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CHINA'S HALON SECTOR STRATEGY

This document consists of the following three parts:

- Part I - Sector Plan for Halon Phaseout in China (revised)
- Part II - Structure of an Agreement Regarding the Implementation of a Sector Phaseout of Halon in China
- Part III - The Halon Sector: 1998 Annual Program (funding request)

PART I

SECTOR PLAN FOR HALON PHASEOUT IN CHINA

October 20, 1997

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INTRODUCTION

A. Background

1. China joined the *Vienna Convention for the Protection of the Ozone Layer* in September 1989, and ratified the London Amendment of the *Montreal Protocol On Substances That Deplete the Ozone Layer* two years later. Since then, China has been committed to the phaseout of ozone depleting substances (ODS) in accordance with its designation as one of the Article 5 countries classified by the Protocol. On January 12, 1993, the Chinese government approved the China Country Program for Phaseout of Ozone Depleting Substances, and started to implement phaseout actions in China for ODS with the support of the *Multilateral Fund For Implementation of the Montreal Protocol* (MLF).

2. Over the past several years, the government has established a Leading Group for Ozone Layer Protection and its working offices to organize phaseout actions. This group has been responsible for the following phaseout activities: issued a set of regulations to control the production and consumption of ODS; compiled phaseout strategies for all ODS-related sectors; and publicized information about ozone layer protection throughout the country. With support from the MLF, China began to phase out ODS using a project-by-project approach. China has approved and is implementing about 160 specific projects for ODS phaseout; and had closed and converted ODS-related enterprises; and had phased out ODS production amounting to about 6,000 metric tons by 1995.

3. The phaseout approach characterized as 'project-by-project' does play a role in ODS phaseout action in China. However, such an approach has limitations in large, complex, fast-growing economies such as China's. The current method of individual project preparation and approval fails to encourage strategic phaseout and makes potential sector-level savings difficult to capture. Also, absent a policy framework, ODS phaseout project implementation may not translate into sector or national level ODS reductions; especially as projects are implemented in advance of Montreal Protocol phaseout controls. Due to the large number of diverse enterprises in China, phaseout on a 'project-by-project' basis is unlikely to be the most efficient way of meeting the requirements in China for ozone layer protection. Determining the most efficient method of ODS phaseout without imposing too great a burden on a rapidly growing economy is a primary concern.

B. The Sector Approach and Mechanism Study for Halon Phaseout

4. At the Xi'an Workshop on ODS Phaseout Sector Strategies in June 1995, the Secretariat of the Multilateral Fund, as agreed by the Chairman and Vice Chairman of the Executive Committee of the Multilateral Fund (MFEC), put forward the concept of a 'sector approach' with the expectation of improving the efficiency and accelerating the progress of ODS phaseout. In response to this proposal from the Secretariat, the Chinese government acknowledged the benefits of introducing a sector approach, and expressed an interest in implementing this approach, as well as the willingness to explore new, more efficient ways to promote the phaseout action.

5. At its 17th Meeting, the MFEC approved project preparation resources for 'further development by the World Bank of the sectoral strategies.' (Decision 17/35) The Bank had requested these funds on behalf of the Government of China to design a sector-based approach with two primary objectives: (a) to reduce the unit costs of phaseout both to China and to the Multilateral

Fund; and (b) to allow the MFEC to manage the Fund's resources based on actual ODS phaseout performance. The fire protection sector was selected by the Chinese government as the candidate to pilot the sector approach.

6. In terms of ozone depletion potential (ODP), the ODS consumed by the Chinese fire protection sector, halon 1211 and halon 1301, accounts for more than one third of the country's total ODP consumption. From this point of view, phaseout of halon in the fire protection sector is essential for the effective implementation and enforcement of the overall Country Program.

7. Research organized by the National Environment Protection Agency (NEPA), the Ministry of Public Security (MPS) and the World Bank, has been conducted by experts from the Center for Environmental Sciences of Peking University, Tianjin Fire Protection Sciences Research Institute of MPS, China International Economic Consultants, Inc., and the World Bank. The study of a sector phaseout mechanism was finished in May 1996, and a revised Fire Extinguishing Sector Plan for Halon Phaseout in China was developed in June 1996 and reviewed in July-August 1996. A *Sector Plan for Halon Phaseout In China* was submitted on an information basis to the 20th MFEC Meeting (UNEP/OzL.Pro/Excom/20/Inf.3). At its 21st Meeting, the MFEC provided "Initial Guidance To Allow Further Development By China and the World Bank of the Halon Sector Approach Pilot Program Under an Umbrella Agreement." This Sector Plan has been prepared following that initial guidance.

8. The research confirms that adoption of the sector-based mechanism will:

- (a) Improve the comprehensive planning and management by concerned ministries and departments of the government for taking action on an overall phaseout plan;
- (b) Improve the implementation of economic incentive instruments;
- (c) Reduce the uncertainty of halon phaseout;
- (d) Improve the efficiency of resources from MLF; and
- (e) Achieve the overall phaseout strategy for halon.

C. Principles and Contents of the Plan

9. This sector phaseout plan has been established on the basis of the Chinese Government's obligations undertaken under the *London Amendment* of the *Montreal Protocol on Substances that Depleting the Ozone layer*, the *Vienna Amendment* of the Protocol, and the *Chinese Country Program on Substantially Phasing Out Ozone Depleting Substances*, and also taking into account the related provisions of the *Copenhagen Amendment* of the Protocol. The plan also accommodates the specific characteristics of the national economic and social development plan and strategy, and the specific development plan for the fire protection sector. The technical support documents of the phaseout plan are consistent with MLF's principles and guidelines, as well as related documents about incremental costs. This sector plan revises China's June 1995 report *Halon Phaseout Strategy for Fire Extinguishing*.

D. Principles

10. The fire protection capability of China must not be jeopardized by the phaseout of halon.
11. MLF should supply the level of eligible funds required to finance the phaseout and facilitate the transfer of the alternative technologies required for the phaseout of halon.
12. On the assumption that MLF approves the sector plan and disburses funds on time according to the annual plan, the Chinese government commits to implement the halon phaseout, and comply with the overall targets and annual targets determined in the Fire Extinguishing Sector Plan for Halon Phaseout in China.
13. The Chinese government will phase out halon in a cost-efficient way.
14. The Chinese government will engage an experienced management institution and set up a reasonable mechanism for managing and implementing the halon phaseout; issue and implement necessary regulations and policy instruments; ensure provision of technical support; and implement related publicity and educational activities.
15. As implementing agency for the halon sector phaseout plan, the World Bank will be responsible for appraising, endorsing and supervising the overall program through an umbrella agreement.

E. Content

16. Based on a comprehensive investigation of halon production and consumption in China and a careful analysis of past phaseout experiences are presented in chapter one including policy and other phaseout actions to date. Chapter two discusses proposes essential policy actions and supporting instruments that would be adopted upon approval by the MFEC of this sector plan. Based on results from a cost model, chapter three explains the total incremental costs to China of halon phaseout and the eligible costs requested from the MLF. A detailed action plan for the first implementation period (through 1998) in accordance with the selected halon phaseout schedule is specified in chapter four. Finally, in chapter five, the management mechanism, including monitoring, evaluation and reporting provisions are defined to ensure full implementation of the plan.

F. Announcement

17. The implementation of this Sector Plan for Halon Phaseout in China will not affect the implementation of the projects that have already been approved. Moreover, the sector plan takes into account the halon projects already approved by the MFEC to avoid double counting.
 18. The Sector Plan for Halon Phaseout in China is specifically targeted for the fire protection sector. The phaseout methods, cost analysis methods adopted by the plan can only be considered as references to other ODS-related sectors, and cannot be used as models or prerequisites in the ODS phaseout action of other sectors or other countries.
 19. The financial mechanism proposed for the phaseout of halon will apply only to the sector-based phaseout activities implemented through the World Bank.
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I. CURRENT STATUS OF THE FIRE PROTECTION SECTOR AND OVERALL STRATEGY FOR HALON PHASEOUT

A. Sector Background

1. Adequate and cost-effective fire protection is an important contributor to sustainable economic development. In order to provide an adequate level of fire protection, the Chinese government has been promoting the development and production of fire protection equipment, and developing and establishing production quality control systems and regulations concerning fire protection standards. However, because of rapid economic growth it has been a strain for the development of fire protection capacity to keep pace with domestic demand, particularly in relation to international standards. Under these circumstances the accelerated elimination of halon from the Chinese fire production industry is a particularly burdensome undertaking, requiring substantial financial and technical resources.

B. Management of the Fire Protection Sector

2. The Ministry of Public Security (MPS) is responsible for overall planning and management of fire protection equipment, including research and development and production activities. According to the *Fire Protection Code (Regulation) of People's Republic of China*, MPS is responsible for organizing, compiling and revising technical standards of the fire protection and production plan of fire protection equipment; and enforcing the monitoring, publicity, education, training and research activities related to fire protection.

C. Production and Consumption of Extinguishing Agents and Fire Extinguishing Equipment

3. There are approximately 470 factories involved in the production of fire protection agents, extinguishers and extinguishing systems in China (of which 117 factories are producing chemicals, 320 are producing extinguishers, and 33 are producing extinguishing systems). The enterprises producing chemicals can produce BC and ABC powder, foam, CO₂, and halon 1211 and halon 1301; the extinguisher enterprises produce hand-held and wheeled extinguishers using these chemicals; and systems enterprises produce water sprinkler systems, steam systems, and systems using halon 1211, halon 1301, foam, powder and CO₂. In 1995, the total production of extinguishing chemicals in China was approximately 72,000 tons.

4. Past trends in production and consumption can be established only in approximate terms, since systematic data have not been collected by the authorities. Surveys conducted by MPS over the past few years have improved the coverage of reporting and the accuracy of production and consumption data. However, it is likely that data for 1994 and 1995 represent more complete coverage of the industry than the figures for earlier years. Production and consumption are given in Table 1-1; consumption in extinguisher production is in Table 1-2; and consumption in fixed system production in Table 1-2.

TABLE 1-1: PAST PRODUCTION AND CONSUMPTION OF AGENTS (MT)

	1991	1992	1993	1994	1995	# of producers (1995)
Halon 1211						
Production Capacity					17,800	
Actual Production	4,144	7,767	10,848	14,294	12,338	14
Import	0	0	0	0	0	
Export	0	0	0	0	1,400	
Domestic consumption	4,144	7,767	10,848	14,294	10,938	
of which use for:						
new extinguishers	4,051	7,043	9,581	12,540	9,350	
new systems	0	432	626	689	705	
service	93	291	641	10645	883	
ABC Powder						
Actual Production	0	0	800	1,500	2,000	5
Domestic Consumption	0	0	800	1,500	2,000	
of which use for:						
new extinguishers	0	0	800	1,500	2,000	
servicing	0	0				
CO₂						
Actual Production	0	0	200	500	500	
AFFF						
Domestic Consumption	0	0	500	1,000	1,000	3
BC Powder						
Domestic Consumption	21,691	23,421	26,619	33,433	39,727	50
Foam						
Actual Production	10,737	11,594	13,176	16,550	19,665	36
Domestic Consumption	10,737	11,594	13,176	16,550	19,665	
of which use for:						
new extinguishers	1,627	1,757	1,996	2,508	2,980	
new systems	9,110	9,837	11,180	14,042	16,685	
Halon 1301						
Production Capacity					1,000	
Actual Production	50	68	120	540	750	1
Import	40	50	NA	NA	NA	
Export	0	0	0	240	450	
Domestic Consumption	90	118	120	300	300	
of which use in:						
new extinguishers	0	0	0	0	0	
new systems	82	110	110	280	277	
service	8	8	10	20	23	

Note: Domestic consumption = Production + Import - Export. Domestic consumption includes consumption of agent for extinguishers, extinguishing systems and servicing (retirement and refilling).

5. From 1991 to 1995, total chemical use in fire protection nearly doubled, reflecting the rapid growth in the Chinese economy and improved fire protection quality. However, the level of fire protection in 1995 is well below international standards, particularly considering that much of BC and ABC powder has low product quality. The main market for chemicals is in extinguishers with 74 percent of the market share.

