach to managing its ODS phaseout programme. China has issued and implemented over 20 policies regarding ODS control and is proposing new policies based on the new situations, especially for implementing sector plans. The policies, regulations, monitoring and enforcement system give full consideration to production, consumption, import and export related to ODS/substitution technology/substitute production, to achieve the proposed ODS phaseout targets efficiently and effectively.

Production Management Policy. China has introduced production quota and permit system to control Halon and CFC production. All producers of Halon and CFCs must apply for production permit system to produce halon and CFCs following related regulations in China. A production quota system for halon has been implemented since 1998, and production quota system for CFC was introduced in 1999.

Import and Export Management Policy. China will introduce ODS import and export licensing and quota system. The types and quantity of ODS import/export quota will be determined according to ODS phaseout targets and domestic production and consumption.

Consumption Management Policy. The essential uses and non-essential uses areas for ODS products is/will be identified according to the changes of situation. Bans will be issued for uses of ODS products in non-essential uses and have already been issued in aerosol and MAC sectors. China is proposing to introduce ODS consumption quota system for some sectors.

Monitoring and Supervision. China will continue to establish monitoring system for ODS phaseout to include data registration and reporting system, management information system and enforcement instruments. China has set up and is improving its data management system for production, consumption, import, and export of ODS, and for MLF funds. This system will monitor the whole process of ODS phaseout activities.

# UPDATE OF CHINA'S COUNTRY PROGRAMME FOR OZONE DEPLETING SUBSTANCES PHASEOUT

*State Environmental Protection Administration*
*The People's Republic of China*

August 1999

# CONTENTS

# I. INTRODUCTION

China's Country Programme for Ozone Depleting Substances Phaseout (CP) was approved by Chinese government in January 1993, and was approved by 9th Executive Committee (ExCom) Meeting for Multilateral Fund (MLF) in March 1993. Since implementing the original CP China has made significant achievements in ODS phaseout. China has successfully controlled the growth trends of production and consumption of ozone depleting substances (ODS), established institutions for implementing MLF projects, and banned the CFCs used in aerosol sector (excluding products that has no substitute technology), which provided basis for further implementation of Montreal Protocol (MP).

The CP Update is based on the overall framework of CP, and guidelines from the Multilateral Fund (MLF) for preparing CP. CP Update gives attentions to new guidelines provided by MLF ExCom regarding incremental cost calculation, operation and implementation of sector plans, substitute technologies and regulation and policies established to be suitable to the market economic system. During preparation of the CP Update, ODS production, consumption, import and export data was surveyed and analyzed. The overall phaseout strategy and phaseout plan for sectors concerned was further developed. The policy, monitoring and supervision system was revised and improved.

China's Leading Group for Ozone Layer Protection entrusted the Center for Environmental Sciences (CES) of Peking University to draft CP Update. The work was organized and coordinated by State Environmental Protection Administration (SEPA). CP Update was prepared based on the sector development reports (including Sector Plan for Halon, CFCs Production, and Mobile Air Conditioning) drafted by expert working groups. These groups consisted of over 30 experts from chemical production, foam, halon, industrial and commercial refrigeration, domestic refrigerators, mobile air conditioners, aerosol, tobacco, solvent, and service sector (recycling and recovery), under the overall management of CES and SEPA. Inputs from ministries and commissions concerned contributed to the CP Update, including: Ministry of Foreign Affairs, State Development Planning Commission, Ministry of Science and Technology, State Economic and Trade Commission, Ministry of Finance, Ministry of Public Security, State Machine-Building Industry Bureau, Ministry of Information Industry, State Petrochemical Industry Bureau, State Internal Trade Bureau, Ministry of Agriculture, General Administration of Customs, State Light Industry Bureau, State Tobacco Monopoly Bureau, State Administration for Medicine Supervision and Management, China Aviation Industry Company, and China Space Science and Technology Company (CSSTC).

CP Update received technical assistance from UNDP and UNEP, funding from MLF, and support from other international organizations.

CP Update does not include ODS phaseout in Hong Kong, Macao and Taiwan.

# II. CURRENT STATUS

## A. Controlled ODS Produced and Consumed in China

Of the 20 controlled substances in Annex A and B under the Montreal Protocol (London Amendment), the following ten are produced and used in China:

| | | |
|---|---|---|
| Annex A | Group I: | CFC-11, CFC-12, CFC-113, CFC-114, CFC-115 |
| Annex A | Group II: | Halon-1211 and Halon-1301 |
| Annex B | Group I: | CFC-13 |
| Annex B | Group II: | Carbon tetrachloride (CTC) |
| Annex B | Group III: | Methyl chloroform (TCA) |

China also produces and consumes other ODS which are listed in Annex C and E under the Copenhagen Amendment. China has not yet adopted the Copenhagen Amendment, thus measures to control these chemicals and the CP Update does not consider their phaseout strategies. These chemicals are:

| | | |
|---|---|---|
| Annex C | Group I | HCFC 22, HCFC141b, etc. |
| Annex E | Group I | Methyl Bromide |

Therefore, ODS mentioned hereinafter refer only to the ten ODS listed in paragraph above.

## B. ODS Production and Consumption in 1995-97

The summary data for production and consumption of ODS (and ODP) in 1995-97 are shown in Table 1. China's ODS consumption in 1997 was about 70,000 tons, of which 12% was imported, and ODS production was about 65,000 tons. In ODP terms, total consumption in 1997 was about 87,600 tons, and ODP production was about 95,800 tons.

Table 1 ODS/ODP Production, Consumption, Import and Export, 1995 -1997 (tons)

| ODS | Year | Production | | Import | Export | Consumption | |
|---|---|---|---|---|---|---|---|
| | | ODS | ODP | ODS | ODS | ODS | ODP |
| Annex A | Group I | | | | | | |
| CFC-11 | 1995 | 18,232 | 18,232 | 11,714 | 265 | 29,681 | 29,681 |
| | 1996 | 18,403 | 18,403 | 2,952 | 532 | 20,823 | 20,823 |
| | 1997 | 23,647 | 23,647 | 1,739 | 488 | 24,898 | 24,898 |
| CFC-12 | 1995 | 19,518 | 19,518 | 18,318 | 1,306 | 36,530 | 36,530 |
| | 1996 | 22,514 | 22,514 | 863 | 508 | 22,869 | 22,869 |
| | 1997 | 22,943 | 22,943 | 548 | 1,253 | 22,238 | 22,238 |
| CFC-113 | 1995 | 3,532 | 2,826 | 177 | 46 | 3,663 | 2,930 |
| | 1996 | 3,637 | 2,910 | 141 | 23 | 3,755 | 3,004 |
| | 1997 | 4,538 | 3,630 | 167 | 18 | 4,687 | 3,750 |
| CFC-114, 115* | 1995 | 27 | 17 | 89 | 0 | 116 | 80 |
| | 1996 | 86 | 52 | 375 | 36 | 425 | 280 |
| | 1997 | 165 | 103 | 94 | 11 | 248 | 170 |
| Subtotal | 1995 | 41,309 | 40,593 | 30,298 | 1,617 | 69,990 | 69,221 |
| | 1996 | 44,640 | 43,879 | 4,331 | 1,099 | 47,872 | 46,976 |
| | 1997 | 51,293 | 50,323 | 2,548 | 1,770 | 52,071 | 51,056 |
| Annex A | Group | II | | | | | |
| Halon-1211 | 1995 | 12,338 | 37,014 | 0 | 1,400 | 10,938 | 32,814 |
| | 1996 | 11,363 | 34,089 | 0 | 1,148 | 10,215 | 30,645 |
| | 1997 | 11,642 | 34,926 | 0 | 795 | 10,847 | 32,541 |
| Halon-1301 | 1995 | 750 | 7,500 | 40 | 600 | 190 | 1,900 |
| | 1996 | 618 | 6,180 | 0 | 371 | 247 | 2,470 |
| | 1997 | 1,027 | 10,270 | 0 | 708 | 319 | 3,190 |
| Subtotal | 1995 | 13,088 | 44,514 | 40 | 2,000 | 11,128 | 34,714 |
| | 1996 | 11,981 | 40,269 | 0 | 1,519 | 10,462 | 33,115 |
| | 1997 | 12,669 | 45,196 | 0 | 1,503 | 11,166 | 35,731 |
| Annex B | Group I | | | | | | |
| CFC-13 | 1995 | 35 | 35 | 125 | 24 | 136 | 136 |
| | 1996 | 17 | 17 | 212 | 36 | 193 | 193 |
| | 1997 | 27 | 27 | 37 | 14 | 50 | 50 |
| Annex B | Group | II | | | | | |
| CTC** | 1995 | 459 | 505 | 0 | 0 | 459 | 505 |
| | 1996 | 200 | 220 | 0 | 0 | 200 | 220 |
| | 1997 | 100 | 110 | 0 | 0 | 100 | 110 |
| Annex B | Group | III | | | | | |
| TCA | 1995 | 1,023 | 102 | 4,078 | 174 | 4,927 | 493 |
| | 1996 | 994 | 99 | 4,718 | 267 | 5,445 | 545 |
| | 1997 | 1,044 | 104 | 5,843 | 170 | 6,717 | 672 |
| TOTAL | 1995 | 55,914 | 85,749 | 34,541 | 3,815 | 86,640 | 105,069 |
| | 1996 | 57,832 | 84,484 | 9,261 | 2,921 | 64,172 | 81,049 |
| | 1997 | 65,133 | 95,761 | 8,428 | 3,457 | 70,104 | 87,618 |

* Import/export data of CFC-114 and CFC-115, which are reported without separation by the Customs.

** CTC does not include CTC used as processing agent, nor CTC production for feedstock.

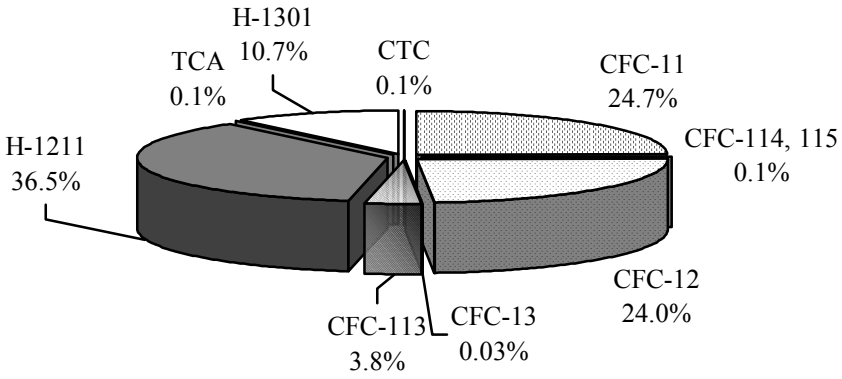


Figure 1 1997 ODS Production (in ODP Value) in China

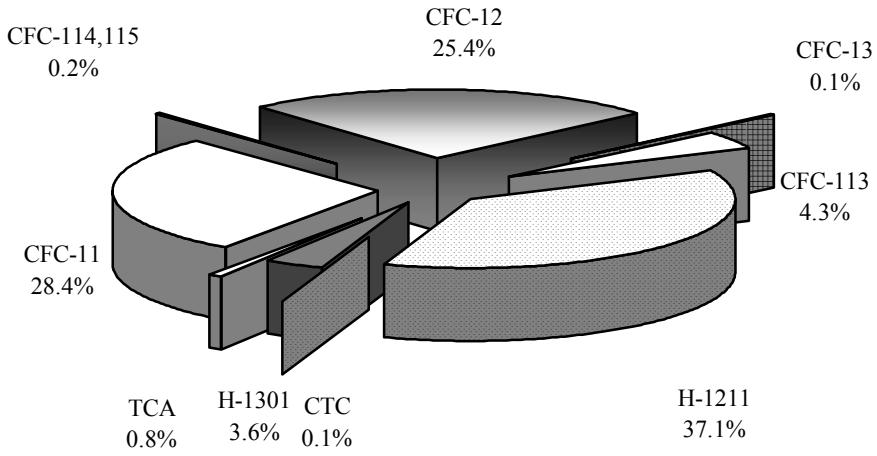


Figure 2 1997 ODS Consumption (in ODP Value) in China

Table 2 ODS/ODP Consumption by Sector in 1997 (tons and percent)

| Sector | Foam | Refrigeration | Halon | Aerosol | Solvent | Tobacco | Total |
|---|---|---|---|---|---|---|---|
| ODS | 23,853 | 19,693 | 11,166 | 2,800 | 11,504 | 1,090 | 70,106 |
| % | 34.0% | 28.1% | 15.9% | 4.0% | 16.4% | 1.6% | 100% |
| ODP | 23,853 | 19,613 | 35,731 | 2,800 | 4,532 | 1,090 | 87,618 |
| % | 27.2% | 22.4% | 40.8% | 3.2% | 5.2% | 1.2% | 100% |

Table 3 ODS Consumption in 1997 Disaggregated by Sectors and Final Applications

| Sector | Sub-sector | ODS | Application | ODS (Tons) | ODP (Tons) |
|---|---|---|---|---|---|
| **Foam** | Extruded Polystyrene | CFC-12 | PS sheet, PE tubes and sticks | 6,661 | 6,661 |
| | Flexible and Rigid Polyurethane | CFC-11 | Mattress, sponge, automobile inner decorations, Insulating boards, tubes | 17,192 | 17,192 |
| | Total | | | 23,853 | 23,853 |
| **Refrigeration Air-conditioning** | Domestic Refrigeration | CFC-11 | Boards foaming | 5,910 | 5,910 |
| | | CFC-12 | Refrigerants | 1,480 | 1,480 |
| | Mobile Air-Conditioning | CFC-12 | Refrigerants | 1,797 | 1,797 |
| | Industrial & Commercial Refrigeration | CFC-11 | Turbo refrigeration | 706 | 706 |
| | | CFC-12 | Other ACs, cold storage, and transportation | 9,500 | 9,500 |
| | | CFC-114 CFC-115 | Low temp. Refrigeration Food Freezer | 250 | 170 |
| | | CFC-13 | Low electronic medical appliance | 50 | 50 |
| | Sub-total | CFC-11 | | 6,616 | 6,616 |
| | | CFC-12 | | 12,777 | 12,777 |
| | Total | | | 19,693 | 19,613 |
| **Solvent** | | CFC-113 | Solvent | 4,687 | 3,750 |
| | | CTC | Solvent | 100 | 110 |
| | | TCA | Solvent | 6,717 | 672 |
| | Total | | | 11,504 | 4,532 |
| **Halon** | | H-1211 | Extinguishers Extinguishing system | 10,847 | 32,541 |
| | | H-1301 | Extinguishing system | 319 | 3,190 |
| | Total | | | 11,166 | 35,731 |
| **Tobacco** | | CFC-11 | Tobacco expansion | 1,090 | 1,090 |
| **Aerosol** | | CFC-12 | Non-medical uses | 800 | 800 |
| | | | Medical uses | 2,000 | 2,000 |
| | Subtotal | CFC-12 | | 2,800 | 2,800 |
| **Total** | | | | 70,106 | 87,618 |

## C. Industry Structure

The industry structure regarding ODS production and consumption has been changed a lot due to the implementation of ODS phaseout activities as well as the approval and implementation of MLF projects in the past 10 years. The industrial structure is described in the following sections.