6. In 1995, the predominant fire protection chemicals produced were BC powder, 39,727 tons or 53 percent, and halon 1211, 12,338 tons or 16 percent of total production, respectively. However, in terms of fire extinguishers, halon 1211 covered 26 percent of the market with BC powder at 65 percent. BC powder is favored due to low cost, and halon 1211 because it is easy to handle, low hardware requirements and its versatility in many applications. Other chemicals

have only recently been introduced but all face marketing problems due to high cost and/or product quality considerations. Halon 1301 use has increased recently.

7. The average annual growth rate for fire protection between 1991 and 1995, according to the figures in Table 1-1, was 18 percent. However, taking into account the changing data coverage over time, it is estimated that underlying growth rate was approximately 15 percent per annum (i.e., early 1990 production and consumption figures were likely higher than reported).

TABLE 1-2: AGENTS CONSUMED IN NEW EXTINGUISHERS (MT) AND NUMBER OF EXTINGUISHERS PRODUCERS ('000 IN BOLD)

Extinguisher Type	1991	1992	1993	1994	1995	# of manufacturers (1995)
Halon 1211 agent consumed extinguishers produced	4,051 2,025	7,043 4,321	9,581 5,630	12,540 7,449	9,350 5,390	72
ABC powder agent consumed extinguishers produced	0 0	0 0	800 267	1,500 500	2,000 667	
CO ₂ agent consumed extinguishers produced	0 0	0 0	200 33	500 83	500 83	
AFFF agent consumed extinguishers produced	0 0	0 0	500 63	1,000 125	1,000 125	
BC powder agent consumed extinguishers produced	21,691 7,230	23,421 7,807	26,619 8,873	33,433 11,144	39,727 13,242	
Foam agent consumed extinguishers produced	1,627 542	1,757 586	1,996 665	2,508 836	2,980 993	
Total Agents: agent consumed extinguishers produced	27,368 11,424	32,221 12,714	39,696 16,056	51,481 20,947	52,776 20,500	

Note: Data are indicative: calculations are based on the 1995 survey for non-halon and 1997 survey for halon and estimates by MPS

TABLE 1-3: AGENT CONSUMED IN EXTINGUISHING SYSTEMS (MT)

	1991	1992	1993	1994	1995
Halon 1211	0	432	626	689	705
Halon 1301	82	110	110	280	277
Foam	9,110	9,837	11,180	14,042	16,685
Total	9,192	10,379	11,916	15,011	17,667

Note: Figures on Halon 1301 fire extinguishing systems do not include halon imported in systems. A large number of halon fire extinguishing systems have been imported as part of joint venture projects and in special risk areas such as the oil and gas, power sector, telecommunication.

D. Analysis of halon enterprises

8. **Enterprises producing halon.** In 1994, China had 23 factories capable of producing halon 1211 and one producing halon 1301, including both state-owned and township-owned¹. The factories range in size from very small, with production of less than 100 tons a year, to plants able to produce several thousand tons. Based on detailed surveys information received from all halon 1211 producers, the enterprises, based on profit-rate, actual production and expected plant life may be divided into two groups: large plants with production of 2,000 tons or more per year and medium to small plants those with production is under 2,000 tons per year. Most plants were established between 1986-1989, but due to better equipment and greater investment in maintenance at the two large facilities, their plant life is expected to be about five years longer than that of the small facilities (average remaining life for large plants is 13 years, whereas it is eight years for small plants). Also, due to superior technical processes, distance from raw material suppliers, and economies of scale economies of scale, large plants enjoy a higher profit margin than the smaller ones.

9. Of the 23 factories capable of producing halon 1211, 8 factories, largely at the small end of the capacity spectrum, have already closed with support from the Chinese government, and the halon unit at Tongxiang fertilizer factory was closed and its equipment demolished in 1995, subsequently receiving compensation for labor displacement through the MLF. Before 1995, there were 14 factories in operation and none of them are located in tax free zone. Afterwards, Chinese government called for ODS phaseout and mobilized five enterprises to gradually stop production of halon, but the production lines remain as these five factories await compensation following approval of funding for this sector plan. To date, there are 9 factories in operation, with production in 1995 of 12,338 tons of halon 1211 and in 1996 of 11,823 tons of halon 1211². The Government of China has agreed to use the previously reported 1995 baseline production figure of 9,950 as the basis for funding compensation. The single halon 1301 factory produced 750 tons of halon 1301 in 1995. Exports of both halon 1211 and 1301 have grown recently in response to the halt in production in developed countries in 1994 (See Table 1-1). The size distribution of

¹ All halon producing plants in China are Chinese owned and none are located in tax-free zones.

² The "Halon Phaseout Strategy for Fire Extinguishing" (1995 Halon Strategy) presented in Xi'an in June 1995 lists production at 12 of the 23 halon producers. There were, in fact, 14 still producing halon extinguishers in 1995. In addition, halon 1211 production capacity, due to confusion over definition, was significantly underestimated in the 1995 report.

enterprises producing halon 1211 and their share of total production are shown in Table 1-4.

TABLE 1-4: ENTERPRISES PRODUCING HALON EXTINGUISHING AGENT IN 1995

	Small-Medium	Large	Total
Enterprise size (according to production)	< 2,000 tons	>1,999 tons	
Number of enterprises	12	2	14
Production	6,416 tons	5,922 tons	12,338 tons
Share of production percent	52 percent	48 percent	100 percent

10. **Enterprises Producing Halon Extinguishers.** In 1994, there were 83 factories producing halon extinguishers in China, including both state-owned and township-owned³. They range in size from small plants capable of producing ten thousand extinguishers, to factories with a capacity of up to half a million units. Within the 83 factories, nine factories, again chiefly small plants, have already closed with support from the Chinese government, and a further two have converted with MLF support. Thus, by 1996 there remained 72 factories requiring further conversion or closure assistance. These 72 enterprises produced a total of 5,390,000 units of halon 1211 extinguishers and consumed 9,350 tons of halon 1211 in 1995.⁴ The sector phaseout plan considers only the remaining 72 enterprises. The size distribution of halon extinguisher enterprises and their share of total production are shown in table 1-5. The table illustrates the typical small scale of production in China.

TABLE 1-5: ENTERPRISES PRODUCING HALON 1211 EXTINGUISHERS IN 1995

	Small	Medium	Large	Total
Enterprise size (according to production)	0-20,000 units	20-75,000 units	above 75,000 units	
Number of enterprises	20	25	27	72
Production (units)	297,000	1,342,000	3,751,000	5,390,000
Halon Consumption (Tons)	514	2,328	6,508	9,350
Share Of Production percent ^{1/}	5.5 percent	24.9 percent	69.6 percent	100 percent

^{1/} In terms of halon consumption

11. **Current enterprises producing halon extinguishing systems.** China uses two different types of halon fire extinguishing systems. One consists of "stand-alone-cylinders" with typically 10 kg to 35 kg of halon 1211, each cylinder is individually sprinkler head activated. This type of system is normally produced by extinguisher manufacturers. The second type are larger extinguishing systems with centralized storage of halon, a distribution network of steel pipes and nozzles, and either a manually operated activation system, and/or activation through an automatic fire detection system. In 1995, there were 22 factories producing the second type of halon

³ All halon fire equipment producers are Chinese owned and none are located in tax-free zones.

⁴ The "1995 Halon Strategy" projected 1994 extinguisher production to reach 4,230,000 units, however, actual production was only 3,570,000 units in 1994. The amount of halon consumed in new extinguishers for 1992-94 was also over estimated in the 1995 Halon Strategy due to incorrect assumptions about the average size of halon extinguishers being produced.

extinguishing systems in China, including both state-owned and group-owned plants⁵. 705 tons of halon 1211 were consumed in new halon 1211 system installations, and new halon 1301 systems consumed 277 tons of halon 1301. In 1995, 883 tons of halon 1211 were consumed for servicing.

12. **Import and export of halon extinguishers and agents.** Currently, China does not import halon extinguishers and agents, and does not export halon extinguishers. In 1995, China exported 1,400 tons of halon 1211 and 450 tons of halon 1301 to Article 5 countries in South East Asia, Latin and South America, the Middle East and West Asia. Halon 1301 fire extinguishing systems have been imported directly, but no data are available on number of systems or quantity of halon.

E. Forecast of Fire Protection Needs

13. The fire protection industry in China has grown rapidly in the recent past, paralleling the growth of the economy, investment, construction and real estate. In view of statistical weaknesses in the historical data for fire protection equipment production, it is difficult to establish a strong and reliable correlation in China between the growth of fire protection and any other variables as a basis for making demand projections. This is partly because the production data for agents and extinguishers prior to the past couple of years are considered to be incomplete, and partly because there was some suppressed demand in the past because of supply shortages and effective restrictions on imports. As previously noted, despite statistics showing average annual growth of 18 percent, the underlying growth rate was more likely about 15 percent per annum from 1991-95.

14. In view of this historic growth rate, a demand projection has been made considering: (a) Chinese requirements in present codes and standards for fire extinguishers and systems; and (b) current economic developments in China. Over time, it is expected that China's growth rate of fire protection will increasingly be determined by the rate of growth of the economy in general. However, for several more years, it is anticipated that fire protection growth will continue at a level above that of the economy, because there remains a strong element of "catching-up" in the industry, especially as regulation and monitoring improve. The overall projection of growth of fire protection is based on the following considerations:

- (a) China is a developing country that has been experiencing rapid growth—annual average GDP growth of 12 percent between 1991 and 1995. It is anticipated by the Bank and other economic observers that growth will continue to run at least at 10 percent per annum until 2000, although the government's own target outlined in "the Ninth Five-Year Plan and Outline Objective for 2010 for the Chinese Economy" is for growth of 8 percent per annum between 1996 and 2000.
- (b) according to the "Chinese Statistical Yearbook", building area has been growing at 14 percent per annum between 1991 and 1995, propelled by rapid growth in major urban areas and special economic zones. Although new starts on commercial construction in major urban areas are reported to have declined in the last year, there remain large

⁵ All halon system manufacturers are Chinese owned and none are located in tax-free zones.

projects underway which will maintain the growth for fire protection for several years, and it is believed that slowdowns in new construction in some areas are being offset by diversification of investments to new areas. Thus, it is expected that growth of commercial construction will continue at close to historical levels for several years;

- (c) following several significant fire disasters in China between 1993-95, MPS adopted stricter codes and standards which increased fire equipment requirements per square meter of occupied building space. Enforcement of these codes in existing buildings has also contributed to demand pressures and is expected to continue for several more years.
- (d) the annual average growth rate of halon 1211 and halon 1301 consumption between 1991 and 1995 was 21 percent and 36 percent, respectively, reflecting consumer and producer preference for what has been a low-cost and convenient fire protection agent; and
- (e) servicing needs for and annual retirement of the existing stock of extinguishers and systems have been at low levels in the past, according to the limited statistics available. However, they are likely to increase, both as the stock increases and as regulation governing inspection and servicing are applied more consistently.

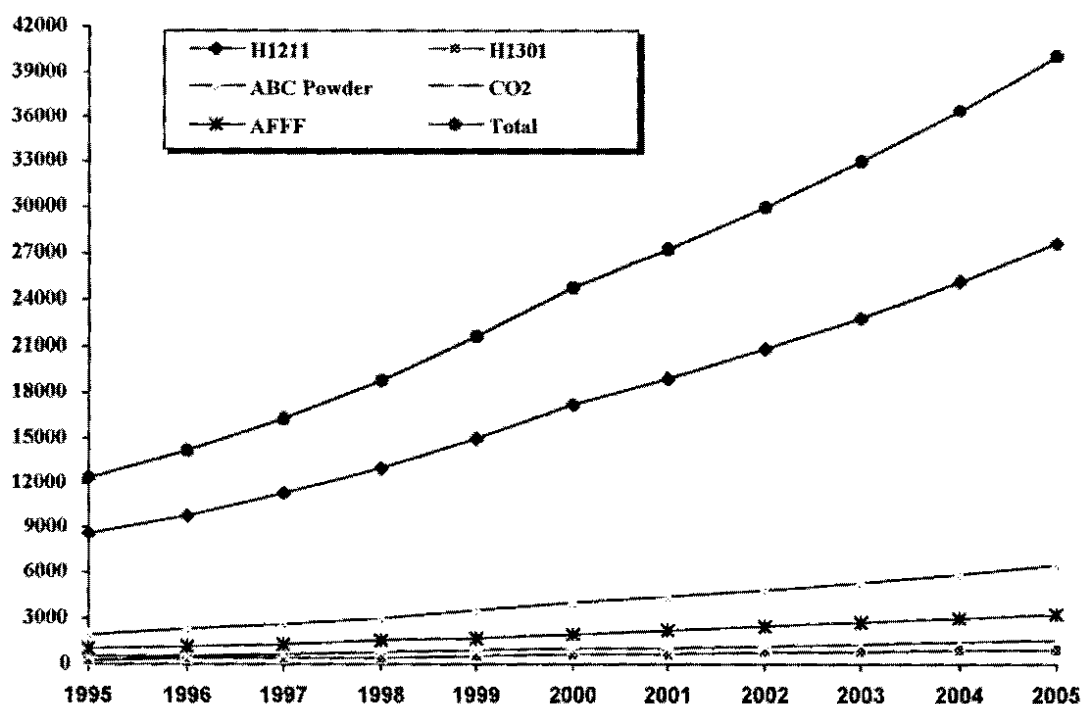
15. The demand projection shown in table 1-6 and figure 1-1 has been constructed on the basis that the aggregate growth of fire protection (expressed in terms of extinguishing agent) will continue at the current rate of 15 percent. After 2000, overall fire protection, including halon, is assumed to increase at 10 percent per annum.

16. The demand projection assumes that the structure of the market will resemble that prevailing in 1995. In other words, the future growth rates of all forms of fire protection are assumed to be identical. The data in table 1-1 indicate that the growth of halon extinguishers and systems has tended to outpace the overall growth of the market, because of the advantages of halon-based fire protection perceived by consumers. As a result, halon has developed a large market share in China (over 20 percent), by international standards, and it is assumed that without more aggressive phaseout activities, halon would at the very least continue to maintain its market share.

TABLE 1-6: DOMESTIC CONSUMPTION FORECAST OF HALON EXTINGUISHING AGENT AND ITS SUBSTITUTES UNDER UNCONSTRAINED CONDITIONS (TONS)

Year	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Halon 1211	8,550	9,833	11,307	13,003	14,954	17,197	18,917	20,809	22,889	25,178	27,696
Halon 1301	300	345	397	456	525	603	664	730	803	883	972
ABC	2,000	2,300	2,645	3,042	3,498	4,023	4,425	4,867	5,354	5,890	6,479
CO ₂	500	575	662	760	875	1,006	1,106	1,217	1,339	1,472	1,620
AFFF	1,000	1,150	1,323	1,521	1,749	2,011	2,212	2,434	2,677	2,945	3,239
Total	12,350	14,203	16,333	18,783	21,600	24,840	27,324	30,057	33,062	36,369	40,005

FIGURE 1-1: DOMESTIC CONSUMPTION FORECAST AS A GRAPH



F. Development of the Halon Phaseout Program

17. **The management structure for halon phaseout.** In order to implement the Protocol, a "Leading Group for Ozone Layer Protection" was established in China, with membership of approximately 20 ministries and commissions. NEPA and MPS are the supervisory and regulatory agencies, respectively, for halon phaseout. NEPA is responsible for the daily management of ODS phaseout. MPS has set up "The Leading Group for Halon Conversion for China's Fire Protection Sector," and is responsible for the organization and implementation of halon phaseout.

18. **Implementation of halon phaseout.** China has already introduced a range of measures related to the fire protection industry and for the use and control of agents used in the industry.

The proposed sector plan builds on action already taken by to control halon 1211 production, including a freeze on the setting up of new halon producers and shutdown of nine existing halon 1211 production facilities. Halon phaseout policies to date have included:

- In 1990, MPS, the Ministry of Electronic Industry, and the Industrial and Commercial Administration jointly issued a *"Circular on a Temporary Halt to the Establishment of New Production Sites for Fire Extinguishers, Fire Extinguishing Agents, and Fire Engines"*;
- In 1991, MPS introduced a production permit system for halon agent and halon extinguishers and issued a circular stipulating that applications to establish new enterprises for halon agent production and halon servicing enterprises would not be approved;
- On November 11, 1994, MPS and NEPA jointly issued a *"Circular on bans of new installations of halon extinguishers for non-essential use"*;
- In 1995, the Fire Protection Agency under MPS issued a *"Circular on Implementing the 'Circular on bans of new installations of halon extinguisher for non essential use'"; and*
- In July 1996, MPS issued a *"Circular for Promoting the Application of Halon Substitutes."*
- (F) In addition, several national level publicity conferences have been held in Fujian, Guangdong, Zhejiang, Liaoning and other provinces.

19. These policies are intended to accelerate halon phaseout in China in advance of Montreal Protocol controls. The impact of these policies on future halon growth and possible reductions is expected to relate directly to availability of MLF technical and financial support for phaseout. To date, these policies have resulted in actual halon phaseout due to MLF support for an ABC powder plant, conversion of two large halon extinguishing facilities, and the closure of Tongxiang for which the MLF provided compensation for labor displacement. In fact, the phaseout achieved through these MLF supported projects is expected to have allowed China to freeze halon consumption in 1996 to 1995 levels of production. However, additional support would be needed to prevent future growth and complete halon phaseout ahead of Montreal Protocol controls.

20. Table 7-1 summarizes the funding for and impact of the fourteen halon phaseout projects in China which have received MLF support (excludes \$730,000 portion of Tongxiang closure which was canceled). Further to these actions, China has supported the closure of eight halon

agent producers and nine halon extinguisher manufacturers. The total cost to China of these closures is estimated to be US\$ 6.5 million⁶

TABLE 1-7: PREVIOUSLY APPROVED MLF PROJECTS FOR THE HALON SECTOR IN CHINA

	ODP phased-out*	Fund allocation
Investment projects:		
Halon fire extinguisher conversion:	2,980 MT ODP	US \$ 1,241,000
Production closure/substitute	(1,200 MT ODP)	US \$ 1,005,000
(not included in total below)		
Recovering and recycling projects:	200 MT ODP	US \$ 1,161,000
Technical assistance/demonstration:		US \$ 762,000
Project Preparation (excluding \$350 for sector approach):		US \$ 200,000
Total	3,180 MT ODP	US \$ 4,369,000

* The ODP for halon 1211 is 3.0

21. Total phaseout cost of halon sector actions to date are summarized below:

China-funded closure actions	US\$6,500,000
MLF funded actions	US\$4,369,000
<u>China-funded portion of Tongxiang Project</u>	<u>US\$ 730,000</u>
Total (rounded)	US\$11,600,000

22. Funding requested through this proposal is to achieve additional phaseout and avoid double-counting. Funds are not being requested to close down production capacity equal to that of the Beijing ABC powder plant financed with an MLF grant. Absent halon reduction measures to comply with the Montreal Protocol, domestic consumption of halon would have grown on average by about 15 percent annually. Thus, unconstrained growth between 1993 and 1996 would likely have seen halon 1211 production increase from 10,848 tonnes to about 16,500 tonnes. However, due to phaseout efforts supported in part by the MLF, actual production in 1996 was limited to 11,823. Though production grew significantly between 1993 and 1994, it has been declining since that time. Thus, the investment in the ABC powder plant, which began producing in 1996, was offset by about 4,700 tonnes of avoided halon 1211 production (over 14,000 ODP tonnes).

23. Not only has China been able to limit total halon growth to 9 percent over the last three years, closure of the 8 halon 1211 production facilities by China took 3,600 ODP tonnes actual production capacity off-line. In addition, the MLF only provided labor compensation for the closure of Tongxiang's 1,200 ODP MT capacity. Finally, Despite new data which indicate that actual production of halon 1211 in China in 1996 was close to 12,000 tonnes and exceed 12,000 tonnes in 1995, The Government of China has agreed to base its incremental cost request on the

⁶ Based on an aggregate cost estimate of US\$2/kg halon (US\$0.66/kg ODP) for the closures of the eight halon production and nine halon extinguisher enterprises described in paras 8 and 9 and assuming that production would have increased to 13,200 tons in 1997 if no action had been taken. These are the estimated incremental costs to the Chinese economy: Actual costs of these closures have not been calculated.

previously reported 1995 baseline of 9,950. Thus, in the first year of implementation, China will be phasing out an additional 2,000 tonnes (6,000 ODP) per year of actual production and consumption without compensation from the Multilateral Fund. Together, these measures ensure that the costs to date are treated as "sunk costs" and that the MLF is not paying for closure of halon capacity or production that was offset by the Beijing ABC plant it financed.

G. Phaseout Strategy for Halon in the Extinguisher Sector

24. The phaseout strategy has been established on the basis of review and analysis as well as the forecast for extinguishing agent, extinguishers and system's production and consumption.

25. **Strategic Objective for Phaseout.** In accordance with the provisions of the Montreal Protocol and the Country Program, the Chinese government has determined that the fire protection sector will phase out halon 1211 production by January 1, 2006, and phase out halon 1301 production (which constitutes about 5 percent of total production) by January 1, 2010. By 2002, halon 1211 production would be reduced to 1,990 tons to cover the demand for servicing and refilling of existing equipment only.

26. **Phaseout Process and schedule.** Since halon possesses large ODP values, the Chinese government has, based on cost analysis presented in chapter three, decided to phase out production and consumption within the shortest feasible period of time as this will result in the lowest unit cost of halon phaseout. The plan is to reduce halon 1211 production and consumption by 60 percent by 2000, reduce an additional 20 percent by 2002, and then complete phaseout by Jan 1, 2006. Halon 1301 production and consumption would be frozen at 1995 levels and then phased out beginning in the year 2001. (Details of halon phaseout schedule and action plan are found in chapter 4.)

27. Principles for Selecting Alternative Technologies and Substitutes

- Selected halon substitute technologies and substitutes must not be harmful to the ozone layer and have an equivalent fire extinguishing capacity;
- Quality of substitutes must meet safety requirements for fire protection;
- Production of substitutes must meet Chinese demands for clean and general extinguishing agents;
- Need to balance extinguishing agent substitutes with market demand based on extinguishing properties.

28. **Alternatives.** Based on China's situation, halon will be kept in essential uses until substitutes that are equal to halon are developed. Based on the selection principles noted above, alternative agents to replace halon in non-essential will be selected from:

- ABC powder, CO₂ and AFFF for new fire extinguishers; and
- CO₂, HFC-based and nitrogen-based fire fighting agents, and possibly water mist for

new fire protection systems (until more suitable alternatives are available).

29. **Ratio of Alternatives.** According to the projections of market demands for extinguishers and information from the extinguisher manufacturers, the Chinese government has concluded that clean agent extinguishers will account for 15 percent of the total extinguisher market as halon 1211 is phased out. (Halon 1211, a clean agent, currently comprises 26 percent of the extinguisher market.)⁷ As a percentage of the total fire extinguisher market, 15 percent clean agent is consistent with Europe and the USA market demand. The MFEC also indicated its support for a post-conversion ratio in the fire extinguisher sector of 85 to 15 percent at its 18th Meeting (Decision 18/4).

H. Phaseout Measures

30. In order to bring about the phaseout of halon 1211 and halon 1301 under this sector plan, China would adopt the following measures:

- (a) Enterprises producing halon 1211 and the halon 1301 manufacturer will be closed in line with the phaseout schedule;
- (a) Manufacturers of halon extinguishers will be closed or converted to the production of non-halon extinguishers⁸;
- (c) Manufacturers of halon 1211 and 1301 extinguishing systems will be converted to the production of non-halon systems;
- (d) Service stations for extinguishers will be equipped to service and refill ABC powder, CO2 and AFFF fire extinguishers;
- (e) Halon extinguisher service stations will be equipped with recovering and recycling equipment to limit emissions during servicing and to capture halon from retired extinguishers;
- (f) A halon bank will be established to meet demands for essential uses of halon as production is phased out;
- (g) Enterprises for producing substitutes for halon 1211 and 1301 in sufficient quantities to satisfy market demands will be established and substitutes will be promoted;
- (h) Campaigns will be organized to promote the halon phaseout program and the need for production and use of alternative agents;

⁷ Incremental cost calculation for extinguisher conversion is based on previously reported figure of 22% halon coverage.