**1. ODS (excluding Halons) Production Sector**. There are 50 plants producing ODS (excluding Halons) in 1997. There are 37 CFC plants with a total designed annual production capacity of 122,000 tons CFC. Technology used by almost all CFC plants is liquid-phase catalytic fluorination process that was developed domestically. Domestic and imported raw materials are used in their production. Since most production facilities have been developed with local technology and designed with low operating pressure, the flexibility to switch from CFC to HCFC-22 is limited. There are about 15 CTC plants with a total production capacity of 80,000 tons, and three TCA plants with a total capacity of 2,800 tons. The production capacity of CFC-13, CFC-114 and CFC-115 in 1997 was about 660 tons.

By August 1998, six TA projects of China ODS production industry have been supported by MLF with a total amount of US$ 1,329,900. Sector Plan for CFC Production Phaseout in China was approved by the ExCom in March of 1999, with US$150 million.

**2. Foam Sector.** In 1997, there were about 1,400 foam plants. Table 4 shows the estimated number of different foam plants and ODS consumption in 1997. It was also found that demand on foam products had been increasing, creating growth in the consumption of CFC in this sector.

By August 1998, there were 79 projects of foam sector funded by MLF with a total amount of US$ 38.5 million. Of these, 71 were investment projects with a total amount of US$ 36.9 million. The total ODS phaseout amount after all projects are completed would be 9,100 tons ODP.

Table 4 ODS Consumption of Different Foam Plants in 1997

| | Number of Plants | Production of Foam Products (tons) | ODS | ODS Consumption (tons) |
|---|---|---|---|---|
| Flexible PU Foam | 140 | 100,000 | CFC-11 | 4,940 |
| Flexible PU Box Foam | 500 | 40,000 | CFC-11 | 1,400 |
| Rigid PU Foam | 600 | 70,000 | CFC-11 | 10,852 |
| PS/PE Extruded Foam | 160 | 50,000 | CFC-12 | 6,661 |
| Total (rounded) | 1,400 | 260,000 | | 23,853 |

**3. Industrial and Commercial Refrigeration Sector.** There are around 130 enterprises in the industrial and commercial refrigeration and air-conditioning industry (excluding systems). The commercial refrigeration industry is being restructured to minimize the cost of conversion to non-CFC basis.

By August 1998, there were 17 projects in the sector funded by MLF with a total amount of US$ 40.9 million. Of these, 16 were investment projects with a total amount of US$ 39.7 million. The total amount to be phased out is about 3,600 tons ODP.

**4. Domestic Refrigeration Sector.** In 1997, China had about 100 production lines for refrigerator and freezer, with total production capacity of 15 million sets a year, and the total production was 13 million sets. CFC-11 used in this sector is supplied by local and import market, while CFC-12 is mainly from local market. However, most substitutes consumed by the sector now are imported.

By August 1998, there were 49 projects in the sector funded by MLF with US$ 75.5 million. Of these, 36 were investment projects with a total amount of US$ 68.5 million. The total amount to be phased out is about 8,970 tons ODP.

**5. Mobile Air-Conditioning (MAC) Sector.** In 1997, there were 38 enterprises producing MAC components in China with production of about 460,000 units/year. MAC production will continue to grow rapidly with the development of vehicle sector as an important industry in China.

By August 1998, four projects in MAC sector were funded by MLF with US$ 6.6 million, which would phaseout 795 tons (ODP), and a MAC Sector Plan has been approved by ExCom in November 1998 with US$ 7.77 million to phaseout 814 tons ODP. By the end of 2001, newly produced vehicles will stop using CFC-12 with the implementation of

this sector plan.

**6. Halon Sector.** In 1997, there were nine Halon 1211 agent producers and one Halon 1301 agent producer. There were 72 Halon extinguisher manufacturers with a total production of about 4,500,000 units of Halon 1211 extinguishers. There were 22 enterprises producing about 8,500 units for Halon-extinguishing systems with H-1211, while the production of H-1301 system was about 2,500 units.

By the end of 1996, 15 projects in Halon sector were funded by MLF with US$ 4.9 million that will phaseout consumption of 800 tons ODP. Halon Sector Plan was approved by MLF in November 1997 for a total funding of US$ 62 million for phasing out Halon production and consumption, including recycling and banking.

**7. Aerosol Sector.** In 1997, production of aerosol was about 450 million cans. There were about 15 medical filling facilities using CFC were imported in China, and over 70 domestic filling facilities, producing three kinds of medical aerosols, i.e., medical dose inhaler (MDI), external use aerosol, Chinese medicinal aerosol. In 1997, production of MDI, external use aerosol and Chinese medicinal aerosol were 15 million cans, 7 million cans and 2 million cans, respectively. In recent years, several aerosol filling enterprises and aerosol producers with substitutes were set up through different funding channels, most of which are spread along the coastal areas. Excluding medical and other products have no substitute technology available, CFC was completely prohibited as the propellant in aerosol sector since December 31, 1997. As a result, 1998 estimated ODP consumption in general purposes aerosol is estimated at substantially zero. Since substitution of medical aerosols is a health issue and there are technological difficulties, CFCs in medical aerosols is still not controlled and there has been no substitution in medical aerosols industry.

By August of 1998, five projects were funded by MLF in aerosol sector with US$ 7.1 million. Of these, four were investment projects with a total amount of US$ 7.0 million that will phaseout consumption of about 1,790 tons ODP. Three aerosol substitute filling centers were established in Tianjin, Shanghai and Guangzhou under the support of MLF.

**8. Solvent Sector.** In 1997, there were about 3,200 enterprises consuming solvent with controlled ODS. The solvent sector is growing rapidly primarily due to growth for cleaning in electronics and precision equipment applications.

By August 1998, 23 solvent projects were funded by MLF with US$ 8.5 million. Of these, 19 were investment projects with a total amount of US$ 7.8 million, which would phaseout consumption of 855 tons CFC-113 (685 tons ODP).

**9. Tobacco Sector.** There are 73 sets of CFC tobacco expansion equipment in 1997.

By August 1998, two projects in tobacco sector for non-investment project were funded by MLF with US$ 250,000.

## D. Substitutes Production

Development of technologies for production of ODS substitutes as well as construction of production facilities are performed by research institutes and companies in China. In 1997, overall production capacity of HCFC-22 was 55,000 tons/year, production reached 40,000 tons/year. Production capacity of HCFC-141b was 10,000 tons/year. Production capacity of HFC-152a was 1,000 tons/year. Production capacity of cyclopentane was 500 tons/year. Production capacity of propane/butane was 60,000 tons/year and dimethyl ether was 2,500 tons/year. Production capacity of dichloride methane was about 13,000 tons/year. Technology for the production of HFC-134a is under development in China. Pilot plant tests are underway, and technology is not yet commercialized. HFC-134a consumed in China is mainly imported from abroad. Substitutes for Halon 1211, primarily ABC powder, AFFF and carbon dioxide, are produced domestically, and the production of substitutes will be increased to satisfy fire protection requirements.

# III. PHASEOUT STRATEGY

## A. Control Targets under Montreal Protocol

In accordance with the requirements of London Amendment of MP, the control targets for Article 5 Countries, including China, are as following:

- freezing production and consumption of CFCs in Group I, Annex A on July 1, 1999 at average of 1995 to 1997 actual levels, then reduce to 50% of freezing level by January 1, 2005, then reduce to 15% of freezing level of consumption and production by January 1, 2007, and to stop production and consumption by January 1, 2010;
- freezing production and consumption of Halon on January 1, 2002 at average of 1995 to 1997 actual levels, then reduce to 50% of freezing level by January 1, 2005, and to stop production and consumption by January 1, 2010;
- production and consumption of CFC-13 in Annex B is reduced to 80% of the average actual level of 1998 to 2000 by January 1, 2003, then to 15% by January 1, 2007, and to stop production and consumption by January 1, 2010;
- reduce production and consumption of CTC to 15% of the average level of 1998 to 2000 by January 1, 2005, and then to stop production and consumption by January 1, 2010;
- production and consumption of TCA will be frozen by January 1, 2003 at the average actual level of 1998 to 2000, then reduce to 70% of freezing level of consumption and production by January 1, 2005, then to stop production and consumption by January 1, 2015.

## B. Government Strategy

1. Provided that MLF supplies necessary funds and supports for the best substitution technology transfer with favorable conditions, China will strictly follow the requirements of MP (London Amendment) to phaseout its ODS production and ODS consumption and achieve the ODS control targets.

2. China has realized the importance and urgent needs for protecting the ozone layer, under the condition that cost-effective substitutes production and technology, as well as the necessary funding for technology transfer is available, China will speed up the ODS phaseout process, and some sectors with technical and economic feasibility will phaseout ODS ahead of the controlled schedule.

3. China will ensure safety of production and consumption of related products, and quality and market shares of related products will not be decreased by ODS phaseout activities.

4. China will keep on adopting commercialized substitutes and substitution technologies which are most cost-effective and best suitable to local conditions with the objective that necessary equipment and raw materials for substitution will be supplied by local market in future. Technical options will be revised in accordance with development of substitutes in international market. China will develop substitution technology locally that cannot be transferred from international market, and build up production capacity independently under support of MLF.

5. Conversion and substitution projects must be implemented under the safe production condition.

6. China will actively use economic instruments to promote ODS phaseout. China will also strengthen the function of regulations and policies, and continue to promote education, training and awareness regarding ozone layer protection.

7. China will combine the ODS phaseout with the industry restructuring and products restructuring, and to design necessary regulations and technology policies to manage and guide the ODS phaseout at sector level.

8. China will continue to focus on the development and implementation of sector plans, which can improve the efficient use of MLF and speed up the implementation process. China will ensure Halon production and consumption, and CFCs production to be phased out in accordance with the Sector Plan for Halon and CFCs in China.

9. China will design phaseout strategies for Methyl Bromide, Medical Aerosol, CTC, and Processing Agent sectors.

10. To reduce ODS emission, emission prevention will be promoted. China will recover and recycle ODS to meet the servicing requirements after ODS production is stopped, as well as to reduce emission of ODS.

11. Government gives attention to the financial and technical difficulties faced by small and medium sized enterprises, China will develop suitable projects with appropriate technologies for SMEs.

## C. ODP Control Limits under Montreal Protocol

Based on MP control target, production and consumption of CFCs in Annex A should be frozen on July 1, 1999 at average of 1995 to 1997 actual levels, then reduce to 0 by January 1, 2010. Therefore, CP Update uses the actual production and consumption in 1995, 1996, and 1997 as the base year data.

Based on MP control target and actual production and consumption of 1995, 1996 and 1997, maximum production and consumption of China in 1999, 2005, 2007 and 2010 can be calculated. Table 5 and Table 6 show control limits for CFC consumption and production in China.

Table 5 Control Limits for CFCs Consumption in China (ODP tons)

| | | | | MP Control Limits | | | |
|---|---|---|---|---|---|---|---|
| | 1995 | 1996 | 1997 | 1999 | 2005 | 2007 | 2010 |
| CFCs in Annex A | 69,221 | 46,976 | 51,056 | 55,751 | 27,876 | 8,363 | 0 |
| CFC-13 | 136 | 193 | 50 | | | 19 | 0 |

Table 6 Control Limits for CFCs Production in China (ODP tons)

| | | | | MP Control Limits* | | | |
|---|---|---|---|---|---|---|---|
| | 1995 | 1996 | 1997 | 1999 | 2005 | 2007 | 2010 |
| CFCs in Annex A | 40,592 | 43,878 | 50,323 | 49,424 | 26,959 | 11,232 | 0 |
| CFC-13 | 35 | 17 | 27 | | | 4 | 0 |

Note: *10 percent of base level production allowed to be produced additionally to meet the basic domestic needs of parties operating under Article 5 (1)

## D. Phaseout Strategy at Sector Level

Following sections summaries the phaseout plans and approaches at sector level, according to the specific situation of each sector.

1. **Foam Sector.** By adopting terminal umbrella projects and/or sector plans, phaseout of ODS used in PS/PE and PU horizontal/vertical foam enterprises will be achieved by 2005, PU sheet and pipe-type foam enterprises by 2007, and spring PU and box-type foam enterprises by 2010.

2. **Industrial/Commercial Refrigeration Sector.** Industrial and commercial refrigeration sector will realize its phaseout through a terminal umbrella project (or sector plan). CFC-11/12 used in new turbine-type refrigeration units will be phased out by 2003, and CFC-11/12 used in refilling practice will be stopped in 2010.

3. **Domestic Refrigeration Sector.** 40% production of new refrigerators and freezers will be substituted in 1999. 70% production of new refrigerators and freezers will be substituted in 2003, and 100% production of new products will be substituted in 2005. Meanwhile, China will meet part of the servicing demand of refrigerator and freezer with recycled CFC.

4. **Halon Sector.** In November 1997, ExCom approved Sector Plan for Halon Phaseout in China with US$ 62 million by MLF. Production of Halons will be phased out through closing Halon producers gradually, and consumption will be phased out through closing Halon extinguishers manufacturer or converting their production to non-Halon extinguishers. Halon 1211 will be totally phased out by the end of 2005, and Halon 1301 will be phased out by January 1, 2010.

5. **Aerosol Sector.** The phaseout of general use was completed by the end of 1997. The phaseout strategy for medical aerosol industry and uses that have no substitute or substitution technology available in aerosol sector will be determined later.

6. **Mobile Air-conditioning Sector.** With approval of the Sector Plan, MAC sector will prohibit use of CFC-12 in all new automobiles from December 31, 2001, and to reduce the uses of CFCs in existing MAC. Any use of CFC after 2009 will be recycled CFC.

7. **Solvent Sector.** It is proposed in the Solvent Sector Plan under developed that China will completely phaseout CTC by 2004, CFC-113 by 2006 and TCA by 2010.

8. **Tobacco Sector.** It is proposed in the Tobacco Sector Plan under developed that China will phaseout CFC-11 in tobacco sector by June 30, 2006.

## E. Technology Selection

Under the condition that the equipment and raw materials needed by substitutes and

substitute technologies should be mainly provided by domestic supply, China will continue to use mature substitutes/technologies which are commercialized, suitable to China's situation, and most cost-effective. China will also adjust the technology selections for each sector based on the development of substitutes/technologies.

China will continue to use some transitional substitutes due to the urgent needs for protecting the ozone layer, as long as economically and technically feasible.

Demand on ODS by essential uses might be met by new produced ODS after 2010.

Technology used for each sector is briefly described below:

**1. Foam Sector:**

- PS/PE extruded foam will use butane, butane/$CO_2$, or $CO_2$;
- Flexible PU foam will use dichloride methane or dichloride methane combining fast-curing process, or $CO_2$; substitution of flexible PU box foam will be dichloride methane, or fast-cooling process, vacuum foaming;
- Rigid PU foam will use pentane, $CO_2$, or HCFC-141b; the substitution of semi-rigid foam is 100% water-based technology, or HCFC-141b;
- New foam substitutes, such as HFC-245fa, will be adopted when they are available.

**2. Industrial and Commercial Refrigeration Sector:**

- Food freezers and cold storage facilities with a semi-open compressor (1-12KW) and facilities with small open compressor (1-15KW) will use HCFC-22 instead of CFC-12; facilities with open compressor (12-72KW) will use HCFC-22 or R-717 ($NH_3$) to substitute CFC-12;
- Turbine-type refrigeration units will use HCFC-123 or HFC-134a instead of CFC-11;
- Unit air-conditioners with medium semi-open compressor (22-140KW) will use HCFC-22 instead of CFC-12;
- Refrigerated transport will use HCFC-22 or HFC-134a instead of CFC-12;
- China will adopt measures of emission preventing and recycling, and encourage replacing CFC refrigerants with mixed refrigerants. Through demonstration projects, China will gradually popularize these practices to speed up substitution in

existing facilities.

**3. Domestic Refrigeration Sector:**

- Available substitution technologies for domestic refrigeration industry include: hydrocarbons, HFC-134a/HCFC-141b, HFC-152a, and mixed refrigerants. Since cyclopentane, isobutane and other hydrocarbons are flammable, HCFC-141b is corrosive, and HFC-134a has high GWP, and servicing standards and its associated materials need to be imported, China will adjust substitution technologies for domestic refrigeration industry based on international technologies development.

- For domestic refrigerators in use, China will encourage substitution of CFC with suitable mixed refrigerants due to the difficulties of refilling of HFC-134a and other refrigerant.

**4. Halon Sector:**

- ABC powder, $CO_2$ and AFFF extinguishers will replace Halon extinguishers in nonessential areas. After phaseout of Halon extinguishers, the cleaning extinguishers (CO2) will have 15% share of extinguishers market;

- Halon extinguishing system in nonessential areas will be replaced with $CO_2$, HFCs, inert gases and water systems;

- Halon bank will be implemented for Halon 1211 and 1301 to meet essential uses after phaseout of Halon production.

**5. Aerosol Sector:**

- China will develop technology and safety standards and codes for aerosol enterprises that have converted to non-ODS technologies, as well as provide technical support to these enterprises;

- The research and development of alternatives for medical aerosol will be based on the principal that to take the easiest first, then the difficult ones. Demonstration projects should be prepared as soon as possible. On this basis, the alternative technologies for each uses of medical aerosol will be determined. HFC-134a can be used as one of the substitutes of MDI (asthma, chronic respiratory).

- For medical aerosol industry and uses that have no alternative or substitution technology available in aerosol sector, it is necessary to apply MLF project to phaseout the ODS consumption.

**6. Mobile Air-conditioning Sector:**

- Mobile air-conditioners, will use HFC-134a instead of CFC-12;
- Since HFC-134a is high GWP with high servicing standards and its associated materials are to be imported, China will adjust the MAC sector in accordance with development of international substitution technologies.

**7. Solvent Sector:**

- No-clean, aqueous, semi-aqueous cleaning and non-ODS solvent cleaning technologies will be used instead of ODS based technologies;

**8. Tobacco Sector**

- $CO_2$ tobacco expansion units will be used instead of CFC units. Newly developed commercialized substitution technologies will be adopted after feasibility assessment. To reduce emission of CFCs, China will modify the units in use as well as improve recycling.

**9. CFC Recycling Sector**

- In order to satisfy demand of servicing of refrigeration equipment after 2010, China will establish demonstration projects at sectors concerned, to select appropriate recycling plan, and to organize to produce related facilities needed by recycling practice. In addition, China will improve the operational skill of servicing staff, by training and promoting experiences of recycling. China will try to reduce unnecessary emission of CFCs.

## F. ODS Phaseout Plan and Substitutes Production Plan

**1. Phaseout Plan of Consumption Sectors**

According to phaseout targets at national and sector level, and the phaseout approach and the technology availability, the ODSs consumption plan was summarized in Table 7, 8, and 9. Data in Table 7 shows that the consumption of CFCs in 1999, 2005, and 2007 is lower than the control target of MP. Table 10 summarizes the ODS consumption and annual phaseout plan in each sector.

Table 7 Estimate of CFCs Consumption (tons)

| | 1999 | | 2005 | | 2007 | | 2010 | |
|---|---|---|---|---|---|---|---|---|
| | ODS | ODP | ODS | ODP | ODS | ODP | ODS | ODP |
| CFC-11 | 22,850 | 22,850 | 10,345 | 10,345 | 4,590 | 4,590 | 0 | 0 |
| CFC-12 | 19,128 | 19,128 | 7,590 | 7,590 | 3,770 | 3,770 | 0 | 0 |
| CFC-113 | 5,125 | 4,100 | 688 | 550 | 0 | 0 | 0 | 0 |
| CFC-114 | 20 | 20 | 10 | 10 | 0 | 0 | 0 | 0 |
| CFC-115 | 300 | 180 | 167 | 100 | 0 | 0 | 0 | 0 |
| Subtotal | 47,423 | 46,278 | 18,800 | 18,595 | 8,360 | 8,360 | 0 | 0 |
| CFC-13 | 70 | 70 | 50 | 50 | 0 | 0 | 0 | 0 |
| TOTAL | 47,493 | 46,348 | 18,850 | 18,645 | 8,360 | 8,360 | 0 | 0 |
| Foam | 21,064 | 21,064 | 9,655 | 9,655 | 4,370 | 4,370 | 0 | 0 |
| ICR | 10,410 | 10,290 | 4,257 | 4,190 | 2,120 | 2,120 | 0 | 0 |
| DR | 5,344 | 5,344 | 400 | 400 | 200 | 200 | 0 | 0 |
| MAC | 2,150 | 2,150 | 1,200 | 1,200 | 670 | 670 | 0 | 0 |
| Aerosol | 2,400 | 2,400 | 2,500 | 2,500 | 1,000 | 1,000 | 0 | 0 |
| Solvent | 5,125 | 4,100 | 688 | 550 | 0 | 0 | 0 | 0 |
| Tobacco | 1,000 | 1,000 | 150 | 150 | 0 | 0 | 0 | 0 |
| Total | 47,493 | 46,348 | 18,850 | 18,645 | 8,360 | 8,360 | 0 | 0 |

Table 8 Estimate of Halon Consumption (tons)

| Annex A Group II | 1999 | | 2005 | | 2010 | |
|---|---|---|---|---|---|---|
| | ODS | ODP | ODS | ODP | ODS | ODP |
| H-1211 | 5,370 | 16,110 | 1,890 | 5,670 | 0 | 0 |
| H-1301 | 300 | 3,000 | 150 | 1,500 | 0 | 0 |
| Subtotal | 5,670 | 19,110 | 2,040 | 7,170 | 0 | 0 |

Table 9 Estimate of CTC and TCA Consumption (tons)

| | 1999 | | 2005 | | 2010 | |
|---|---|---|---|---|---|---|
| | ODS | ODP | ODS | ODS | ODP | ODP |
| CTC* | 100 | 110 | 0 | 0 | 0 | 0 |
| TCA | 7,405 | 741 | 5,188 | 519 | 0 | 0 |

Note: * Does not include feedstock and process agent.

Table 10 ODS Consumption Phaseout Plan in Each Sector (ODP tons)

| | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **ODS Phaseout Target** | | | | | | | | | | | | |
| CFC-11 | 2,048 | 3,950 | 2,225 | 340 | 1,370 | 1,877 | 2,743 | 2,880 | 2,875 | 1,040 | 3,410 | 140 |
| CFC-12 | 3,110 | 1,503 | 1,005 | 2,540 | 1,030 | 2,203 | 3,257 | 2,040 | 1,780 | 690 | 520 | 2,560 |
| CFC-113 | 0 | 800 | 600 | 500 | 500 | 600 | 550 | 550 | 0 | 0 | 0 | 0 |
| CFC-114 | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 0 | 10 | 0 | 0 | 0 |
| CFC-115 | 0 | 0 | 0 | 0 | 0 | 0 | 80 | 0 | 100 | 0 | 0 | 0 |
| CFC-13 | 0 | 0 | 0 | 0 | 50 | 0 | 0 | 0 | 50 | 0 | 0 | 0 |
| Halon 1211 | 5,370 | 5,370 | 1,389 | 1,692 | 2,292 | 0 | 0 | 5,970 | 0 | 0 | 0 | 0 |
| Halon 1301 | 0 | 0 | 0 | 180 | 0 | 0 | 0 | 500 | 0 | 0 | 0 | 1,000 |
| CTC | 0 | 0 | 0 | 0 | 55 | 55 | 0 | 0 | 0 | 0 | 0 | 0 |
| TCA | 0 | 0 | 0 | 38 | 38 | 111 | 111 | 104 | 104 | 104 | 104 | 104 |
| **ODS Phaseout Targets of Sectors *** | | | | | | | | | | | | |
| Foam | 2,789 | 1,592 | 650 | 1,220 | 2,080 | 2,400 | 3,467 | 2,460 | 2,825 | 1,000 | 3,370 | 0 |
| Industrial and Commercial Refrigeration | 360 | 880 | 1,110 | 1,430 | 370 | 530 | 1,740 | 1,360 | 550 | 440 | 340 | 1,340 |
| Domestic Refrigeration | 2,046 | 3,101 | 1,400 | 0 | 0 | 400 | 43 | 200 | 0 | 0 | 0 | 200 |
| Solvent | 0 | 763 | 561 | 538 | 593 | 766 | 661 | 654 | 104 | 104 | 104 | 104 |
| Tobacco | 0 | 90 | 120 | 180 | 200 | 200 | 150 | 150 | | | | |
| MAC | 220 | 480 | 400 | 250 | 50 | 150 | 200 | 250 | 280 | 290 | 220 | 160 |
| Halon | 5,370 | 5,370 | 1,389 | 1,872 | 2,292 | 0 | 0 | 6,470 | 0 | 0 | 0 | 1,000 |

* The sum of annual consumption of TCA in Foam and Solvent sector is larger than that in 1999, because the consumption of TCA by existing equipment is increasing while implementing phaseout activities in these two sectors. For the refrigeration sector, the data in this table is the sum of phaseout amount of servicing and new consumption.

## 2. Phaseout Plan for Production Sector

ExCom has approved the Sector Plans for CFCs and Halon Production. The annual production has been determined by the sector plans. China will strictly follow the sector plans to control the CFCs and Halon production. Table 11 and Table 12 show that ODS production in 1999, 2005, and 2007 is lower than the control target set by MP, it shows that China can comply with the control targets of MP. Table 13 summarizes the ODS production and annual phaseout plan.