⁸ Of the 83 halon extinguisher manufacturers, nine have been shut down as part of China's halon phaseout strategy. Of the 72 remaining enterprises, the incremental cost request in this proposal assumes that 20 would close and the balance would convert.

- (i) Technical standards and codes will be designed for substitutes, particularly to develop a system of quality control;
- (j) Policies and regulations to support the phaseout plan will be designed and introduced;
- (k) A licensing system for halon imports and exports will be set up; and
- (l) An effective monitoring and enforcement system including a management information system (MIS) will be introduced to ensure the achievement of the phaseout plan.

II. CHINA'S POLICIES FOR HALON PHASEOUT IN ITS FIRE EXTINGUISHING SECTOR

A. Necessity for China to Implement Policies For the Halon Phaseout

31. Because of the campaign launched by China's government for ozone layer protection and also the implementation of projects supported by MLF, producers of halon agent and halon fire equipment acknowledge that halon is to be phased out. However, there exist obstacles to the phaseout process, including: consumer preference for halon-based fire protection equipment; the profitability of halon agent and extinguisher production; the costs of closing halon production lines including labor displacement costs, dismantling equipment and investing in substitutes that currently display lower profitability and consumer resistance; and the need of many existing enterprises for capital investments and technical assistance for conversion. Thus, in addition to financial support from MLF, achievement of the phaseout requires government policies that alter final consumers' and enterprises' incentives; transfer of technology for suitable substitutes and alternatives; training and re-deployment of workers; and technical assistance.

B. Policy Objectives

32. According to the Country Program, the general objectives of policies that support and promote the phaseout of halon are: to establish an integrated policy system to provide effective support for China's halon phaseout process; to ensure total phaseout of the production of halon 1211 in China by 2006 and halon 1301 by 2010; to promote and ensure production of alternatives and substitutes to meet the rapidly growing demand for fire protection; and to ensure the safety of fire protection systems in China.

33. Because the program for halon phaseout links production and consumption, the specific policy objectives under this sector plan are as follows:

- (a) To limit the demand for halon extinguishers and system by extending and enforcing bans on new installations for non-essential uses and thereby to control and reverse trends in increased consumption of halon. This policy seeks to reduce halon production by constraining the market for halon based extinguishers and systems;
- (b) To limit and control production and supply of halon agent and to manage imports and exports of halon. This policy seeks to control directly the production of halon agents and to reduce the supply of halon available to producers of extinguishers and systems;
- (c) To increase the demand for halon alternatives and substitutes by encouraging production and use of halon alternatives and substitutes, improving their quality, and altering consumer preferences;
- (d) To control production of halon extinguishers and systems by encouraging the closure or conversion of halon extinguisher and system enterprises; and
- (e) To establish halon banks to ensure that demands for essential uses of halon are met

after the phaseout of halon production, and to destroy and dispose of halon through the adoption of appropriate technology.

C. Policy Framework and Enforcement Mechanism Design

34. **Principles for Policy Design.** The basic principles are:

- (a) To be consistent with the characteristics of the halon sector in China and the nature of recent reforms of the economic system, including the modifications of enterprises behavior within the context of a transition from a planned to market economy;
- (b) To ensure the practicality and feasibility of implementing policy instruments and possibility of monitoring and management;
- (c) To learn from the experiences of other countries; and
- (d) To create a balance between economic efficiency and equity.

35. **Policy Framework.** Based on the above objectives and principles, China will introduce additional policy instruments to ensure the achievement of a cost-effective halon phaseout. The policy instruments designed include command and control measures, as well as economic incentives and voluntary agreements.

36. The policy package which will be introduced through this sector plan has, as its central pillars, the control of production and supply of halon agents on the one hand, and the conversion of enterprises producing halon extinguishers and systems on the other. From the point of view of policy control, both control of halon demand and supply are required to achieve cost-effective halon phaseout and maintenance of fire protection.

37. **Supply-side Policy.** A permit and tradable production quota system is the key instrument in the policy framework that will be adopted upon approval of this sector plan. It will reduce the uncertainty for implementing the halon phaseout strategy. The quota system will be complemented by availability of grants that will encourage enterprises to phase out through a bidding scheme. An import and export licensing system will also be studied in the first implementation year. Based on the conclusions of the feasibility study proposed for 1998, China will introduce an import and export licensing policy which would require licensing of all imported and exported halon. The license policy would aim to strictly control any illegal import or export of halon.

38. **Demand-side Policy.** The major instrument will be bans on new installations of halon extinguishers for non-essential uses and periodic modification of the definition of non-essential areas. As noted in chapter 1, a circular banning new installations of halon in non-essential uses took effect in 1995. However, its effectiveness will depend on aggressive enforcement. This sector plan, when approved by the MFEC, is expected to provide sufficient compensation to affected enterprises making possible more rigorous enforcement of the non-essential use bans. In

this way, the scope of the market for halon-based fire protection will be narrowed.

39. Public education and related training and technical assistance are important supporting instruments for control of halon production and consumption. Therefore, implementation of all policies adopted as part of this sector plan will include design and implementation of public education and training programs.

40. China's policy framework for ensuring halon phaseout is summarized in Table 2-1 on the following page. (This timetable is based on prompt financial assistance from MLF beginning in 1997. Delays in financial assistance would delay the program.)

D. Description of Policy Instruments

41. **Ban on New Installations of Halon Extinguishers for Non-Essential Uses and its Adjustment over Time.** On November 11, 1994, MPS and NEPA jointly issued a "Circular on New Installations of Halon Extinguisher for Non-Essential Uses." This circular identifies three general categories with 51 specific areas of non-essential use. The three general categories are: the civil buildings which include the cinemas, ordinary hotels, hospitals ect.; the transportation which includes the trains, cars ect.; the industrial buildings which include the cement storehouse, cereal processing workshop, ect. The circular introduces the following restrictions: (a) all new installations of halon extinguishers are forbidden for non-essential areas; (b) enterprises without a permit are not allowed to produce halon agent and halon extinguishers; and (c) local fire protection monitoring agencies have no right to process applications for production permits for halon agent and extinguishers. It also calls attention to the need for producing and using halon substitutes. This circular took effect on October 1, 1995. On October 12, 1995, MPS also issued a "Note for Implementing the Circular on New Installations of Halon Extinguishers for Non-Essential Use."

42. This policy is monitored and supervised jointly by MPS and NEPA, and local (provincial level). Fire Fighting Agencies and Environmental Protection Bureaus are involved in the monitoring system.

Table 2-1. Policy Framework for Halon Sector Phaseout

Objective	Policy	Timetable for introduction	Timetable for implementation	Responsible agency
Limiting consumption of halon products	1. Bans on new installations for halon extinguishers for non-essential uses	Nov. 11, 1994	Oct. 1, 1995 definition of non-essential use to be tightened every 3 years	MPS NEPA
	2. Management for halon extinguisher servicing enterprises	Dec. 1996	Jun. 1997	MPS NEPA
	3. Revision of fire protection codes for buildings			MPS MOC
	* Fire protection code for design of tall buildings	Dec. 1996	Dec. 1996	
	* Fire protection code for design of buildings	Jan. 1997	Jun. 1997	
Controlling Production and supply of halon agents	* Code for fire extinguishers in design of buildings	Jan. 1998	Jan. 1998	
	* Fire protection code in underground engineering	Jan. 1998	Jan. 1998	
	4. Production permit system for halon agent producers	1991	1991	MPS NTSA
	5. Tradable production quota system for halon agent producers	Nov. 1997	Dec. 1997	MPS NEPA
	6. Bans on halon agent production			SETC MPS NEPA
Increasing demand for Halon substitutes and alternatives	* Halon 1211	Dec. 2003	Jan. 1, 2006	
	* Halon 1301	Jan. 2008	Jan. 1, 2010	
	7. Regulations on import and export of halon agents	1998	1999	MPS NEPA Customs
	8. Technical supervision for halon alternatives and substitutes: revising the technical standards for ABC dry powder	1997	1998	MPS
	9. Circular on promoting the application of halon alternatives	July 5, 1996	July 5, 1996	MPS
Controlling Production of halon Extinguisher and systems	10. Policies for encouraging production of alternatives and substitutes for halon agents and extinguishers	n.a.	n.a.	MPS NEPA
	11. Policies for encouraging conversion of halon extinguisher and system enterprises	n.a.	n.a.	MPS NEPA
	12. Introduction of production permit system for halon extinguishers and systems	1991	1991	MPS NTSA
	13. Ban on production of halon extinguishers and systems			SETC MPS NEPA
	* Halon 1211	2003	Dec. 31, 2005	
Halon Banking and halon destruction	* Halon 1301	2008	Jan. 1, 2010	
	14. Management of halon banking	Dec. 2000	Jun 2001	MPS NEPA
	15. Management of halon destruction	Jan 2005	Jan 2005	MPS NEPA

Note: MPS: Ministry of Public Security; NEPA: National Environmental Protection Agency; MOC: Ministry of Construction; SETC: State Economy and Trade Commission; NTSA: National Technical Supervision Administration

43. Effective July 5, 1996, an administrative circular was issued by the Fire Fighting Department of MPS defining a new policy. The characteristics of this policy are:

- Main alternatives for halon are CO₂, AFFF and ABC powder in "non-essential uses";
- Production permit system for ABC powder is proposed to be effective in 1997 in order to promote improvements in ABC quality. Production permits will be issued only after certification by MPS agency of satisfactory production processes and product quality;
- Quality of ABC powder will be assessed as a basis for issuing production permits for new and existing producers; and
- Use of fire fighting systems should follow the various fire fighting codes.

44. The definition of non-essential uses will be more narrowly defined in 1999, 2002, and 2005, respectively, in order to reduce the scope of the market and thereby the demand for halon extinguishers.

45. These policies are potentially effective instruments for controlling halon consumption, and send a signal to producers of halon concerning future market size and development. For these command-and-control instruments, strong enforcement is critical to their success. Enthusiasm for proactive enforcement of halon reduction policies in advance of Montreal Protocol controls is expected to depend on the availability of technical and financial assistance to halon producers and extinguisher and systems manufacturers.

46. **Following approval of this sector plan**, the Chinese Government would enhance enforcement efforts by:

- (a) Promoting awareness of users about the bans through various channels (TV, newspapers and other media, specific campaigns and training);
- (b) Requiring users of extinguishers (chiefly in the non-essential use areas) to report to fire fighting agencies the name, type and size of extinguishers and the premises protected. Local fire fighting agencies and environmental protection bureaus are responsible for monitoring users and for requiring users to replace halon extinguishers used in non-essential areas to adopt alternatives within a specific period; and
- (c) Requiring local fire fighting agencies and environmental protection bureaus to report to MPS and NEPA concerning extent of enforcement and measures adopted to ensure compliance with the policy.

E. Management for Halon Extinguisher Servicing Enterprises

47. Halon extinguisher servicing enterprises are responsible for servicing the existing stock of extinguishers. Bilateral assistance from the MLF through US EPA has helped to demonstrate the feasibility of halon recycling during extinguisher servicing. As part this sector strategy, MPS will require servicing enterprises to hold a servicing permit and have appropriate recovery and refilling equipment installed to minimize emissions during servicing and allow for halon recovery from retired extinguishers.

F. Revising the Codes for Fire Protection of Buildings

48. The four major codes concerning uses of halon extinguisher and system are the "Code for Fire Protection Design of Tall Buildings" (which covers civil works), "Code for Fire Protection Design of Buildings," "Code for Fire Extinguishers Allocation Design of Buildings," and "Code for Fire Protection Design of Underground Structures." With the promulgation of the non-essential use ban, the four codes no longer suited China's fire protection requirements and needed to be revised. The revision of the four codes has been supported with MLF financial assistance through UNDP project. The revision of the codes has been basically finished. By the end of 1997, a workshop will be held to propagate the revised fire codes. The related fire protection code issued at ministry and department levels would be changed accordingly after revision of these four major codes is complete.