Table 11 Production Estimate of CFCs (tons)

| | 1999 | | 2005 | | 2007 | | 2010 | |
|---|---|---|---|---|---|---|---|---|
| | ODS | ODP | ODS | ODP | ODS | ODP | ODS | ODP |
| CFC-11 | 22,850 | 22,850 | 10,345 | 10,345 | 4,590 | 4,590 | 0 | 0 |
| CFC-12 | 17,781 | 17,781 | 7,590 | 7,590 | 3,770 | 3,770 | 0 | 0 |
| CFC-113 | 5,125 | 4,100 | 688 | 550 | 0 | 0 | 0 | 0 |
| CFC-114 | 20 | 20 | 10 | 10 | 0 | 0 | 0 | 0 |
| CFC-115 | 300 | 180 | 167 | 100 | 0 | 0 | 0 | 0 |
| Subtotal | 46,076 | 44,931 | 18,800 | 18,595 | 8,360 | 8,360 | 0 | 0 |
| CFC-13 | 70 | 70 | 50 | 50 | 0 | 0 | 0 | 0 |
| TOTAL | 46,146 | 45,001 | 18,850 | 18,645 | 8,360 | 8,360 | 0 | 0 |

Table 12 Production Estimate of Other Controlled Substances (tons)

| | 1999 | | 2005 | | 2010 | |
|---|---|---|---|---|---|---|
| | ODS | ODP | ODS | ODP | ODS | ODP |
| Halon-1211 | 5,970 | 17,910 | 1,990 | 5,970 | 0 | 0 |
| Halon-1301 | 618 | 6,180 | 600 | 6,000 | 0 | 0 |
| Subtotal of Halons | 6,588 | 24,090 | 2,590 | 11,970 | 0 | 0 |
| CTC* | 100 | 110 | 0 | 0 | 0 | 0 |
| TCA | 1,150 | 115 | 922 | 92 | 0 | 0 |
| Total | 7,838 | 24,315 | 3,512 | 12,062 | 0 | 0 |

* Excluding the quantity of feedstock and processing agent

Table 13 ODS Production Phaseout Plan in China (ODP tons)

| | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CFC-11 | 797 | 3,950 | 2,225 | 340 | 1,370 | 1,877 | 2,743 | 2,880 | 2,875 | 1,040 | 3,410 | 140 |
| CFC-12 | 5,162 | 156 | 1,005 | 2,540 | 1,030 | 2,203 | 3,257 | 2,040 | 1,780 | 690 | 520 | 2,560 |
| CFC-113 | 0 | 800 | 600 | 500 | 500 | 600 | 550 | 550 | 0 | 0 | 0 | 0 |
| CFC-114 | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 0 | 10 | 0 | 0 | 0 |
| CFC-115 | 0 | 0 | 0 | 0 | 0 | 0 | 80 | 0 | 100 | 0 | 0 | 0 |
| CFC-13 | 0 | 0 | 0 | 0 | 50 | 0 | 0 | 0 | 50 | 0 | 0 | 0 |
| Halon 1211 | 5,970 | 5,970 | 1,989 | 1,992 | 1,992 | 0 | 0 | 5,970 | 0 | 0 | 0 | 0 |
| Halon 1301 | 4,090 | 0 | 0 | 180 | 0 | 0 | 0 | 4,500 | 0 | 0 | 0 | 3,000 |
| CTC | 0 | 0 | 0 | 0 | 55 | 55 | 0 | 0 | 0 | 0 | 0 | 0 |
| TCA | 0 | 0 | 0 | 0 | 0 | 0 | 35 | 0 | 0 | 0 | 0 | 92 |
| **Total** | 16,019 | 10,876 | 5,819 | 5,552 | 4,997 | 4,735 | 6,675 | 15,940 | 4,815 | 1,730 | 3,930 | 5,792 |

### 3. Recycling Plan for CFCs

The demand of CFC-12 for servicing requirement after 2010 will mainly come from MAC, domestic refrigeration and industrial and commercial refrigeration sectors. Table 14 shows demand on the recyclable CFC-12 of China by considering historical production, servicing and retiring of existing refrigeration equipment and units. China is planning to build recycling capacity to meet the servicing requirement on CFC-12.

Table 14 Estimated Demand for Recycled CFC-12 (tons/year)

| Time | Estimated Demand for Recycled CFC-12 |
|---|---|
| 2006-2010 | <2,000 |
| 2011-2015 | <1,000 |
| 2016-2020 | <500 |

### 4. Production Plan for CFCs Substitutes

Based on the strategic consideration that ODS substitutes will gradually be met by domestic production, the demand on major substitutes, HCFC-22, HCFC-141b, HFC-134a, isobutane and cyclopentane was estimated, and a substitute production plan was developed, see Table 15.

Table 15 Estimate of Substitutes Production (tons)

| | 1999 | 2005 | 2010 |
|---|---|---|---|
| HCFC-22* | 15,000 | 33,000 | 45,000 |
| HCFC-141b* | 2,500 | 5,200 | 12,000 |
| HFC-134a | 2,000 | 11,000 | 20,000 |
| HFC-152a* | 130 | 160 | 200 |
| Isobutane | 80 | 100 | 120 |
| Cyclopentane | 1,100 | 1,400 | 1,800 |
| Butane | 850 | 3,300 | 4,400 |
| Pentane | 400 | 2,700 | 9,500 |
| Dichloride methane | 650 | 4,600 | 44,000 |
| Propane/butane blends | 60,000 | 70,000 | 80,000 |

Note: *Excluding feedstocks.

## G. Technical Assistance Needed

Technical assistance is very important in the conversion from ODS technologies to non-ODS technologies. China will continue to apply for increment cost related to technical assistance. The major technical assistance activities needed are:

- Management capacity building for ODS phaseout
- Communication programme/network
- Technical support system for quality control of substitutes
- Quality monitoring center for substitutes
- Safety support system for production of substitutes
- Technical support center for substitution in small and medium enterprises
- Technical support to the development of related phaseout strategy
- Technical support to the development of phaseout policies
- Technical support to minimizing emission of process agent
- Technical support to phaseout of medical aerosol
- Training and public awareness propagation

# IV. INCREMENTAL COST

Based on guidelines of MLF, and Chinese expert's understanding of sectors still with no developed guidelines, a computer model was setup to calculate incremental cost to implement ODS phaseout in China. The model uses data of different producing and consuming sectors in China as input to analyze the factors that will influence incremental cost. Projects already under way and funded are taken into account. Assumptions and calculation methodologies are shown in Annex.

From 1999 to 2010, China needs an additional US$ 541 million to achieve the phaseout targets, excluding the incremental costs approved for Halon, MAC, and CFCs production sectors (see Table 16).

Table 16 Incremental Cost for ODS phaseout in China

| | US$ 1,000 | Percentage |
|---|---|---|
| Incremental Cost approved by August 1998 (sub-total) | 205,307 | 100% |
| Of which Aerosol | 7,053 | 3.4% |
| Of which Foam | 38,476 | 18.7% |
| Of which Tobacco | 250 | 0.1% |
| Of which Industrial &Commercial Refrigeration | 40,931 | 19.9% |
| Of which MAC | 6,583 | 3.2% |
| Of which Domestic Refrigeration | 75,515 | 36.8% |
| Of which Solvent | 8,547 | 4.2% |
| Of which Production | 1,330 | 0.6% |
| Of which Halon | 17,403 | 8.5% |
| Of which Methyl Bromide | 675 | 0.3% |
| Of which recycling | 603 | 0.3% |
| Of which others | 7,941 | 3.9% |
| Incremental Cost for future phaseout activities | 747,826 | |
| Incremental cost needs to be approved (sub-total)* | 540,616 | 100% |
| Of which Foam | 154,839 | 28.6% |
| Of which Tobacco | 40,000 | 7.4% |
| Of which Industrial &Commercial Refrigeration | 24,737 | 4.6% |

| | | |
|---|---|---|
| Of which Domestic Refrigeration | 8,513 | 1.6% |
| Of which Solvent | 92,292 | 17.1% |
| Of which TCA Production | 5,635 | 1.0% |
| Of which substitutes | 156,000 | 28.9% |
| Of which recycling | 32,856 | 6.1% |
| Of which TA | 25,744 | 4.8% |
| Incremental Cost has been approved (sub-total) | 207,210 | |
| Of which Halon | 49,500 | |
| Of which MAC | 7,700 | |
| Of which CFCs production | 150,000 | |

Note: * Incremental cost of Methyl Bromide, aerosol essential uses, CTC production closure, solvent essential uses and HCFCs are not included because of the uncertainties of alternative technologies, strategies and absence of guidelines.

Table 17 Incremental Cost of ODS Phaseout in Different Sectors of China (US$ 1,000, 1997 Price)

| | FPV | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Foam | 154,839 | 3,756 | 762 | 1,621 | 8,187 | 18,597 | 18,734 | 25,103 | 20,713 | 22,230 | 8,476 | 26,660 | 0 |
| Tobacco | 40,000 | | 9,500 | 9,500 | 9,500 | 9,500 | 1,000 | 1,000 | 0 | 0 | 0 | 0 | 0 |
| Industrial and Commercial Refrigeration | 24,737 | 0 | 6,919 | 14,183 | 3,635 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Domestic Refrigeration | 8,513 | 0 | 2,768 | 2,837 | 2,908 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Solvent | 92,293 | 3,810 | 9,188 | 9,883 | 10,165 | 14,147 | 13,655 | 13,699 | 4,274 | 4,380 | 4,490 | 4,602 | 0 |
| Production of TCA | 5,635 | 0 | 0 | 0 | 257 | 273 | 227 | 1,404 | 233 | 232 | 229 | 222 | 2,558 |
| Production of Substitutes | 156,000 | 28,000 | 27,000 | 26,000 | 25,000 | 25,000 | 25,000 | 0 | 0 | 0 | 0 | 0 | 0 |
| Recycling | 32,856 | 3,598 | 3,438 | 2,478 | 4,678 | 8,200 | 5,260 | 5,200 | 4 | 0 | 0 | 0 | 0 |
| TA | 25,744 | 1,958 | 2,979 | 3,325 | 3,216 | 3,786 | 3,194 | 2,320 | 1,261 | 1,342 | 660 | 1,574 | 128 |
| **TOTAL** | 540,616 | 41,122 | 62,554 | 69,827 | 67,546 | 79,502 | 67,070 | 48,726 | 26,485 | 28,185 | 13,855 | 33,058 | 2,686 |
| MAC* | 7,700 | | | | | | | | | | | | |
| Halon* | 49,510 | 9,700 | 10,600 | 4,500 | 3,700 | 5,900 | 1,200 | 1,800 | 11,400 | 400 | 300 | 10 | 0 |
| CFC Production* | 150,000 | 20,000 | 13,000 | 13,000 | 13,000 | 13,000 | 13,000 | 13,000 | 13,000 | 13,000 | 13,000 | 13,000 | 0 |

Note: * Sector Plans for CFC Production, Halon and MAC have been approved by ExCom, therefore, they are not included in the total fund required.

# V. POLICY, MONITORING AND ENFORCEMENT

## A. Institutional Framework

**Leading Group.** The Leading Group for Ozone Layer Protection of China is a cross-agencies organization of the Government established in 1991. The Leading Group is responsible for organizing and coordinating implementation of Vienna Convention and MP, as well as the Country Programme. Leading Group is also responsible for supervising the implementation plans and provides decisions.

The Leading Group is leaded by State Environmental Protection Administration (SEPA), with the vice-leaders of Ministry of Foreign Affairs (MOFA), State Development Planning Commission (SDPC), State Economic and Trade Commission (SETC), Ministry of Sciences and Technology (MST), and Ministry of Finance (MOF). The member organizations includes Ministry of Public Security (MPS), Ministry of Information Industry (MII), Ministry of Agriculture (MOA), General Administration of Customs (GAC), Ministry of Foreign Trade and Economic Cooperation (MOFTEC), State Internal Trade Bureau(SITB), State Machine-Building Industry Bureau (SMBIB), State Petrochemical Industry Bureau (SPIB), State Light Industry Bureau (SLIB), State Tobacco Monopoly Bureau (STMB), China Aviation Industry Companies (CAIC), China Space Science and Technology Company (CSSTC).

**Working Group of Leading Group.** A Working Group composed of the coordinators under the Leading Group has also been established. Coordinators are appointed by member agencies of the Leading Group. The office of the Working Group is located at SEPA which is responsible for its daily operations. The Working Group has been entrusted with: Coordination of implementation of the Convention and the MP; Coordination of production, import, export and consumption of ODS; Financial analysis of domestic and external funding for implementation of CP; Proposing various options to the Leading Group; and Handling other affairs related to CP implementation.

**The MLF Project Management Office for Ozone Layer Protection (PMO).** PMO established under SEPA is responsible for organizing CP implementation, preparation and submission of projects to MLF, and coordination, management and supervision of project implementation. To further improve effectiveness of ODS phaseout activities, Special Working Groups for sectors concerned have been established for implementing sector

approaches and umbrella projects, for example, Special Working Groups for Halon Sector, Solvent Sector, Chemical Production Sector and Tobacco Sector.

## B. Responsibilities Arrangement

**State Environmental Protection Administration** is responsible for the supervision of Convention/Protocol and Country Programme implementation as its routine duties. This includes elaborating international cooperation projects, organization and establishment of related regulations, evaluation of ODS production, import, export and consumption, collection and reporting of data on ODS production and consumption, and supervision of projects submission and implementation progress, as well as the acceptance of the projects, monitoring and supervising the implementation of policies and regulations regarding ozone layer protection.

**Ministry of Foreign Affairs** is responsible for international affairs related to the Convention and Protocol, as well as policies and laws that have external implications.

**State Development Planning Commission & State Economic and Trade Commission** are responsible for macro-level programming and planning for the production, import, export and consumption of ODS and their products, involve decision-making for taxation policies. SETC is also responsible for phaseout of medical aerosols consuming ODS.

**Ministry of Sciences and Technology** is responsible for elaboration, organization, implementation and management of plans of scientific research and new product development for ozone layer protection.

**Ministry of Finance** involves the management for external funds granted for ozone layer protection, as well as establishment and administration of related taxation regulations.

**Ministry of Public Security** is responsible for research, production, consumption, recycling of Halon agents, extinguishers and fixed fire fighting systems.

**Ministry of Information Industry** is responsible for management and substitution of production and consumption of solvents using ODS.

**Ministry of Agriculture** is responsible for management and phaseout of Methyl Bromide used in agricultural production.

**General Administration of Customs** is responsible for management and statistics of

the import and export of controlled substances and their products, and participation in formulation of import and export polices on controlled substances.

**Ministry of Foreign Trade and Economic Cooperation** joins other agencies concerned to determine the import and export allowance for controlled ODS, designs the products list for controlled ODS import and export and allocation approach for import and export allowance. The import and export license is issued by agencies authorized by MOFTEC.

**State Internal Trade Bureau** is responsible for production and consumption management for small size commercial refrigeration facilities consuming ODS, and is also responsible for coordinating the management for recycling CFCs in use.

**State Machine-Building Industry Bureau** is responsible for production and consumption management on three-phase air conditioning facilities, compressors (excluding for domestic refrigeration), refrigeration facilities (excluding domestic refrigeration and small size commercial used refrigeration facilities), mobile air conditioners. SMBIB is also responsible for development and production management of special large size recycling facilities and monitoring and leakage monitoring facilities.

**State Petrochemical Industry Bureau** is responsible for research and development and production management for substitutes and production management on controlled ODS (excluding Halons).

**State Light Industry Bureau** is responsible for production management for domestic refrigerators, single-phase air conditioners used in rooms and compressors, aerosol products, foams.

**State Tobacco Monopoly Bureau** is responsible for production and substitution of ODS used in this sector.

**China Aviation Industry Companies and China Space Science and Technology Company** are responsible for consumption and phaseout management of ODS used in their companies.

**Local Environmental Protection Bureaus (EPBs).** The Government emphasizes monitoring and supervision functions through local EPBs. The local EPBs are responsible for: 1) implementing related regulations and policies at local level; 2) monitoring the production, consumption, import and export of controlled substances at local level; 3) collecting ODS production and consumption data by emission registration and reporting system; 4) strictly controlling new, modernization expansion construction projects for

ODS/products by construction projects management system and environmental impact assessment system.

**Local Sector Management Agencies** are responsible for monitoring ODS phaseout activities within this sector, and submition ODS phaseout projects follow the procedures desgined.

**Industrial Organizations**. Industrial associations and industrial research institutes related to production and consumption of ODS participate in previous ODS phaseout activities by collecting basic information of enterprise of related industries, selecting phaseout technologies, determining phaseout strategy, developing and preparing phaseout projects, or collecting and disseminating information on related phaseout technologies.

## C. Policy Framework

The policies, regulations, monitoring and enforcement system give full consideration to production, consumption, import and export related to ODS/substitution technology/substitute production, to achieve the proposed ODS phaseout targets efficiently and effectively. Policy actions already taken and proposed are listed in Table 18 and Table 19.

**1. Production Management Policy**. China is strictly controlling or banning the installation of facilities which are new, expansion, modernization of ODS production and consumption projects. By environmental impact assessment system and participation of planning, economic and trade, financial and fiscal, industrial and commercial management, as well as the sectors in charge, to implement effective monitoring and enforcement to control new capacity of ODS production and consumption.

China has introduced production quota system to control Halon and CFCs production. All producers must apply for production quota to produce Halon and CFCs. Production quota in total is determined according to the approved Sector Plan for Halon Phaseout and Sector Plan for CFCs Production Phaseout. The annual production quota is allocated to producers by SEPA and sectors concerned. The ODS production quota are tradable among enterprises. Annual quota will be reduced substantially through a bidding system.

China is strictly implementing registration, checking and approval management for ODS substitutes production. Any production activities should be approved by SEPA and SPIB.

**2. Import and Export Management Policy.** While introducing the production quota system, China will introduce ODS import permit and quota system. All the importers and enterprises that need to import ODS should apply for import permit following related regulations. After checking and approval by government agencies concerned, the importers can then import. The types and quantity of ODS import quota will be determined according the ODS phaseout targets and domestic production. While controlling the domestic production by adopting the production management policy, introducing import management policy to control the ODS import can therefore control the domestic consumption of ODS and stimulate the development and production of ODS substitutes.

An export registration and reporting system will be introduced. Export registration and reporting system aims at collecting accurate information on domestic ODS production, and to control the illegal trade of ODS. China is going to adopt strict penalties for illegal ODS trade.

**3. Consumption Management Policy.** The essential uses and non-essential uses areas for ODS products is/will be identified according to the changes of situation. Bans will be issued for uses of ODS products in non-essential uses.

China will also issue bans on consumption of ODS for specific sectors or implementing ODS consumption quota system according to the requirements of implementing related sector plans.

**4. Emission Registration System.** ODS production and consumption is being linked into existing emission registration system, to monitor and manage the production and consumption behaviors of enterprises. This policy will help to collect more accurate information and data regarding the ODS domestic production and consumption.

**5. Products Quality Management Policy.** China will continue to design product quality standards, environmental standards, and standards for safety for ODS substitutes/productions, to improve the quality of substitutes/products, to ensure the ODS phaseout process moved smoothly.

**6. Environmental Labeling System.** China will continue to revise the requirement related to environmental labeling, and issue environmental labels to ODS substitute products, to encourage substitution.

**7. Taxes and Charges.** China is conducting feasibility studies for taxing ODS/products and charges on ODS producers. By introducing system of tax and/or charges, one can provide the market with signals which will influence consumer preference

and encourage the enterprises and consumer to reduce their consumption of ODS products. Study results are not yet available.

**8. Education, Training and Communication Policy.** By using broadcast, television, newspaper and journals, China will continue to improve public awareness on Ozone layer protection. China will continue to make efforts on technical training, to improve the skills of technicians and management personnel on ODS/substitutes production, consumption and management. Meanwhile, a communication programme/network is proposed to be established to ensure the target groups are being reached to further ensure the effectiveness of policies and actions proposed.

**9. Other Policies.** China will continue to implement other related policies, including bans, policies for recycling and recovery, management for servicing, policy for industry restructuring, policy for development management.

## D. Monitoring and Supervision

China will continue to establish monitoring and supervision system for ODS phaseout. This system includes data registration and reporting and checking system, management information system, and enforcement instruments. This system will increasingly be relied on to track phaseout performance linked to funding and ensure compliance with the phaseout targets as established in the CP update.

**1. Data Management System.** China has set up and is improving the dada management system for production, consumption, import, and export of ODS, and for MLF funds implementation. This system includes:

- All related enterprises to ODS/products production, consumption, recovering and recycling, import and export; as well as enterprises implementing phaseout activities have to register and report the data required, and agree to inspections by agencies concerned;
- Industrial Ministries and Associations are responsible for collecting and summarizing the data of their sectors and report to PMO, and to undertake inspections individually or with other agencies concerned;
- Local EPBs and local industrial agencies/associations should monitor the implementation process of this system, and to join the inspections at enterprise level. Local EPBs should collect and check the data concerned by pollution

emission registration system;

- Customs is responsible for collecting import and export data and report to PMO and to join the inspection with other agencies concerned;
- PMO is responsible for summarizing data reported by sectors and Customs, and to lead inspections for monitoring of this system. SEPA should also report data to Leading Group and to the Secretariat of the Montreal Protocol and the Secretariat of the MLF.

**2. Management Information System.** China is proposing to establish a comprehensive management information system to monitor the overall process of ODS phaseout activities to realize: 1) systematic data registration and reporting system; 2) link product quality and management system into MIS; 3) monitor and control the ODS phaseout process to ensure achievement of phaseout targets; 4) monitor and control the MLF projects implementation; 5) monitor the implementation of policies and regulations.

**3. Enforcement Instruments**. China has implemented some enforcement instruments for implementing ODS phaseout plan and policies. Such enforcement instruments are used to monitor and manage implementation of ODS phaseout activities, and policies. These instruments include: 1) production permit and quota system, to control the production and consumption; 2) regular or non-regular inspection, checking, auditing to check the phaseout process and data; 3) inspection to check whether organizations and individuals concerned had carried out their responsibilities; and 4) penalties for non compliance by enterprises and individuals.

**4. Evaluation**. SEPA will periodically evaluate performance under the various policy initiatives, recommend policy changes and/or formulate new policies as may be required to ensure full compliance with MP targets.

Table 18 Policy Documents Issued by Chinese Government

| | Year Issued | Policy | Agencies issued the documents |
|---|---|---|---|
| 1 | 1993 | Circular on Management for CFCs and Their Substitutes Production Construction | MCI, NEPA |
| 2 | 1993 | Circular on Implementing Projects Sponsored by MLF | NEPA |
| 3 | 1994 | Circular for Data Reporting Regarding ODS Production, Consumption, Import and Export | NEPA |
| 4 | 1994 | Environmental Labeling System for Production | NEPA |
| 5 | 1994 | Bans on New Installation of Halon Extinguishers at Non-essential Uses Area | MPS, NEPA |
| 6 | 1995 | Circular on Implementing the Bans on New Installation of Halon Extinguishers at Non-essential use Area | MPS |
| 7 | 1995 | Circular on Strengthening the Expansion of CFCs Production | MCI |
| 8 | 1995 | Circular on Environmental Impact Assessment for MLF Sponsored Projects | NEPA |
| 9 | 1995 | Guidelines for MLF Projects Implementation | NEPA |
| 10 | 1996 | Policies for Promoting Halon Substitutes | MPS |
| 11 | 1997 | Construction Design Code for Tall Civil Buildings (Revised) | MOC |
| 12 | 1997 | Code on Fire Fighting for Construction Design (Revised) | MOC |
| 13 | 1997 | Code on Fire Fighting Facilities Installation for Constructions (Revised) | MOC |
| 14 | 1997 | Construction Design Code for Antiaircraft Engineerings (Revised) | MOC |
| 15 | 1997 | Circular for Implementing Pollution Emission Registering and Reporting System | NEPA |
| 16 | 1997 | Circular on Strengthening the Monitoring and Supervision Responsibility of Local EPBs | NEPA |
| 17 | 1997 | Bans for Using CFCs at Aerosol Sector | NEPA, CLIA, SPC, SETC and others |
| 18 | 1997 | Bans for New Installation of Facilities for Production and Consumption of ODSs | NEPA, SPC, SETC, SICA |
| 19 | 1997 | Production Quota and Permit System for Halon | NEPA, MPS |
| 20 | 1997 | Circular on Data Base Management System for ODSs Registration and Reporting | NEPA |
| 21 | 1997 | Production Permit System for CFCs | MCI |
| 22 | 1997 | Bans on Consumption of CFCs for New Produced Cars of | MMI |

| | | | |
|---|---|---|---|
| | | China's Mobile Industry | |
| 23 | 1997 | Circular on Issuing the List of First Group of Production Process and Equipment Heavily Polluting Environment (atmosphere) Subject to be Phased Out | SETC, NEPA, MMI |
| 24 | 1999 | Circular on Phaseout of Halon Fixed Fire Fighting System and Extinguishers | MPS |
| 25 | 1999 | Supplement to Bans for New Installation of Facilities for Production and Consumption of ODS | SEPA, SDPC, SETC, SICA |
| 26 | 1999 | Circular on Issuing the Management for Flammable Areosol Enterprises | SLIB |
| 27 | 1999 | Circular on Production Quota and Permit System for CFCs | SEPA, SPIB |

Note: **MCI** for Ministry of Chemical Industry (now State Petrochemical Industry Bureau, **SPIB**); **NEPA** for National Environmental Protection Agency (now the State Environmental Protection Administration, **SEPA**); **MPS** refers to Ministry of Public Security; **MOC** for Ministry of Construction; **CLIA** for China's Light Industry Association (now State Light Industry Bureau, **SLIB**); **SPC** for State Planning Commission (now State Development Planning Commission, **SDPC**); **SETC** for State Economic and Trade Commission; **SICA** for State Industrial and Commercial Agency; **MMI** for Ministry of Machinery Industry.

Table 19 Policies Proposed

**Policies at National Level**

| Name | Applied Fields | Major Contents | Note |
|---|---|---|---|
| Quota system | Applied for ODS production, consumption and import/export | * define and issue quota to related firms<br>* any producers, importers, exporters and consumption enterprises must have quota to produce, import, export, and use ODSs | |
| Products quality control | For substitutes/products | * introduce products quality standards | |
| Policies for consumption management | For ODS products | * define essential and non-essential use areas dynamically<br>* issue bans for non-essential use | |
| Import and export management policies | For ODS import and export management | * issue controlled substances list for import/export<br>* registration and reporting system<br>* ODS import/export management system | The list will be renewed based on phaseout requirement, and to control their import and export |
| Tax/charges | For ODSs production, consumption, import, recycle and re-use; development of substitute technology | * tax on ODSs/products<br>* favorable tax for substitutes/products<br>* pollution charges for ODS consumption<br>* favorable tax for development of substitutes technologies | Is conducting feasibility study |
| Other policies | For all ODS/products and substitutes production<br>For servicing enterprises | * code for production safety requirement for sectors concerned | |

**Policies at Sector Level**

| Sectors | Policies | Proposed timing for issuing |
|---|---|---|
| ODS production and substitution | ODS import and export<br>Production management for substitutes<br>ODS production bans | 2000<br>to be decided<br>2008 |
| Foam | Consumption bans on ODS used in foam sector | 2005 |
| Industrial and commercial refrigeration (ICR) | Consumption bans on CFC-11/CFC-12 used in ICR<br>Servicing management policy for ICR | 2001/2002<br>2005 |
| Domestic refrigeration | Consumption bans on CFCs used in DR<br>Servicing management policy for DR | 2005<br>2005 |
| MAC | Authentication for non CFCs MAC<br>Servicing management policy for MAC<br>Monitoring and control for license for new produced cars | 2001<br>2002<br>2002 |
| Solvent | Production quota and bidding system<br>Revision of production standards and codes<br>Import management for ODS based solvent<br>Incentives for development of substitutes/technologies<br>Bans on consumption of CFC-113 used in solvent sector | After approval of Sector Plan<br><br><br><br>2005 |
| Tobacco | Consumption quota for CFC-11<br><br>Consumption bans on CFC-11 used in tobacco sector | After approval of Sector Plan<br>2006 |

# *Annex Incremental Cost Model and Key Parameters*

## A. Incremental Cost Model

Key assumptions for the cost model are:

- Prices related to incremental cost will be 1999 prices; discount rate for future year is 7% per year;
- 1999 prices are the same as 1997 prices[1];
- Inflation rate is 2.5% per year after 1999; and
- Implementation period for each project is two years average.