49. The revision of these codes is expected to reduce the demand for halon extinguishers (and thus the demand for halon agent). Implementation and enforcement of the codes will be done within the framework of existing regulations governing the implementation and enforcement of codes.

G. Production Permit System for Halon Agents

50. In 1991, MPS and the Technical Supervision Administration jointly introduced a permit system for halon agent production, and stipulated that new enterprises for halon agent production and servicing would not be approved, while existing capacities should not be expanded. Due to insufficient baseline information about halon manufacturers at that time, capacity expansion has been difficult to monitor. While the number of halon agent producers has been limited through the permit system, more recent surveys by MPS and World Bank technical experts indicate that manufacturers' capacity increased between 1991 and 1995 mainly due to technical process improvements. MPS estimates that current production capacity for halon 1211 is 17,800 MT.

51. Nonetheless, the permit system has been an important instrument for improving sector management and ensuring product quality. Enterprises that do not have a valid permit are not allowed to produce halon agent. Production without a permit is punishable within the framework of China's general regulations on industrial production permits and the products are not allowed to sell in the market.

H. Tradable Production Quota System for Halon Agents

52. The production quota system, which will be adopted upon approval of this sector plan, combined with the existing production permit system is the key policy element for implementing the halon phaseout strategy. Since China is moving toward a market-based economic system,

enterprises will be allowed to trade their quotas, so that they are encouraged to implement a

phaseout program while reducing the costs of phaseout. The major contents of the quota system can be summarized as following:

- (a) in accordance with regulation jointly published by NEPA, MPS and the Ministry of Chemical Industry, NEPA will issue production quotas for each year to those enterprises holding a permit for halon production;
- (b) only the enterprises with production permits will be eligible for application of quota;
- (c) the relative size of the quota in the first year of operation of the quota system will be based on the structure and level of declared production in 1995 (not to exceed 9,950 for halon 1211 and 750 for halon 1301). The quota will be reissued each year and reduced in accordance with the overall phaseout plan;
- (d) producers of halon will not be allowed to exceed the allocated yearly production quota;
- (e) enterprises with a permit can trade their quota either for that year, or as a permanent trade. Enterprises that trade their quotas must report trades to NEPA who will reallocate quota accordingly; and
- (f) based on the outcome of grant bid scheme, enterprises participating in the bid which have been selected to sell back their quota to the government would sign a contract to dismantle their halon production facilities. After the contract is in effect, the production quota and production permit would be taken back.

53. Monitoring and enforcement mechanism for the quota system is expected to be:

- (a) Enterprises holding a quota must report halon production figures to NEPA who will inform MPS, the local EPB and fire fighting agencies;
- (b) Local EPBs and fire fighting agencies would from time to time check production information and visit enterprises to confirm data submitted, and report to NEPA and MPS on the monitoring activities as well as the data;
- (c) NEPA and MPS will monitor and supervise implementation of the quota system;
- (d) Any enterprise giving false information will be warned and fined;
- (e) Any enterprise that fails to report or delays its report will be fined;
- (f) Any enterprise whose production exceeds the quota will be fined and its production quota would be correspondingly reduced in the following year or, if appropriate, its production would be sealed off; and
- (g) Any enterprise producing halon without a quota will be fined, its production will be closed off by the local government.

I. Grants for Halon Agent Producers Awarded By Competitive Bidding System

54. Under this sector plan, halon agent producers would have an opportunity once a year to sell back their production quota to the government through a competitive bidding process. Manufacturers would submit bids -- offers to sell their halon quota -- for a specific unit price (Yuan/kg halon). The government would evaluate bids and award grants to those with the lowest offer price based on the amount of grant available for production closure in that year. Provided the government is able to buy back sufficient quota through the bid, the remaining halon producers would retain their quota at the same level in the next year. However, if the level of quota purchased through the bid is less than the targeted phaseout amount, quota reductions would be made pro rata among firms which were unsuccessful, or did not participate in the bid. If the bidding system fails totally, China would proportionally reduce the quota of all enterprises to meet the annual phaseout target.

J. Bans on Halon Agent Production

55. Following approval of this sector plan, the government will announce publicly the phaseout program. An official ban on halon 1211 and 1301 production will be issued in 2003 and 2008, respectively.

K. Regulations on Import and Export of Halon Agent

56. China is planning to list halon agents on the 'List of Toxic Chemicals Which are Banned or Strictly Restricted in China'. During the first implementation year, China will study the feasibility study of halon import and export management and licensing system options based on the 'Regulations for Import and Export Environmental Management of Toxic Chemicals and First Time Imports of Chemicals,' which was issued by NEPA in March 1994 and took effect on May 1, 1994. The import and export management system to be introduced for implementation beginning in 1999 would aim to strictly control any illegal import or export of halon.

L. Technical Supervision for Halon Alternatives and Substitutes

57. The technical standard for ABC dry powder will be revised in order to improve the quality of halon alternatives available, since ABC powder extinguishers will be a major alternative for halon extinguishers installed in buildings. The implementation of technical standards of ABC powder will be regulated within the context of general regulations concerning technical standards of China.

M. Circular on Promoting the Application of Halon Alternatives

58. On July 5, 1996, MPS issued the 'Circular on Promoting the Application of Halon Alternatives.' The major contents of this circular are:

- (a) The alternatives for halon 1211 extinguisher are: ABC, CO₂, and AFFF;
- (b) In order to improve the quality of ABC dry powder, MPS will issue a production permit to enterprises producing ABC agent and extinguishers. The production

permit will include a standard requirement for MAP in the ABC powder, which should be 50 percent and 70 percent;

- (c) To reflect the principle that higher quality justifies a higher price, and to inform users about MAP content and benefits, ABC dry powder extinguisher enterprises should include MAP content on the label for their products; and
- (d) Areas that are allowed to use halon extinguishing systems should follow strictly the Code for Fire Protection Design of High-rise Buildings (civil works), Code for Fire Protection Design of Buildings, and other related codes and regulations, and should not expand the application area of halon systems. For those areas that should make use of a gaseous system, CO₂ and inert gaseous systems are recommended, while HFC-based systems like FM 200 are permitted.

59. The implementation of this policy will promote the production of halon alternatives and, therefore, speed up the halon phaseout process in China.

N. Encouraging Production of Alternatives and Substitutes for Halon Agents and Extinguishers and Conversion of Halon Extinguisher and System Enterprises

60. The government will carry out a study on how to make effective use of multiple funding sources (including the MLF funds) to encourage production of alternatives and substitutes for halon agents. Such incentives would have the characteristics of investment subsidies, with a view to provide an incentive for investment in the production of halon alternatives and substitutes. Conversions of halon extinguisher and system manufacturers will be supported through grants made available through an annual bidding process. As manufacturers will have to compete for grants, it is expected that they will pursue appropriate least cost conversion options and will time phaseout so as to minimize conversion costs.

O. Production Permit System for Halon Extinguishers

61. In 1991, MPS implemented a production permit system for halon extinguishers, and stipulated that new enterprises for halon extinguisher production and servicing would not be approved. However, high profits in the halon sector led to development of over-capacity among halon extinguisher producers. Nine halon extinguisher enterprises were recently shut down by the government to consolidate production as part of China's halon phaseout strategy.

62. The permit system is an important instrument for improving sector management and ensuring quality production. Production without a permit is penalized in accordance with China's general rules on industrial production permits.

P. Bans on Production of Halon Extinguishers and System

63. Following approval of this sector strategy, the government will announce publicly the phaseout program. An official ban on halon 1211 and 1301 extinguishers production will be issued in 2003 and 2008, respectively.

Q. Management of Halon During Servicing and From Retired Extinguishers/Systems

64. To meet demands of essential use of halon and ensure fire fighting protection in specific areas, the government plans to expand halon recycling practices to all registered extinguisher service shops and to set up a halon banking system including recovery and reclamation of halon from retired extinguishers and systems.

R. Management of Halon Destruction

65. To avoid emission of halon 1211 that is recovered from extinguishers, but contaminated, MPS and NEPA will conduct investigations to design ways of ensuring appropriate disposal and destruction of halon.

III. INCREMENTAL COST ANALYSIS FOR PHASEOUT OF HALON IN CHINA

A. Introduction

66. This chapter discusses the incremental costs of phasing out halon in China and explains the results of calculations done with a computer-based model. The model was developed to provide a basis for choosing the most cost-efficient phaseout profile for China and to determine both the total incremental costs to the Chinese economy and the eligible incremental costs for which funding is being requested. Annual grant funding requests to meet specific phaseout targets are given in chapter four. Assumptions, model inputs and the calculation methodology are found in Annex I to this chapter.

67. The cost model has five major facets:

- (a) To calculate, on the basis of various assumptions and data, the incremental costs (measured in constant dollars) for the Chinese economy and those costs eligible for funding from the Multilateral Fund of various phaseout options (scenarios), with the costs expressed in terms of both annual costs over the phaseout period and also NPV;
- (b) To calculate the amount of halon production "savings" (overall halon consumption avoided) under each scenario, compared to the alternative of continuing to produce and consume halon in compliance with the provisions of the London Amendment of the Montreal Protocol;
- (c) To rank different phaseout scenarios in terms of total cost, eligible incremental cost and cost per kilogram of "saved" halon;
- (d) To provide a basis for selecting the recommended phaseout plan, taking cost, uncertainty associated with those costs, and halon saved into consideration; and
- (e) To compare the funding request for this sector plan to a project-by-project scenario.

B. Scope of Cost Analysis

68. Two costs of phasing out Halon 1211 and 1301 in China are analyzed within the model: the total economic incremental cost to China (TEIC), and the eligible economic incremental cost from MLF under its current rules (EEIC). For measuring, double-counting has been avoided and the methodology identifies costs where they first arise, thereby ignoring the fact that additional costs in the manufacturing sector would normally be passed on to consumers of the product in the form of higher prices.

C. The Modeling Process

69. The modeling process comprised five steps:

- (a) the factors that influence the incremental costs associated with a complete phaseout of halon were identified;
- (b) a demand projection for fire protection in China until 2010 was developed, showing the allocation of fire fighting agents to new extinguisher and systems production and to servicing of existing stock over time;
- (c) phaseout scenarios were developed, setting up both the date for total phaseout and the profile for phaseout;
- (d) based on the phaseout profile and the amount of halon agent production to be reduced annually, the model calculated the production of substitute agent and extinguishers and systems required to replace the halon-based production removed from the market and calculated the allocation of remaining halon to new production and servicing, while estimating the need for recycling and recovery of halon to build a halon bank; and
- (e) based on the incremental cost categories developed for each element of the phaseout program, the model calculated the incremental costs to China and the eligible incremental costs from the MLF.⁹

D. Factors Influencing Incremental Cost of Halon Phaseout in China

70. There are numerous factors that will influence the incremental costs of halon phaseout, including: phaseout schedule; the overall level and structure of demand for fire protection; the conversion rate from halon fire extinguishers and systems to substitutes; substitute selection; the extent of halon recovery, recycling and destruction; and the size and sources of halon banking. Some of the incremental costs to halon phaseout can be estimated with a degree of certainty. These include costs of premature retirement of halon production plants and the costs of converting halon extinguisher manufacturers to well established substitutes. However, other costs are even less well known. The costs of avoiding premature retirement of installed halon equipment through halon recovery and banking are perhaps the least well understood.

Growth Rate

71. As discussed in Chapter 1, the demand for fire protection is likely to continue to grow at least as quickly as the growth rate of the economy. The EEIC, is insensitive to changes in the overall growth rate of the market for fire protection. This is because the model assumes in all scenarios that halon production is capped at the 1995 production level. The significance of the

⁹ As the Government of China has agreed to base its incremental cost request on previously reported halon production and consumption baseline data for 1995, the cost model was not up-dated with higher production and consumption figures noted in chapter 1.

continued high growth rate for the halon phaseout is linked to fact that a high rate of growth in the fire protection market requires a large amount of financial resources, and a phaseout program imposes further costs on the industry.

Fire Extinguisher Market Structure

72. The overall growth rate of the fire protection industry is not the determining factor in halon phaseout costs. It is the structure of the fire extinguisher market, and in particular, the share of the market requiring clean extinguishers that affects the nature of the halon phaseout, and thus the costs of replacement and conversion. Since halon 1211 alternatives differ in terms of price and physical properties and fire fighting capacities (none of the alternatives is equivalent to halon), different choices of alternatives affect the ability of the fire equipment sector to meet fire protection needs and the incremental capital and operating costs associated with conversion to those alternatives. So while there is reasonable consensus on the costs of conversion, the costs are very sensitive to the choice of technology.

73. Analysis of the Chinese market suggests that approximately 15 percent of the overall market demand for extinguishers will be for clean agent. Consequently, in order to produce this market structure after halon phaseout, the model shows that the conversion rate from halon extinguisher production should be 31 percent to ABC; 65 percent to CO₂; and four percent to AFFF.¹⁰

Fire System Market Structure

74. To eliminate the use of halons in new fire protection systems, market structure is less of a factor in determining incremental costs. Alternatives for halon 1301 systems vary in physical properties and fire fighting/suppressing capabilities (again none of the alternatives is equivalent to halon), but the substitutes are more comparable in price -- when installed costs of systems are compared -- than those that will be adopted for halon 1211 in fire extinguishers. Thus, while there is still uncertainty about which substitutes will ultimately be selected by Chinese fire system manufacturers, the incremental costs of phaseout appear to be relatively insensitive to this choice.

Speed of Phaseout

75. Overall incremental costs are influenced as much by the profile of substitute selection for fire extinguishers as by the speed of phaseout. The faster the phaseout, the higher the incremental costs for closure of halon agent producers, due to the higher cost of premature retirement for the closed factories. In addition, the economy faces an economic cost related to the advancement of replacement investments. For example, if the phaseout results in halon plants closing in 2005 instead of continuing to the end of their life of 2010, the economy has to incur costs of investing in a replacement at an earlier date.

76. However, the faster the phaseout, the lower the incremental costs for halon recovery,

¹⁰ These conversion percentages are based on 22 percent halon coverage in extinguisher market as previously reported. More recent data suggests that actual halon coverage is about 26%. This would indicate an even higher need for clean agent to maintain 15 percent of extinguisher market.

reclamation, and banking which are needed to avoid even higher costs of premature retirement of newly installed halon equipment (systems and extinguishers). A faster phaseout requires the economy to start incurring costs under these categories at an earlier date; but the overall costs are likely to be less under a faster phaseout because the stock of halon equipment that will be needed to make use of these relatively expensive activities for assuring a supply of halon after phaseout will be smaller. In principle, the alternative to recycling and banking would be to import halon, but this is not a realistic scenario for China, given the scale of needs relative to probable world supply of halon after China's proposed phaseout.

Halon Recovery, Reclamation and Banking

77. The potentially high costs of premature retirement of halon equipment would lead to a clear decision to cease as soon as feasible the manufacture of new halon systems and extinguishers as a means to reducing overall halon phaseout costs. Halon recovery, reclamation, and banking from retired units provide a means to offset the costs of premature retirement. However, the degree to which costs of premature retirement may be offset through recovery and banking is not well known, and may be sensitive to factors which have been excluded from this analysis. In one industrialized country, for example, the government pays \$16/kg to bank halon 1301 (more than double the price of newly produced halon in China). Due to the high degree of uncertainty and comparisons to costs reported by industrialized countries, the costs for halon recovery, recycling, reclamation and banking are easily underestimated (whereas the costs associated with production closure and extinguisher/system production conversion are much better known.) Thus, opting for a delayed phaseout schedule would shift to China a high risk that incremental costs would greatly exceed estimates.

Ozone Protection

78. Finally, there is the major issue of ozone protection. Obviously, the longer phaseout is delayed, the greater the build-up of halon that will ultimately be emitted and contribute to ozone depletion. So, while the costs of a later phaseout may be less in absolute terms (comparing NPV of costs), this would ignore the environmental benefits of earlier phaseout. A more accurate way of considering this tradeoff would be to consider the unit cost of saved halon against some baseline. In this case, the Montreal Protocol phaseout schedule was used as to compare the total amount of halon phased out under various phaseout schedules.

E. Design of Phaseout Scenarios

79. Seven scenarios for phasing out halon 1211 production, and one scenario for halon 1301 were developed for more intensive analysis within the cost model. The seven scenarios provide variations in three parameters: phaseout speed and profile, alternative technologies and substitutes, and halon banking (see Table 3-1).

TABLE 3-1: HALON 1211 PHASEOUT SCENARIOS

	1997-1999 (percent)	2000-2002 (percent)	2003-2005 (percent)	2006 (percent)	Alternative Agent for extinguisher	Halon bank
Scenario A	50	30	0	20	HCFC	Yes
Scenario B	50	30	0	20	ABC, C ₀ 2, AFFF	Yes
Scenario C	50	30	20	0	ABC, C ₀ 2, AFFF	No
Scenario D	36.7	40	0	23.3	ABC, C ₀ 2, AFFF	Yes
Scenario E	20	40	13.3	26.7	ABC, C ₀ 2, AFFF	Yes
Scenario F	Baseline MP limits with growth after 1995				ABC, C ₀ 2, AFFF	Yes

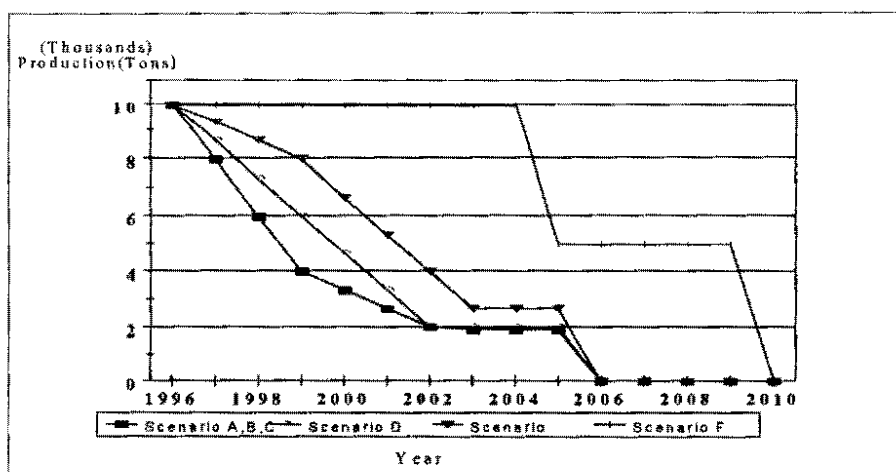
Note: Baseline from which percentage reductions are made is 9,950 MT halon 1211 (1995 production level). Steady production in 2003-05 is needed to build a bank for servicing of extinguishers/systems until 2010.

80. Scenario 'F' is defined here as the baseline scenario for reference. Its halon 1211 phaseout schedule is in conformity with that of the London Amendment of the Montreal Protocol; that is, halon production increases to meet basic domestic needs (15 percent annually until 2000 and then 10 percent) until 2002, in 2002 production is reduced to the average production of 1995 - 1997, in 2005 halon production is 50 percent of the 2002 level, and complete phaseout is achieved in 2010. Such a scenario would generate large phaseout costs to China, and eligible incremental costs from the MLF would also be high. An additional reference scenario for comparisons to project-by-project approach is being developed.

81. Scenarios 'A', 'B' and 'C' estimate the costs of adopting different approaches to phasing out halon 1211 by 2006 on a phaseout profile of 50/30/20 (Scenario C phases out more rapidly as no extra production is done to create a bank). As scenario 'B' is the least cost among these options,¹¹ the question becomes one of choice between Scenarios 'B', 'D' and 'E', which measure the costs of different time frames for phaseout by the end of 2006. Scenario 'B' front loads the phaseout, Scenario 'E' back loads the phaseout, and 'D' is in between.

Figure 3-2: The Phaseout Schedule of Halon 1211

¹¹ Scenario A assumes conversion of halon extinguishers to HCFC, generating (because of its high costs) huge costs for China and somewhat higher costs than scenarios B and C for the MLF. Scenario C assumes that halon banking would be supplied from imported halon; at current world prices, this option would increase costs to China and to the MLF, compared to scenario B.



82. A single scenario has been defined for phaseout of halon 1301 (See Table 3-3). Halon 1301 production is frozen at 1995 levels, and it is assumed that newly produced halon will mainly be used for servicing and refilling existing installed systems. As such, it is also assumed that all beginning in 2006, all new systems will use halon 1301 substitutes. In order to limit costs of premature retirement for existing systems (alternatives are expensive), the phaseout is rear-end loaded, with most of the production phaseout occurring after 2005. By itself, the proposed phaseout would not meet the provisions of the London Amendments, but is acceptable because an accelerated phaseout of halon 1211 is anticipated.

TABLE 3-2: HALON 1301 PHASEOUT SCENARIO

	1997-2000	2001	2006	2010	substitute	Banked
Phaseout percent	0	20	60	20	FM 200 ¹²	Yes

* The percentages refer to the phasing out of 750 tons of Halon 1301.

F. Technical Assistance

83. The costs of technical assistance (TA) required to achieve halon phaseout are considered to be independent of the scenarios being evaluated. TA includes such items as policy development and implementation of policy measures, codes, quota systems, public awareness, development of alternate technologies, technical assistance to enterprises and service stations, testing facilities and development of the management information system as a monitoring tool for the entire halon sector phaseout plan.

84. The NPV cost of technical assistance is estimated at \$6.0 million covering the entire phaseout period. These costs will be broken down into components with detailed scope and costs

¹² The model uses FM 200 as a proxy for substitute system costs. According to HTOC members, the incremental installed cost of halon substitute systems such as Inergen and CO2 is either more expensive or roughly equivalent to FM 200.

prescribed as part of each annual plan. Chapter 4 includes a detailed breakdown of cash flow requirements for TA over each stage of the phaseout program.

G. Specification of Incremental Costs

85. The incremental costs included in the calculations of TEIC and EEIC are subdivided into eleven cost categories as defined in Table 3-3:

TABLE 3-3: DEFINITIONS OF INCREMENTAL COST CALCULATIONS

Incremental Costs	TEIC	EEIC ¹³
1. Premature closure of halon 1211 producers	lost profits and two years labor compensation based on halon 1211 production capacity (17,800 MT) and unconstrained halon demand	lost profits and two years labor compensation based on previously reported 1995 halon 1211 production
2. Conversion or closure of halon 1211 fire extinguisher producers	capital costs and incremental operating cost until 2010	two years labor compensation (20 firms) capital costs and six-months incremental operating cost
3. Conversion of halon 1211 system producers	incremental operating costs until 2010	one year incremental operating costs
4. Conversion of halon 1301 system producers	incremental operating costs until 2010	one year incremental operating costs
5. Modification of halon 1211 extinguisher servicing stations to handle new substitutes	capital costs	capital costs for one-third of major service centers
6. Recovery, recycling and reclamation of halon 1211 from extinguishers	capital costs and incremental operating costs/savings until 2010	capital costs and operating costs/savings until 2010
7. Recovery and reclamation of halon 1301	capital costs and incremental operating costs/savings until 2010	capital costs and incremental operating costs/savings until 2010
8. Banking of halon 1211 and halon 1301	capital costs and incremental operating costs until 2010	capital costs and incremental operating costs until 2010
9. Destruction of contaminated halon 1211	incremental operating costs until 2010	incremental operating costs until 2010
10. Premature idleness of halon 1301 producer	(capital cost of halon 1301 substitute plant)	lost profits based on actual 1995 halon 1301 production
11. Technical assistance and supporting activities	Policy and other support activity (e.g., training, promotion, etc.)	Policy and other support activity (e.g., training, promotion, etc.)

¹³ Incremental cost analysis including detailed model inputs and assumptions are in Annex 1 to this chapter.