Incremental costs for phaseout include five aspects: incremental costs for consumption sectors, incremental cost for production sector, incremental cost for setting up capacity of substitute production, incremental cost for recycling, and incremental cost for supporting activities. Parameters and methodology for calculating the incremental cost for production sector are same as "Sector Plan for Phaseout CFC Production in China" and "Sector Plan for Phaseout Halon in China"; incremental cost for supporting activities are calculated based on approved technical assistant projects; incremental for recycling are estimated based on understanding of ExCom guidelines; incremental cost for consumption sectors, excluding Halon sector and MAC sector which were approved by ExCom, are calculated according to the following formula:

$$IC = R1 * \Sigma \, average\ phaseout\ cost * annual\ phaseout\ amount$$

IC is incremental cost; R1 refers to eligible proportion; average phaseout cost per unit is determined according to ExCom guidelines, the distribution and status of remaining consumption, such as suitable alternative technologies, size of ODS consumers in China.

Annual phaseout amount is determined according to annual phaseout plan of related consumption sectors. The impact of approved project implementation are considered and excluded in the calculation of incremental cost. In addition, the impact of constrained

[1] Inflation index from World Bank shows combined about 0% for 1997/1998, so 1999 price is assumed same as 1997 price.

increase rate of consumption is considered based on economic growth and products demand in some of industrial sectors.

## B. Parameters for Incremental Cost Calculation

### 1. Production Sector

### Key Inputs

- Production and reduction for Production Sector in 1999-2010;
- Closure cost for CFC-11, CFC-12 and CFC-113 uses the results of "Sector Plan for CFC Production Phaseout in China";
- Closure cost for TCA adopts the same methodology in "Sector Plan for CFC Production Phaseout in China";
- Incremental cost for setting up capacity of substitute production adopts the suggestion of "Production Sector Phaseout Strategy"(1995).

Annex Table 1 Key Parameters and Basic Information on Production Sector

| | |
|---|---|
| Production Capacity of CFC-13, CFC-114&115 (tons) | 660 |
| CFC-13, CFC-114&115 Production in 1997 (tons) | 190 |
| Average Price of CFC-13, 114&115 in 1997 ($/kg) | 17 |
| Production Capacity of TCA (tons) | 2,800 |
| TCA Production in 1997 (tons) | 1,045 |
| Average Price of TCA in 1997 ($/kg) | 1.5 |
| Compensation Profit Rate of all chemicals (%) | 22.5 |
| Remaining life time at end 1998 (year) | 18 |
| Unconstrained increase rate for current producers (%) | 5 |

### 2. Foam Sector

### Key Inputs

- Consumption and reduction for Foam Sector in 1999-2010.

Average phaseout cost for Foam Sector is determined according to the phaseout costs

of projects approved by MLF, the proposal of experts and the distribution of remaining consumption in China. By August 1998, 79 projects were approved by MLF. Weighted cost effectiveness is $4.22/kg ODP. Most of the approved projects are for large and medium enterprises. The total consumption of Foam Sector is 23,853 tons in 1997. The average incremental cost for phasing out the remaining consumption is higher than the approved projects. The main reason is that most of the remaining consumptions are consumed by SMEs. The average cost effectiveness is $6/kg ODP for the remaining consumption phaseout.

Annex Table 2 Key Parameters and Basic Information for Foam Sector

| | | |
|---|---|---|
| 1 | Consumption in 1997 (tons ODP) (1=2+3) | 23,853 |
| 2 | Of which includes CFC-11 | 17,192 |
| 3 | Of which includes CFC-12 | 6,661 |
| 4 | ODP to be phased out by approved projects by August 1998 (tons) (4=5+6) | 9,112 |
| 5 | Of which approved by end of 1997 | 7,430 |
| 6 | Of which approved in 1998 | 1,682 |
| 7 | Total Incremental costs approved by August 1998 (US$ 1,000) (7=8+9) | 38,476 |
| 8 | Of which approved by end of 1997 | 31,150 |
| 9 | Of which approved in 1998 | 7,326 |
| 10 | Number of projects approved | 79 |
| 11 | Of which number of TA projects | 8 |
| 12 | Weighted average Cost effectiveness ($/kg ODP) (12=7/4) | 4.22 |
| 13 | Completed phaseout by end of 1997(ODP tons) | 354 |
| 14 | Remaining CFC Consumption to be phased out [= $\Sigma$ Annual $phaseout_{i;}$ Annual $phaseout_i$ = $Consumption_{(i-1)}$ $Consumption_i$ / (1+3%) ] (ODP tons) | 21,915* |
| 15 | Phaseout cost effectiveness for the remaining consumption ($/kg ODP) | 6 |

Note: * The potential growth in the production of CFC-Foam was taken into account in the phaseout. The increase rate of production is 3% per year.

# 3. Refrigeration Sector

## Key Inputs

- Consumption and reduction for refrigeration sector in 1999-2010;
- R1 = 1

The cost effectiveness for remaining consumption phaseout is assumed to be $13.5/kg ODP rather than $11.38/kg ODP and $8.42/kg ODP. There are two reasons for choosing $13.5/kg ODP. One is the remaining consumption is located mainly in SMEs. Another reason is that $11.38/kg ODP and $8.42/kg ODP calculated are based on direct phaseout and indirect phaseout. If indirect phaseout is excluded, the cost effectiveness for Refrigeration Sector is $13.04/kg ODP. It is close to $13.5/kg ODP.

Annex Table3 Key Parameters and Basic Information for Refrigeration Sector*

| | | I&C | DR |
|---|---|---|---|
| 1 | Consumption in 1997 (tons ODP) (1=2+5) | 10,206 | 7,390 |
| 2 | Of which includes CFC-11 (2=3+4) | 706 | 5,910 |
| 3 | Of which Servicing | 456 | |
| 4 | Of which New production | 250 | |
| 5 | Of which includes CFC-12 (5=6+7) | 9,500 | 1,480 |
| 6 | Of which Servicing | 4,400 | 500 |
| 7 | Of which New production | 5,100 | 980 |
| 8 | ODP to be phased out by approved projects by August 1998 (tons) (8=9+10) | 3,599 | 8,970 |
| 9 | Of which approved by end of 1997 | 3,599 | 8,054 |
| 10 | Of which approved in 1998 | 0 | 816 |
| 11 | Total Incremental costs approved by August 1998 (US$ 1,000) (11=12+13) | 40,931 | 75,514 |
| 12 | Of which approved by end of 1997 | 40,931 | 69,769 |
| 13 | Of which approved in 1998 | 0 | 5,745 |
| 14 | Number of projects | 24 | 49 |
| 15 | Weighted average Cost effectiveness($/kg ODP) (15 = 11/8 ) | 11.38 | 8.42 |
| 16 | Completed phaseout by end of 1997(ODP tons) | 0 | 2,700 |

| | | | |
|---|---|---|---|
| 17 | Remaining CFC Consumption for new production to be phased out [17= 4+7-(8-16)] | 1,750 | 620 |
| 18 | Phaseout cost effectiveness for the remaining consumption($/kg ODP) | 13.5 | 13.5 |

Note: * Information for MAC is described in the "MAC ODS Phaseout Sector Plan"

## 4. Solvent Sector

## Key Inputs

- Consumption and reduction for solvent sector in 1999-2010;
- R1 = 0.9

Annex Table 4 Key Parameters and Basic Information for Solvent Sector

| | | |
|---|---|---|
| 1 | Consumption of 1997 (tons ODP) (1=2+3+4) | 4,532 |
| 2 | Of which CFC-113 | 3,750 |
| 3 | Of which TCA | 672 |
| 4 | Of which CTC | 110 |
| 5 | ODP to be phased out by approved projects (tons) (5=6+7) | 710 |
| 6 | Of which CFC-113 (tons ODP) [including to be phased out with refrigeration projects (item 9)] | 685 |
| 7 | Of which TCA (tons ODP) | 25 |
| 8 | To be phased out with refrigeration projects (8=9+10) | 97* |
| 9 | Of which CFC-113 | 96 |
| 10 | Of which TCA | 1 |
| 11 | Incremental costs approved (US$ 1,000) | 8,547 |
| 12 | Number of projects approved | 23 |
| 13 | Of which Number of TA projects | 4 |
| 14 | Weighted average Cost effectiveness ($/kg ODP) | 15.73** |
| 15 | Completed phaseout (ODP tons) | 140 |
| 16 | Of which includes CFC-113 | 140 |
| 17 | Remaining Consumption to be phased out (tons ODP) (17=18+19+20) | |
| 18 | Of which CFC-113 [18=2*1.05$^2$-(6-16)] | 3,555 |

| | | |
|---|---|---|
| 19 | Of which CTC (tons ODP) (19=4) | 110 |
| 20 | Of which TCA (tons ODP) [20 = $\Sigma$ Annual phaseout$_i$; Annual phaseout$_i$ = Consumption$_{(i-1)}$ – Consumption$_i$ / (1+3%) ] | 841 |
| 21 | Phaseout cost effectiveness for the remaining consumption ($/kg ODP) | |
| 22 | CFC-113 | 16.6 |
| 23 | TCA | 38 |
| 24 | CTC | 12.1 |

Note: * Incremental Costs for phasing out are included in the Refrigeration Sector.

** The project that includes CFC-12 as refrigerant was excluded in calculation of the cost effectiveness.

Average phaseout cost for CFC-113 is determined according to the phaseout costs of single project and the distribution of CFC-113 solvent consumption in China. Single project is determined according to single phaseout projects approved by MLF and the proposal of experts. Detailed consumption distribution and phaseout cost effectiveness of CFC-113 solvent consumption for different alternative technologies are shown in Annex Table 6.

Assuming that synchronized phaseout is carried out among large, medium and small enterprises. The **weighed average phaseout cost** is:

***Weighted Average phaseout cost = $\Sigma$ phaseout cost of certain replacement technology X percent of certain technology***

The phaseout cost of certain replacement tech is shown in Table 5.

- Average phaseout cost effectiveness for TCA is the threshold value.
- Average phaseout cost effectiveness for CTC is the same value as CFC-113 at ODS level.

Annex Table 5 Classification of phaseout cost effectiveness ($/kg ODP)

| | Precision cleaning | | | Metal cleaning | | | PCB cleaning | | | | Others |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Large Size | aqueous cleaning | semi-aqueous cleaning | solvent cleaning | aqueous cleaning | semi-aqueous cleaning | Solvent cleaning | no clean | aqueous cleaning | semi-aqueous cleaning | solvent cleaning | all replacement technologies |
| | 11.3 | 33.4 | 18.8 | 10.4 | | 14.3 | | | | 8.0 | |
| Medium Size | aqueous cleaning | semi-aqueous cleaning | solvent cleaning | aqueous cleaning | semi-aqueous cleaning | Solvent cleaning | no clean | aqueous cleaning | semi-aqueous cleaning | solvent cleaning | all replacement technologies |
| | 12.3 | 33.4 | | | | | | 17.3 | 19.7 | 10.4 | |
| Small Size | all replacement technologies | | | | | | | | | | |
| | 16.6 | | | | | | | | | | |

Annex Table 6 Classification of CFC-113 Solvent Consumers

(Based on 1996 Information, ODS tons

| CFC-113 Consumption | Precision | Metal | PCB | Others | Consumption | Percentage |
|---|---|---|---|---|---|---|
| Large size | 646 | 851 | 60 | 285 | 1,842 | *49%* |
| Medium-size | 488 | 298 | 175 | 136 | 1,097 | *29%* |
| Small-size | 77 | 49 | 107 | 24 | 257 | *22%* |
| Others* | | | | | 559 | |
| | 38% | 37% | 11% | 14% | 3,755 | |

Note: * Includes unreported data from distributors and/or small and medium size users, and that number also includes essential uses.

## 5. Tobacco Sector

## Key Inputs

- Consumption and reduction for Tobacco Sector in 1999-2010;

- R1 = 0.9

Average phaseout cost is determined as follow:

- All CFC users in Tobacco Sector choose $CO_2$ as alternative technology;
- The conversion basis is the Tobacco expanding capacity, MLF supports the enterprises to build the same capacity of CFC Tobacco expansion;
- The practice cost effectiveness for CFC-11 phaseout is $86/kg ODP;
- Considering the special characters of the Tobacco sector and enterprises' acceptance level, the cost effectiveness used to request funding from the MLF to phase out CFC-11 is $42/kg ODP.

Annex Table 7 Key Parameters and Basic Information for Tobacco Sector

| | |
|---|---|
| Consumption in 1997 (tons ODP) | 1,090 |
| Of which includes CFC-11 | 1,090 |
| To be phased out by approved projects (tons ODP) | 0 |
| Consumption without phaseout project by end of 1997 | 1,090 |
| Of which includes CFC-11 (tons ODP) | 1,090 |
| Phaseout cost effectiveness for the remaining consumption ($/kg ODP) | 42 |

## 6. Halon Sector

Phaseout cost for Halon Sector including production, consumption, servicing, banking and technical assistances will adopt the results of the Sector Plan that was approved by MLF.

# ACTION PLAN FOR ODS PHASEOUT IN CHINA

*State Environmental Protection Administration*
*The People's Republic of China*

*November, 1999*

# CONTENTS

# ACTION PLAN FOR ODS PHASEOUT

According to the ODS phaseout strategy, phaseout plan and phaseout approaches decided in the CP Update, China has set its Action Plan for meeting China's commitments to the MP. This Plan covers the sectors and types of ODS, respectively. It will also address special issues such as SMEs and service sector.

This Action Plan will be periodically updated based on the approval of projects, funds provided, technology availability and other situations affecting phaseout. Action plan for ODS production substitutes, CTC production closures, aerosol essential uses, solvents essential uses and methyl bromide, will be addressed when developed and approved. The implementation and enforcement of the policies for certain sectors could be delayed accordingly if the approval of phaseout plans by MLF for these sectors are delayed.