86. The model does not include some of the incremental costs for phasing out halon in China:
- (a) Other incremental costs related to ABC powder substitution in extinguishers; i.e., costs of more frequent refilling, costs of complete refilling and disposal of used ABC powder, higher property damage from ABC (compared to clean agent);
 - (b) Capital costs of converting halon 1211 and 1301 system producers;
 - (c) Capital costs of halon 1211 destruction;
 - (c) Incremental costs of halon 1301 destruction; and
 - (d) Contingencies and unforeseen costs.

H. Analysis of Scenario Costs

87. Table 3-4 summarizes the incremental costs to China and to the MLF under each scenario, and compares the NPV of each scenario's costs to the amount of halon production saved (avoided production and consumption as compared to MP controls).

TABLE 3-4: TEIC, EEIC AND HALON SAVINGS UNDER DIFFERENT SCENARIOS

	TEIC (NPV \$ '000)	EEIC (NPV \$ '000)	Cumulative Avoided Halon 1211 Production/Consumption (MT)*	EEIC of Avoided Halon 1211 Production/Consumption (\$ per kg)
Scenario B	191,190	59,706	99,246	.0.60
Scenario D	183,327	58,312	93,294	0.63
Scenario E	173,513	54,423	84,339	0.65
Scenario F	172,642	72,914	0	not applicable

*This figure represents the total avoided halon 1221 production/consumption from 1997-2010 as compared to Scenario F -- growth to meet basic domestic needs then phaseout according to MP controls.

88. In Table 3-4, Scenario 'F' is the baseline from which cumulative (as opposed to annual) halon "savings" are measured. Scenario 'F', as previously described, represents the maximum allowable halon production (according to the Montreal Protocol controls for halon in Article 5-1) for countries anticipating growth in halon demand to meet basic domestic needs. Scenario 'B' offers the largest cumulative halon savings because production reductions are high in early years (including the cap in 1996 and 1997). Once halon production is stopped, halon "savings" (avoided halon production/consumption) are considered for each subsequent year as long as those "savings" are above and beyond halon reductions mandated by the Protocol.

89. The interpretation of the results of the model's estimation of the costs of each scenario is fairly straightforward. Summing up the stream of costs (expressed in constant prices) to be incurred over the phaseout period shows that the delayed phaseout results in highest costs (to both China and the MLF) in terms of unit cost of "saved" halon production and consumption. Moreover, when phaseout is delayed and the economy avoids the costs of closure in the early

years and defers costs of conversion, the economy faces considerably higher costs in dealing with servicing or retiring on a premature basis a much larger stock of halon-based fire equipment. (The estimates for these costs are, however, based on conservative assumptions and likely underestimate costs China would incur.) When the costs for various phaseout schedules are measured in economic terms and the time value of resources is expressed as a 10 percent discount rate, a slower phaseout represents a lower NPV, and thus economic cost, than a faster phaseout; the economy lowers the economic cost of phaseout by pushing out as far into the future as possible the costs of phaseout. Thus, the faster phaseout, Scenario 'B', has a slightly higher NPV. Likewise, while Scenarios 'D' and 'E' have higher unit costs of "saved" halon, there is also much greater uncertainty associated with their NPV costs as they include a larger proportion of halon recovery, reclamation and banking costs which are not well known.

90. The lower economic costs associated with deferring the phaseout result in higher production of ODS substances over the period. As Table 3-4 shows, the "efficiency" of each scenario can be ranked in terms of the eligible unit costs to the MLF of avoided annual halon 1211 production; Scenario 'B', the accelerated phaseout scenario, is the most efficient in these terms. Scenario 'B' also reduces the risk to China that banking costs have been significantly underestimated.

I. Conclusions

91. Taking into account the results of the modeling exercise and considering the risk of higher costs for halon banking that China may incur if halon phaseout were delayed, the Chinese government has developed its sector plan for halon phaseout based on implementation of Scenario 'B'. As funding for this program would not be approved until the end of 1997, Scenario 'B' has been up-dated for phaseout to start in 1998. Other costs which have been adjusted include: closure costs for halon 1301 (instead of costs for a substitute plant), closure costs for 20 small halon 1211 fire extinguisher manufacturers (instead of conversion), and the incremental operating costs for halon reclamation activities (which were under-costed in the proposal). The following chapter lays out the action program including the year-by-year phaseout schedule and funding requests required to ensure the achievement of this overall program.

92. Based on up-dated Scenario 'B', total phaseout costs for halon in China are summarized in Table 3-5:

TABLE 3-5: TECI AND EEIC FOR SELECTED HALON SECTOR PHASEOUT SCENARIO

	Total Cost to China (not revised) (US\$ million)	Up-dated MLF Funding Request (US\$ million)
Cost Incurred to date (as of 9/96)	11.6	4.4
Phaseout for Halon 1211	171.0	48.6
Phaseout for Halon 1301	17.7	8.1
Technical Assistance	6.0	6.0
TOTAL	206.3	67.1
Minus costs incurred to date	11.6	4.4
Net Incremental Costs	194.7	62.7

93. The costs in Table 3-4 and 3-5 are expressed in NPV terms in 1997 dollars. These costs do not represent the amount of funds that will be required over the phaseout period from the MLF. The sum to be paid to China over the period is computed first by reversing the discounting that was done to arrive at the NPV figure (thereby expressing the actual cost in each year in terms of 1997 dollars). Present value incremental costs that would be requested each year are given in Chapter IV.

94. The cost effectiveness of this using the phaseout schedule and cost assumptions in Scenario 'B' is \$1.32/kg ODP based on the present value cost streams (not the net present value total). If actual halon production and consumption amounts were used instead amounts previously reported, the program's cost effectiveness would be even more favorable (See Annex II to this chapter for analysis). This 'sector approach' program also compares favorably to a project-by-project implementation approach. According to the analysis found in Annex II, savings of at least 20 percent can be expected.

IV. ACTION PLAN

95. This chapter presents the plan for implementing the halon phaseout schedule proposed in chapter 3, including annual phaseout targets, MLF funds required to meet those targets (based on cost analysis presented in chapter three), and key policy and other actions that will be implemented to achieve the phaseout objectives. As long as funds are made available in a timely manner, the Government of China commits to realizing the halon phaseout by carrying out the following action plan which is divided into three stages:

- Stage one will begin following the MFEC's approval of funds and will continue through 2000. During this time, annual halon 1211 production will be reduced from 9950 MT to 3980 MT;
- Stage two will be from 2001-2005, during which time annual halon 1211 production will be further reduced to 1990MT and annual halon 1301 production will be reduced from 750 MT to 600 MT.
- Stage three will be from 2006-2010, during which the remaining 1990 MT of halon 1211 and 600 MT of halon 1301 are eliminated.

A. Stage One: 1998-2000

96. Stage one will begin in 1998 after the approval of the sector plan in November 1997 and continue through December 31, 2000. The phaseout time table, funding request and main phaseout actions for this stage are listed in Table 4-1. To achieve its target of 60 percent reduction in halon 1211 production from 1995 levels the Government of China will introduce a production quota system and grant bidding scheme that will lead to the closure of a certain number of halon 1211 agent manufactures (or production lines) and the conversion of several halon 1211 extinguisher enterprises. To meet essential uses, China will maintain its halon 1301 production at 1995 levels during this stage.

Table 4-1 Halon Phaseout Plan Stage One: Phaseout, Funding Requests, and Actions

Phaseout and Funds	Baseline (1995)	1998	1999	2000
Production target halon 1211 halon 1301	9,950 MT 750 MT	7,960 MT 750 MT	5,970 MT 750 MT	3,980MT 750MT
Production phaseout target ¹⁴ halon 1211 halon 1301		1,990 MT 0	1,990 MT 0	1,990MT 0
Consumption phaseout target ¹⁵ halon 1211 halon 1301		1,790 MT 0	1,790 MT 0	1,790MT 0
Required funding from MLF (NPV in 1997 constant US\$)		\$13,113,000	\$9,692,000	\$9,645,000
Funding request from MLF (PV of each year, in '97 \$) ¹⁶ of which TA		US\$13,113,000 US\$ 1,550,000	US\$10,661,000 US\$ 900,000	US\$11,671,000 US\$930,000
Policy and Other Actions	1998		1999	2000
Phaseout Measures	• close about 7-8 H1211 production enterprises; • convert H1211 extinguisher producers; • begin construction of an ABC powder plant.		• close H1211 production lines/enterprises; • convert H1211 extinguisher producers; • continue construction of ABC powder plant.	• Close H1211 production lines/enterprises; • Convert H1211 extinguisher producers;

¹⁴ The "phaseout amount" is based on reductions from previously reported 1995 baseline production figures. Actual phaseout would be amount needed so that production target is not exceeded.

¹⁵ The "phaseout amount" is based on reductions from the previously reported 1995 baseline consumption. Actual phaseout would be amount needed so that production target is not exceeded.

¹⁶ The "funding request from MLF" is derived from the cost analysis described in Chapter III.

Policy Measures	• Promote the ban on halon extinguisher uses in non-essential areas; • revise fire protection building design codes; • adopt bidding system to support production closure and conversion of halon extinguisher and system enterprises; • implement quota system for halon producers	• revise technical standards for ABC dry powder (to be completed in about 24 months) • revise fire protection underground engineering design code	• adjust the definition of "non essential use (area)".	• adjust further the definition of "non essential use (area)".
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Policy and Other Actions	1998	1999	2000
Technical Assistance Activities	• Train enterprises for bidding; • Investigate and develop halon import and export management policies; • Develop halon sector plan sector management information system (MIS); • Revise ABC dry powder standard; Prepare design code on inert gas fire extinguishing systems; • Formulate national standard for property requirements and test methods for spare parts of air fire extinguishing systems; • Establish testing laboratory for inert gas fire extinguishing systems; • Preparation for the development of a halon management plan;	• Introduce techniques for using halon substitutes; • Train and educate environmental protection and fire protection officials. • Train enterprises for bidding; • Implement revised ABC dry powder standard	

B. Stage Two: 2001-2005

97. Stage two begins on January 1, 2001 and ends on December 31, 2005. The phaseout time table, funding request and main phaseout actions for this stage are listed in Table 4-2. During this stage, the Government of China will continue to close a certain number of halon 1211 agent manufactures (or production lines) through the bidding and quota systems. The Government will also continue to convert halon 1211 extinguisher producers by offering assistance through the grant bidding mechanism. Beginning in 2003, the Government will establish a bank for halon 1211, begin modification of halon 1211 extinguisher servicing centers to service extinguishers produced with halon substitutes, and enforce reclamation standards for recovered halon 1211. To continue to meet essential use requirements, the Government will only require a small reduction in the production of halon 1301.

98. At the end of Stage Two China will have:

- Completely stopped halon 1211 production (by January 1, 2006);
- Shut down all halon 1211 producers;
- Converted all halon 1211 extinguisher and system manufacturers;
- Begun using recycling equipment at all licensed halon 1211 extinguisher service stations; and
- Banked about 3000 MT of reclaimed halon 1211 (to meet servicing needs until 2010).

Table 4-2 Halon Phaseout Plan Stage Two: Phaseout, Funding Requests, and Actions

Phaseout and Funds	2001	2002	2003	2004	2005
Production target					
halon 1211	3,317 MT	2,654 MT	1,990 MT	1,990 MT	1,990 MT
halon 1301	750 MT	600 MT	600 MT	600 MT	600 MT
Production phaseout target ¹⁷					
halon 1211	663 MT	664 MT	664 MT	0	0
halon 1301		150 MT			
Consumption phaseout target ¹⁸					
halon 1211	463 MT	564 MT	764 MT	0	0
halon 1301		150 MT			
Funding request from MLF (NPV in 1997 constant \$)	\$5,160,000	\$3,382,000	\$7,157,000	\$2,028,000	\$1,951,000
Funding request from MLF (PV of each yr in 1997 \$) ¹⁹					
of which TA	US\$6,868,000 US\$ 980,000	US\$4,952,000 US\$ 840,000	US\$11,527,000 US\$ 700,000	US\$3,592,000 US\$ 560,000	US\$3,802,000 US\$ 560,000
Policy and Other Actions	2001-2002			2003-2005	
Phaseout Measures	• Close H1211 production lines/enterprises; • Convert H1211 extinguisher producers.			• Establish H1211 bank; • Modify H1211 extinguisher service stations; • Reclaim H1211 from retired extinguishers; • Close remaining H1211 agent producers by the end of 2005; • Convert remaining H1211 extinguisher manufacturers; • Convert H1211 system manufacturers.	
Policy Measures	• Adjust the definition of "nonessential use (area)"			• Adjust the definition of "non essential uses (area)"	
Technical Assistance Activities	• Publicize halon phaseout plan and educate officials, managers and public; • Train fire officials and engineers • Evaluate effect of policies to date			• Publicize halon phaseout plan and educate officials, managers and public; • Train fire officials and engineers • Evaluate effect of policies to date	

¹⁷ The "phaseout amount" is based on reductions from previously reported 1995 baseline production figures. Actual phaseout would be amount needed so that production target is not exceeded.