## A. Action Plan for ODS Phaseout at National Level

The Action Plan will help China reach the following targets:

- freezing production and consumption of CFCs in Group I, Annex A on July 1, 1999 at average of 1995 to 1997 actual levels, then reduce to 50% of freezing level by January 1, 2005, then reduce to 15% of freezing level of consumption and production by January 1, 2007, and to stop production and consumption by January 1, 2010;

- freezing production and consumption of Halon on January 1, 2002 at average of 1995 to 1997 actual levels, then reduce to 50% of freezing level by January 1, 2005, and to stop production and consumption by January 1, 2010;

- production and consumption of CFC-13 in Annex B is reduced to 80% of the average actual level of 1998 to 2000 by January 1, 2003, then to 15% by January 1, 2007, and to stop production and consumption by January 1, 2010;

- reduce production and consumption of CTC to 15% of the average level of 1998 to 2000 by January 1, 2005, and then to stop production and consumption by January 1, 2010;

- production and consumption of TCA will be frozen by January 1, 2003 at the average actual level of 1998 to 2000, then reduce to 70% of freezing level of consumption and production by January 1, 2005, then to stop production and consumption by January 1, 2015.

- to phaseout Halon in accordance with Halon Sector Plan endorsed by ExCom;

The Action Plan will be implemented under the following conditions:

- With sufficient MLF support provided; the Government will phaseout ODS under the principle that production phaseout, consumption phaseout and substitutes production are supported and implemented simultaneously as shown in the Action Plan.

- China would use commercialized substitutes and substitution technologies that are cost-effective and suitable to local conditions. Technical options will be revised in accordance with development of ODS substitutes. China will develop substitution technology that cannot be transferred from international market, and build up production capacity independently under support of MLF.

- China will secure the health and safety of workers, and safety of properties of industries, and would not sacrifice the quality and market shares of the products during the conversion from ODS production to non-ODS production.

- China will adopt different approaches to phaseout ODS (project by project, umbrella projects and sector plans) to improve CP cost effectiveness and efficiency.

The aggregate annual forecast of ODS production and consumption is given in Table 1 and Table 2 based on the current assessment of results. The policies and TA activities are listed in Table 3. Action Plans for individual sectors are given in the following sections. The estimated results in the tables are subject to change as the Action Plan is periodically updated.

CP Action Plan at national level will also include:

1. Policy Working Group. SEPA will establish a policy working group that will:

   a) Periodically review lessons learned of both international and domestic experiences;

   b) Review progress under local policy action and propose/implement corrective steps as required;

   c) Review/assess external policy actions and propose/implement action for China ODS progress as may be appropriate;

   d) Assess the feasibility and practicality of the policies proposed; and

   e) Prepare periodic reports to Leading Group as required.

2. Implementation Review Working Group. SEPA will establish an implementation review-working group that will:

a) Periodically review the implementation progress of the CP Update and Action Plan;

b) Preparing implementation manual (sector and cross sector implementation manual, and safety manual) as needed;

c) Review and assess actions needed; and

d) Prepare periodic reports to Leading Group as may be required.

3. Communication. China will establish a communication programme/network, which will involve ministries concerned, local EPBs, implementation bureaus and producers and consumers to ensure that target groups are reached.

4. Capacity Building. As the lessons learned, capacity building is essential to ensure the implementation of ODS phaseout activities, especially for domestic implementation agencies and the local EPBs. They are essential for reporting, monitoring and enforcement of the policies and actions proposed. Such capacity building will be undertaken through technical assistance programmes, such as training, networking of the local EPBs, information collection and dissemination networks.

## Table 1 ODS Consumption Phaseout Plan in Each Sector (ODP tons)

| | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **ODS Phaseout Target** | | | | | | | | | | | | |
| CFC-11 | 2,048 | 3,950 | 2,225 | 340 | 1,370 | 1,877 | 2,743 | 2,880 | 2,875 | 1,040 | 3,410 | 140 |
| CFC-12 | 3,110 | 1,503 | 1,005 | 2,540 | 1,030 | 2,203 | 3,257 | 2,040 | 1,780 | 690 | 520 | 2,560 |
| CFC-113 | 0 | 800 | 600 | 500 | 500 | 600 | 550 | 550 | 0 | 0 | 0 | 0 |
| CFC-114 | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 0 | 10 | 0 | 0 | 0 |
| CFC-115 | 0 | 0 | 0 | 0 | 0 | 0 | 80 | 0 | 100 | 0 | 0 | 0 |
| CFC-13 | 0 | 0 | 0 | 0 | 50 | 0 | 0 | 0 | 50 | 0 | 0 | 0 |
| Halon 1211 | 5,370 | 5,370 | 1,389 | 1,692 | 2,292 | 0 | 0 | 5,970 | 0 | 0 | 0 | 0 |
| Halon 1301 | 0 | 0 | 0 | 180 | 0 | 0 | 0 | 500 | 0 | 0 | 0 | 1,000 |
| CTC | 0 | 0 | 0 | 0 | 55 | 55 | 0 | 0 | 0 | 0 | 0 | 0 |
| TCA | 0 | 0 | 0 | 38 | 38 | 111 | 111 | 104 | 104 | 104 | 104 | 104 |
| **ODS Phaseout Targets of Sectors *** | | | | | | | | | | | | |
| Foam | 2,789 | 1,592 | 650 | 1,220 | 2,080 | 2,400 | 3,467 | 2,460 | 2,825 | 1,000 | 3,370 | 0 |
| Industrial and commercial refrigeration | 360 | 880 | 1,110 | 1,430 | 370 | 530 | 1,740 | 1,360 | 550 | 440 | 340 | 1,340 |
| Domestic refrigeration | 2,046 | 3,101 | 1,400 | 0 | 0 | 400 | 43 | 200 | 0 | 0 | 0 | 200 |
| Solvent | 0 | 763 | 561 | 538 | 593 | 766 | 661 | 654 | 104 | 104 | 104 | 104 |
| Tobacco | 0 | 90 | 120 | 180 | 200 | 200 | 150 | 150 | | | | |
| MAC | 220 | 480 | 400 | 250 | 50 | 150 | 200 | 250 | 280 | 290 | 220 | 160 |
| Halon | 5,370 | 5,370 | 1,389 | 1,872 | 2,292 | 0 | 0 | 6,470 | 0 | 0 | 0 | 1,000 |

* The sum of annual consumption of TCA in Foam and Solvent sector is larger than that in 1999, because the consumption of TCA by existing equipment is increasing while implementing phaseout activities in these two sectors. For the refrigeration sector, the data in this table is the sum of phaseout amount of servicing and new consumption

## Table 2 ODS Production Phaseout Plan in China (ODP tons)

| | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CFC-11 | 797 | 3,950 | 2,225 | 340 | 1,370 | 1,877 | 2,743 | 2,880 | 2,875 | 1,040 | 3,410 | 140 |
| CFC-12 | 5,162 | 156 | 1,005 | 2,540 | 1,030 | 2,203 | 3,257 | 2,040 | 1,780 | 690 | 520 | 2,560 |
| CFC-113 | 0 | 800 | 600 | 500 | 500 | 600 | 550 | 550 | 0 | 0 | 0 | 0 |
| CFC-114 | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 0 | 10 | 0 | 0 | 0 |
| CFC-115 | 0 | 0 | 0 | 0 | 0 | 0 | 80 | 0 | 100 | 0 | 0 | 0 |
| CFC-13 | 0 | 0 | 0 | 0 | 50 | 0 | 0 | 0 | 50 | 0 | 0 | 0 |
| Halon 1211 | 5,970 | 5,970 | 1,989 | 1,992 | 1,992 | 0 | 0 | 5,970 | 0 | 0 | 0 | 0 |
| Halon 1301 | 4,090 | 0 | 0 | 180 | 0 | 0 | 0 | 4,500 | 0 | 0 | 0 | 3,000 |
| CTC | 0 | 0 | 0 | 0 | 55 | 55 | 0 | 0 | 0 | 0 | 0 | 0 |
| TCA | 0 | 0 | 0 | 0 | 0 | 0 | 35 | 0 | 0 | 0 | 0 | 92 |
| **Total** | 16,019 | 10,876 | 5,819 | 5,552 | 4,997 | 4,735 | 6,675 | 15,940 | 4,815 | 1,730 | 3,930 | 5,792 |

## Table 3 Policy and Other Actions

| **Policy and other actions** | 1999 | 2000 | 2001 | 2002-2005 | 2005-2008 | 2008-2010 |
|---|---|---|---|---|---|---|
| Phaseout measures | Project by project, umbrella projects, and sector plans | Same | Same | Same | Same | Same |
| Policies | • Production permit and quota system<br>• Construction project management policy and environmental impact assessment<br>• Import/export licensing and quota system<br>• Pollution emission registration and reporting system<br>• Product quality standards<br>• Environmental labeling<br>• Identification of essential and non essential uses for ODS products<br>• Other supporting polices, includes, education, training, recycling and recovering management, Servicing management | Continue to implement the policies | Continue to implement the policies | Continue to implement the policies | Continue to implement the policies | • Issue and implement bans on production for ODSs concerned<br>• Issue and implement bans on consumption for ODSs concerned |
| Technical assistance activities | • Management capacity building for phaseout of controlled ODS, including management information system, monitoring management system, training and networking of the local EPBs<br>• Communication program/network<br>• Supporting system for substitutes and substitutes products quality control<br>• Monitoring center for substitutes/products quality<br>• safe production supporting system for substitutes/products<br>• technical supporting centers for ODS phaseout at SMEs<br>• technical assistance for sector phaseout strategy development, include, methyl bromide, medical use of aerosols<br>• technical assistance for design of policies, especially the import and export policies, tax/ charges policy<br>• technical assistance for reducing the emission and leakage of chemical process agents<br>• training, education and public awareness improvement | Same | Same | same | same | same |

## B. Phaseout Plans at Sector Level

## 1. ODS Production and Substitutes Production Sector (excluding Halon and TCA)

1.1 With the support of MLF and domestic policies, China will freeze the production of CFCs at the average 1995-1997 level by July 1, 1999, at (or below) 50% by January 1, 2005, at (or below) 25% by January 1, 2007 and complete phaseout by 2010.

1.2 Major issues to be addressed in CFC production phaseout in China:

- Local supply of cost effective substitutes must be accelerated and supported by MLF so as to secure ODS phaseout in consumption sector; and
- There is no consideration for CTC production as raw material by MLF.

1.3 Current Status:

- As of 1997, the current status of ODS phaseout in the ODS Production and Substitutes Production Sector is given in Chapter II of the CP update. Current status will be updated here in future updates of the Action Plan.

**Table 4 Estimate of Substitutes Production (tons)**

| ODS | 1999 | 2005 | 2010 |
|---|---|---|---|
| HCFC-22 | 15,000 | 33,000 | 45,000 |
| HCFC-141b | 2,500 | 5,200 | 12,000 |
| HFC-134a | 2,000 | 11,000 | 20,000 |
| HFC-152a | 130 | 160 | 200 |
| Isobutane | 80 | 100 | 120 |
| Cyclopentane | 1,100 | 1,400 | 1,800 |
| Butane | 850 | 3,300 | 4,400 |
| Pentane | 400 | 2,700 | 9,500 |
| Dichloride Methane | 650 | 4,600 | 44,000 |
| Propane/butane blends | 60,000 | 70,000 | 80,000 |

## Table 5 Policy and Other Actions in the Sector

| Policies and other actions | 1999 | 2000 | 2001 | 2002-2005 | 2005-2008 | 2008-2010 |
|---|---|---|---|---|---|---|
| Phaseout measures and approaches | • Implement the Sector Plan for ODS Production Phaseout in China<br>• close some enterprises and dismantle the production facilities<br>• Control import of CTC according to CFC phaseout process<br>• During 1999-2001will set up<br>5000 ton/year pentamethylene production facilities<br>5000tons/year HFC-134a production facility, production facilities for lubricant and any other necessary materials which compatible to HFC-134a. | • Continue to implement the phaseout measures | • Continue to implement the phaseout measures | • Continue to implement the phaseout measures<br>• 2002-2005 construct over 10000 tons/year HFC-134a, other substitutes, and other compatible materials production facility<br>• introduce production technologies for reducing chemical process agents emission (CCl4) | • continue to implement the phaseout measures | • continue to implement the phaseout measures |
| Policies | • implement polices at national levels (see Table 3)<br>• start to implement the ODS production quota system<br>• prepare to implement import and export licensing and quota system<br>• design and implement polices for substitute production management | Continue to implement the policies | Continue to implement the policies | Continue to implement the policies | Continue to implement the policies | • issue and implement the bans on ODS production |
| Technical assistance | • management capacity building for controlled ODS production phaseout , including Management information system, monitoring system<br>• substitutes/products quality control system<br>• safety control system for substitutes and their production<br>• phaseout policy design, especially import, export, tax/charges policy<br>• technology for reduction of emission of process agents<br>• training, education and promotion of public awareness, especially for ODS producer, consumption sector and end user | Same | Same | Same | Same | Same |

## 2. Foam Sector

2.1 Foam Sector will phase out ODS consumption based on the combination of project by project, general umbrella projects, terminal umbrella projects and possibly sector plan. By adopting terminal umbrella projects and/or sector plans, phaseout of ODS used in PS/PE and PU horizontal/vertical foam enterprises will be achieved by 2005, PU sheet and pipe-type foam enterprises by 2007, and spring PU and box-type foam enterprises by 2010.

2.2 Major issues for Foam Sector to phaseout ODS consumption:

- A workable approach is required to deal with a large number of enterprises with many SMEs in widely dispersed geographical locations;
- Safety issue needs to be addressed for both enterprise property and health of workers during the conversion process;
- Continuing growth of ODS consumption;
- Substitute price is higher than CFC prices; and
- Whether enterprises should discount eligible cost calculated according to the principle of MLF for incremental cost when they have inevitable technology upgrade during conversion.

2.3 Current Status:

- As of August 1998, the current status of ODS phaseout in the Foam Sector is given in Chapter II of the CP Update. Current status will be updated here in future updates of the Action Plan.

## Table 6 Policy and Other Actions in the Foam Sector

| **Policies and other actions** | 1999 | 2000 | 2001 | 2002-2005 | 2005-2008 | 2008-2010 |
|---|---|---|---|---|---|---|
| Phaseout measures and approaches | • preparation and implementation of individual project<br>• preparation and implementation of PE umbrella projects<br>• preparation of PS umbrella projects<br>• preparation of PU turbine umbrella project | • preparation and implementation of individual project<br>• implementation of PE umbrella projects<br>• implementation of PS umbrella projects<br>• preparation of PU turbine umbrella project | • preparation and implementation of individual project<br>• implementation of PE umbrella projects<br>• implementation of PS umbrella<br>• implementation of PU turbine umbrella<br>• preparation of PU panel umbrella project | • preparation and implementation of individual project<br>• implementation of PE umbrella projects<br>• implementation of PS umbrella projects<br>• implementation of PU turbine, panel umbrella projects<br>• preparation of PU box, and spray umbrella project | • preparation and implementation of individual project<br>• implementation of PU panel, box, and spray umbrella projects | • preparation and implementation of PU spray umbrella projects and individual projects<br>• completely phaseout of ODS in this sector by end of 2010 |
| Policy measures | • implementing related policies at national level (see Table 3) | Continue to implement the policies | Continue to implement the policies | Continue to implement the policies | • issue ODS consumption bans in this sector | • implement ODS consumption bans in this sector |
| Technical assistance | • management capacity building for CFC-11, CFC-12 consumption phaseout, including management information system, monitoring system<br>• quality control system for substitute products<br>• safety production system for substitutes products<br>• design and development of phaseout policies<br>• training, education, and promotion of public awareness | same | same | Same | same | Same |

# 3. Industrial and Commercial Refrigeration Sector

3.1 Industrial and Commercial Refrigeration Sector will realize its phaseout through a terminal umbrella project (or sector plan). CFC-11/12 used in new turbine-type refrigeration units will be phased out by 2003 and CFC-11/12 used in refilling practice will be stopped in 2010.

3.2 Major issues for Industrial and Commercial Refrigeration Sector to phaseout ODS consumption:

- Sufficient local supply of HCFC-22;
- Approval and completion of terminal umbrella project or sector plan;
- Completion of second group of projects;
- Technology availability;
- Service sector/recycling;
- Whether enterprises should discount eligible cost calculated according to the principle of MLF for incremental cost when they have inevitable technology upgrade during conversion; and
- Price of alternatives is higher than ODS.

3.3 Current Status:

- As of August 1998, the current status of ODS phaseout in the Industrial and Commercial Refrigeration Sector is given in Chapter II of the CP Update. Current status will be updated here in future updates of the Action Plan.

## Table 7 Policy and Other Actions in the Industrial and Commercial Refrigeration Sector

| **Policies and other actions** | 1999 | 2000 | 2001 | 2002-2005 | 2005-2008 | 2008-2010 |
|---|---|---|---|---|---|---|
| Phaseout measures and approaches | • Preparation and implementation of individual projects<br>• Preparation and implementation of terminal umbrella project | • Preparation and implementation of individual projects<br>• Preparation and implementation of terminal umbrella project or sector plan | • implementation of terminal umbrella project | • implementation of terminal umbrella project<br>• complete phaseout CFC-11/12 in new turbine-type refrigeration units by end of 2003 | | |
| Policy measures | • implement the related national policy (see table 3) | • implement the related national policy | • implement the related national policies | • implement the related national policies<br>• issue new consumption bans on CFC-11/12 consumption | • servicing management policy<br>• enforcement of CFC-12 consumption bans | • servicing management policy |
| Technical assistance | • Management capacity building for CFC-11, CFC-12 phaseout in I & C Refrigeration sector, including management information system, monitoring management system<br>• Quality control system for substitutes<br>• Preparation of safety control system for the conversion<br>• Preparation of servicing management policy<br>• Preparation of necessary policies<br>• Training and promotion of public awareness | Same | same | Same | same | Same |

# 4. Domestic Refrigeration Sector

4.1 Domestic Refrigeration Sector will adopt individual and umbrella projects, and/or sector plans to phaseout CFC-11 and 12 in the industry. In this sector, 40% production of new refrigerators and freezers will be substituted in 1999. 70% production of new refrigerators and freezers will be substituted in 2003, and 100% production of new products will be substituted in 2005. Meanwhile, China will meet part of the servicing demand of refrigerator and freezer with recycled CFC.

4.2 Major issues for Domestic Refrigeration Sector to phaseout ODS consumption:

- Most of substitutes, such HFC-134a, Iso-butane, and cyclo-pentane rely heavily on import because of insufficient domestic supply;
- Service sector / replace refrigerant by transitional substitutes;
- Improvement and enforcement of environmental labeling system;
- Approval and completion of umbrella project; and
- High cost of HFC-134a refrigerant in the market.

4.3 Current Status:

- As of August 1998, the current status of ODS phaseout in the Domestic Refrigeration Sector is given in Chapter II the CP Update. Current status will be updated here in future updates of the Action Plan.

## Table 8 Policy and Other Actions in the Domestic Refrigeration Sector

| **Policy and other actions** | 1999 | 2000 | 2001 | 2002-2005 | 2005-2008 | 2008-2010 |
|---|---|---|---|---|---|---|
| Phaseout measures and approaches | • Implementation the individual projects approved<br>• Preparation and implementation of terminal umbrella projects | • implementation of the individual projects approved<br>• implementation of terminal umbrella projects | • implementation of the individual projects approved<br>• implementation of terminal umbrella projects | • implementation of the individual projects approved<br>• implementation of terminal umbrella projects | | |
| Policy measures | • implementation of related national policies (table 3)<br>• continue to implement environmental labeling policy | • implementation of related policies | • implementation of related policies | • implementation of related policies<br>• issue and enforce bans on CFC consumption in this sector | Servicing management policy | Service management policy |
| Technical assistance | • Management capacity building for CFC-11, CFC-12 phaseout in Domestic Refrigeration sector, including management information system, monitoring management system<br>• Quality control system for substitutes<br>• Preparation of safety control system for the conversion<br>• Preparation of servicing management policy<br>• Preparation of necessary policies<br>• Training and promotion of public awareness | same | same | Same | same | Same |

# 5. Mobile Air Conditioning Sector

5.1 Mobile Air Conditioning Sector (MAC) will adopt sector plan approach to phaseout CFCs in this sector. With approval of sector plan, MAC sector will prohibit use of CFC-12 in all new automobiles from December 31, 2001, and to reduce the uses of CFCs in existing MAC. Any use of CFC after 2009 will be recycled CFC. Phaseout of CFC-11 used in motor vehicles foam will be considered in the foam sector.

5.2 Major issues for MAC Sector to phaseout ODS consumption:

- Supply of substitutes heavily depends on imports;
- Service sector;
- Completion of sector plan;
- High price of HFC-134a; and
- Auto industry needs to accelerate use of MAC with substitute refrigerant.

5.3 Current Status:

- As of August 1998, the current status of ODS phaseout in the Mobil Air Conditioning Sector is given in Chapter II of the CP update. Current status will be updated here in future updates of the Action Plan.

## Table 9 Policy and Other Actions in the MAC Sector

| **Policies and other actions** | 1999 | 2000 | 2001 | 2002-2005 | 2005-2008 | 2008-2010 |
|---|---|---|---|---|---|---|
| Phaseout measures and approaches | • implementation of sector plan approved | • Implementation of sector plan approved | • Implementation of sector plan approved | Implementation of sector plan approved | implementation of sector plan approved | implementation of sector plan approved |
| Policy measures | • implementing related national policies (see table 3) | • continue to implement related policies<br>• enforcement of the policies for bans on using of CFC-12 air conditioners for new cars by end of 2001<br>• to check the enforcement situation for bans on CFCs use in new motor vehicle air conditioners by annual check for vehicles | • continue to implement related policies<br>• Authentication for non CFCs MAC | • service management policy<br>• Monitoring and control for license for new produced cars | • service management policy<br>• Monitoring and control for license for new produced cars | • service management policy<br>• Monitoring and control for license for new produced cars |
| Technical assistance | • capacity building, including management information system, monitoring system<br>• policy design and development<br>• training, education and promotion of public awareness | same | same | same | Same | Same |

# 6. Solvent Sector

6.1 Solvent Sector is finalizing a Solvent Sector Plan for ODS Phaseout to be submitted to the ExCom for consideration. The phaseout plan for CFC-113, CTC and TCA will be on different schedule because of the low ODP level of TCA and its later phaseout targets of the TCA sub-sector, and phaseout for CFC-113 and CTC will proceed first. The target date for CFC-113, CTC and TCA phaseout are 2006, 2004 and 2010 respectively if the sector plan can be approved according to the current schedule. In CFC-113 sub-sector, China will give priority to conversion of large and medium scale consumers (in ODP term) because these enterprises consumed more than 75% of ODP. Phaseout plan for solvent essential uses will proceed separately when technology is available.

6.2 Major Issues for Solvent Sector to phaseout ODS consumption:

- Higher cost of alternative technologies;
- Workable approach is needed to deal with large number of small- and medium-size enterprises;
- Information flow to the enterprises using ODS;
- Substitute technology is more sophisticated than other ODS technology;
- Technical support is needed for SMEs;
- Control import as well as production through quota system; and
- Essential uses.

6.3 Current Status:

- As of August 1998, the current status of ODS phaseout in the Solvent Sector is given in Chapter II of the CP update. Current status will be updated here in future updates of the Action Plan.

## Table 11 Policy and Other Actions in the Tobacco Sector

| **Policies and actions** | 1999 | 2000 | 2001 | 2002-2005 | 2005-2008 | 2008-2010 |
|---|---|---|---|---|---|---|
| Phaseout measures and approaches | • preparation of sector plan | • preparation and implementation of sector plan | • implementation of sector plan | • implementation of sector plan | Complete phaseout by June 3- of 2006 | |
| Policy measures | • continue to implement related policies at national level (see table 3) | • issue and implement consumption quota system for CFC-11 in Tobacco Sector<br>• Bidding system | • implementation of consumption quota system for CFC-11 in tobacco sector<br>• bidding system | • implementation of consumption quota system for CFC-11 in tobacco sector<br>• bidding system | Bans on consumption of CFCs in this sector | |
| Technical assistance | • management capacity building for CFC phaseout of CFC consumption in Tobacco sector, including management information system, monitoring system<br>• phaseout policy design<br>• training, education and promotion of public awareness | Same | same | same | same | Same |

# 7. Tobacco Sector

7.1 China is preparing the Sector Plan for ODS Phaseout in Tobacco Sector. The phaseout plan of this sector will follow the sector plan approved by the ExCom. Current target date for ODS phaseout is June 30, 2006.

7.2 Major Issues for Tobacco Sector to phaseout ODS consumption:

- Technology availability; and
- High equipment price.

7.3 Current Status:

- As of August 1998, the current status of ODS phaseout in the Tobacco Sector is given in Chapter II of the CP update. Current status will be updated here in future updates of the Action Plan.

## 8. Halon Sector

China will follow strictly the Halon Sector Plan for halon phaseout. The plan is under implementation from January 1998.

## 9. Essential Uses Aerosol

China is conducting the study on the Sector Strategy for Medical Aerosol ODS phaseout in China. The action plan for this sector will be updated based on the Strategy developed.

## 10. Service Sector

Phaseout of CFC in service applications is being developed within the three main sub-sector – MAC, Industrial and Commercial Refrigeration and Domestic Refrigeration. The action plans for these three sectors will be revised and detailed plan for service requirements will be prepared. Recycling would reduce the demand for new CFC 12. Given the uncertainty in service demand and supply from recycling programmes, the forecast of CFC-12 production and consumption has not included any allowance for use of recycled CFC. In practice, recycling CFC-12 will reduce demand for new CFC and result in a faster closure of CFC-12 production facilities. The maximum recycling target is about 2,000 tons around 2005/2006. This amount will not essentially offset the cost of CFC-12 phaseout.

## 11. SMEs

Phase out action plans for foam and solvent sectors will require special attention to SMEs. The action plan for SMEs will address sector approach and umbrella projects as proposed. SMEs are characterized as small size with low production technology level and higher production cost. It is difficult for them to find suitable technology to substitute ODS technology at affordable costs. How to develop technologies and approaches suitable for SMEs with lower cost is a major issue. Cost-Effectiveness is worse for SME's, which is somewhat offset by new technologies and umbrella projects to give economic of scale. But, the cost will still be higher for this sub-sector.

## 12. Methyl Bromide

China is conducting the study on the Sector Strategy for Methyl-Bromide Phaseout in China; the action plan for this sector will be updated based on the Strategy developed.

## Table 10 Policy and Other Actions in the Solvent Sector

| Policy and other actions | 1999 | 2000 | 2001 | 2002-2005 | 2005-2008 | 2008-2010 |
|---|---|---|---|---|---|---|
| Phaseout measures and approaches | • Preparation and implementation of sector plan<br>• Gradually close and phaseout the production of CFC-113<br>• Establish solvent phaseout support system<br>• Implementing program for emission reduction of CFC-113 | • implementation of sector plan<br>• Gradually Close and phaseout the production of CFC-113<br>• Establish solvent phaseout support system<br>• Implementing program for emission reduction of CFC-113 | • implementation of sector plan<br>• Gradually Close and phaseout the production of CFC-113<br>• Establish solvent phaseout support system<br>• Implementing program for emission reduction of CFC-113 | • Start to store CFC-113 from 2004 | | |
| Policies | • Implementing national policies (see table 3)<br>• Production quota management system<br>• bidding system for large and medium size users<br>• modify production standards and technical specification to encourage phaseout<br>• establish ODS solvent recycling center;<br>• import control for CFC-113, and TCA<br>• encourage the development, production of substitute | • Production quato and bidding system<br>• Revision of production standards and codes<br>• Import management for ODS based solvent<br>• Incentives for development of substitutes/technologies | • continue to implement the policies | • continue to implement the policies<br>• Bans on consumption of CFC-113 used in solvent sector | | • complete phaseout of TCA production and consumption |
| Technical assistance | • Solvent recycling network<br>• Management capacity building, MIS, monitoring system<br>• Technical standards, and quality control policies<br>• Design and development of phaseout policies<br>• Training, education, and promotion of public awareness | Same | same | same | same | same |