¹⁸ The "phaseout amount" is based on reductions from previously reported 1995 baseline consumption. Actual phaseout would be amount needed so that production target is not exceeded.

¹⁹ The "funding request from MLF" is derived from the cost analysis described in Chapter III.

C. Stage Three: 2006-2010

99. Stage three begins on January 1, 2006 and ends December 31, 2010. The phaseout time table, funding request and main phaseout actions for this stage are listed in Table 4-3. During this stage, the Government of China will continue recycling and reclaiming halon 1211 and will draw from the halon 1211 bank to minimize pre-mature retirement of halon 1211 fire extinguishers and systems. In 2006, the Government will establish a bank for halon 1301 and enforce reclamation standards.

100. At the end of the Stage Three China will have:

- Completely stopped import and production of halon 1301 (by January 1, 2010);
- Shut down the halon 1301 producer;
- Converted all halon 1301 systems manufacturers; and
- Banked about 500 MT of reclaimed halon 1301.

Table 4-3 Halon Phaseout Plan Stage Three: Phaseout, Funding Requests, and Actions

Phaseout and Funds	2006	2007	2008	2009	2010
Production target					
halon 1211	0	0	0	0	0
halon 1301	150 MT	150 MT	150 MT	150 MT	0
Production phaseout target²⁰					
halon 1211	1,990 MT	0	0	0	0
halon 1301	450 MT	0	0	0	150 MT
Consumption phaseout target²¹					
halon 1211	1,990 MT	0	0	0	0
halon 1301	50 MT	0	0	0	100MT
Funding request from MLF (NPV in 1997 constant \$)	\$941,000	\$523,000	\$296,000	\$258,000	\$116,000
Funding request from MLF (PV of each yr in 1997 \$)²² of which TA	US\$20,177,000 US\$420,000	US\$ 1,234,000 US\$ 420,000	US\$ 772,000 US\$ 280,000	US\$ 735,000 US\$ 140,000	US\$363,000 US\$140,000

²⁰ The "phaseout amount" is based on reductions from previously reported 1995 baseline production figures. Actual phaseout would be amount needed so that production target is not exceeded.

²¹ The "phaseout amount" is based on reductions from previously reported 1995 baseline consumption. Actual phaseout would be amount needed so that production target is not exceeded.

²² The "funding request from MLF" is derived from the cost analysis described in Chapter III.

Policy and Other Actions	2006-2009	2010
Phaseout Measures	• Establish H1301 bank; • Close H1301 agent producer by the end of 2009; • Banked H1211 available in 2006; • Continue H1211 recycling and reclamation	• Banked H1301 available;
Policy Measures	• Adjust the content of "unessential uses".	• Enforce bans on halon production • Enforce bans on halon Ext/systems production
Technical Assistance Activities	• Publicize halon phaseout plan and educate officials, managers and public; • Train fire officials and engineers • Evaluate effect of policies to date	

D. Summary

CHINA															
Halon Sector Phaseout Action Plan, January 1,1998 to January 1,2010															
		First Stage			Second Stage					Third Stage					Total Funding Request
Year	Base line production	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	
Halon 1211 (MT)															
Production target	9,950	7,960	5,970	3,980	3,317	2,654	1,990	1,990	1,990	0	0	0	0	0	
o.w. Export		800	600	400	200	100	100	100	0	0	0	0	0	0	
Import		0	0	0	0	0	0	0	0	0	0	0	0	0	
Domestic Consumption		7,160	5,370	3,580	3,117	2,654	1,890	1,890	1,990	0	0	0	0	0	
Production phaseout target		1,990	1,990	1,990	663	664	664	0	0	1,990	0	0	0	0	
Consumption phaseout target		1,790	1,790	1790	463	564	764	0	0	1,990	0	0	0	0	
Halon 1301 (MT)															
Production target ^{3/}	750	750	750	750	750	600	600	600	600	150	150	150	150	0	
o.w. Export		450	450	450	450	450	450	450	450	50	50	50	50	0	
Import		0	0	0	0	0	0	0	0	0	0	0	0	0	
Domestic Consumption		300	300	300	300	150	150	150	150	100	100	100	100	0	
Production phaseout target		0	0	0	0	150	0	0	0	450	0	0	0	150	
Consumption phaseout target		0	0	0	0	150	0	0	0	50	0	0	0	100	
Required funding from MLF (\$'000) (NPV in 1997 constant \$)		13,113	9,692	9,645	5,160	3,382	7,157	2,028	1,951	941	523	296	258	116	62,702
Funding request from MLF ('000) (PV of each year, in 1997\$)		13,113	10,661	11,671	6,868	4,952	11,527	3,592	3,802	20,177	1,234	772	735	363	89,448
of which, TA activities		1,550	900	930	980	840	700	560	560	420	420	280	140	140	8,400

V. Operating Mechanisms of the Sector Plan for Halon Phaseout

101. Upon approval of this sector plan, the Government of China will introduce additional policy measures and take other actions, as described in chapter two, to achieve a rapid cost-effective halon phaseout. This chapter explains the funding arrangements, operating mechanisms, and the responsibilities of the institutions involved in implementation of this sector plan.

A. Umbrella Agreement

102. The World Bank and China have negotiated an Umbrella Grant Agreement which sets forth the terms under which grant resources approved by the MFEC Sector Approach programs in China would be carried out. This Umbrella Grant Agreement is similar to the umbrella grant agreements under which project-by-project activities are carried out, but it includes provisions which allow the Bank to disburse funds to China based on performance in terms of ODS phaseout rather than for goods and services. The Umbrella Agreement will become effective when the following conditions are met:

- (a) The first Annual Program for the halon sector has been approved by the World Bank and the MFEC;
- (b) the Project Implementation Manual has been adopted by China and the Bank; and
- (c) A regulation for a production quota system for the halon sector acceptable to the Bank has been adopted by China and has entered into effect

B. Funding Arrangements

Multilateral Fund Approval

103. Funds for this halon sector phaseout plan would be approved in two steps:

- (a) First, the Chinese Government, through the World Bank, requests the MFEC to consider this overall sector phaseout plan and agree to fund halon phaseout with annual advances as described in chapters three and four provided that China meets the annual phaseout targets in chapter four. At the same time, China requests the MFEC to fund the 1998 Annual Program which has been submitted as a separate document; and
- (b) Secondly, the Chinese Government, through the World Bank, would submit its request for funds to the last annual meeting of the MFEC to implement annual phaseout plans for subsequent years beginning with the 1999 annual program funding request. This annual funding request would be consistent with amounts in agree in the overall sector plan. For example, The World Bank, on behalf of the Government of China, would submit the 1999 annual program to the MFEC in time to

allow for funding approval by November 15, 1998. The MFEC would be asked to approve funding at the levels agreed to in this sector plan based on achievement of previous phaseout targets.

104. In general, approval of the funds would be based on achievement of halon phaseout targets (production and consumption targets for the previous year not exceeded):

- As the 1998 production and consumption targets would be achieved only at the end of 1998, the 1999 annual program funding request would be based on the semi-annual progress report of 1998; and
- Annual program funding requests for the years 2000-2010 would be based on achievement of halon phaseout targets of the previous year and the semi-annual progress report of the current year. For example, year 2000 funds would be approved based on 1998 phaseout results and the 1999 semi-annual progress report, 2001 funds on 1999 phaseout and 2000 progress, and so on.

105. In the unlikely event that China were to fall short of phaseout targets for a given year (halon production exceeds target), the Bank and China would agree on remedial actions. New funding requests to the MFEC would go forward only after phaseout targets had been met.

106. *Remedial actions* have been built into the halon production quota regulation and would go into effect should production exceed quota. Quota equal to the national production targets is allocated annually to enterprises. Enterprises exceeding production quota in a given year would be fined according to the quota regulation and their subsequent year's quota would be proportionally reduced. For example, if an enterprise exceeded its halon production quota in 1998 by 100 tonnes, its quota for 1999 would be reduced by 100 tonnes. Depending on circumstances that have caused delay in program implementation, other specific remedial actions would be agreed between the Bank and China as the need arises.

107. By the time any over-production for a previous year is confirmed, the current year's Annual Program would most likely already be funded and be underway. Thus, the proposed approach to remedial action is to bring the program back on-track by the end of the current year. For example, if over production occurred in 1998, remedial actions would ensure that by the end of 1999, cumulative production for the two years 1998 and 1999 would not exceed the combined targets for those years. The remedial actions taken to assure this result would be submitted along with the next year's funding request (2000 Annual Program using our example). The MFEC would then be in a position to either approve funds or condition release of funds for the next year's Annual Program upon evidence that the remedial actions were successful and that the combined two year production did not exceed combined targets. This approach to remedial action allows the program to maintain momentum and keeps the phaseout schedule on track even if difficulties arise in a particular year.

108. If within two years the program is still not back on-track, continued funding of the program could be based on a reduced level of compensation. For example, future funding eligibility could be reduced based on the slower phaseout schedule. As production phaseout is

based on compensation for lost profits and plants have continued to produce reducing the level of profits that would be foregone, grant compensation could be reduced proportionally. Under this plan, grant funds would be approved for annual programs and advanced through the World Bank to China to achieve specific phaseout targets. As such, the Chinese government requests use of these funds to achieve the those targets even in the face of delays. However, if it becomes clear that a delay is persistent and the phaseout targets would not be achieved within schedule of Montreal Protocol controls, funds proportional to phaseout shortfall would be reimbursed to the Multilateral Fund.

109. *Annual programs* would comprise of the following sections:

- (a) sector phaseout schedule;
- (b) performance of activities of previous years and any agreed remedial actions for the current year (not required for the 1998 annual program);
- (c) performance of activities of current year (not required for the 1998 annual program);
- (d) objectives of following year's annual program -- its phaseout targets and funding requirements for different activities in the following year²³;
- (e) description of activities in the following year -- policies to be implemented and technical assistance activities;
- (f) tables --
 - (i) Table 1: 1998 Annual Program -- targets and activities with details on policy actions, enterprise actions and technical assistance; and
 - (ii) Table II: 1998 Annual Program on Performance Indicators; and
 - (iii) Table III: Halon Sector Phaseout Action Plan, January 1, 1998 to January 1, 2010.

110. The World Bank would approve technical assistance activities consistent with the annual program based on agreed terms of reference up to level of TA funding approved under the annual program for that year. TA trends approved in the annual program which are not committed during the two year would be returned to the Multilateral Fund.

Disbursement mechanisms

111. *World Bank disbursement to China* -- Following approval of funds for Annual Program implementation and effectiveness of the Umbrella Grant Agreement, the Bank would transfer

²³ Total grant funding for each year would be agreed along with this sector plan proposal. However, China would have flexibility in each annual program to allocate funds within enterprise-level or TA activities to bees achieve phaseout targets.

grant funds to China by depositing them in a bank account (the 'ODS phaseout account') set up by China's Ministry of Finance (MOF). There would be four disbursements into the ODS phaseout account for each Annual Program's activities. The Chinese would be allowed to request these four disbursements at any time during the year provided disbursement conditions have been met. Disbursement conditions and amounts to be disbursed are:

First disbursement -- funds for technical assistance and other services

- Condition --
 - ⇒ Annual Program has been approved by MFEC and the Bank, and
 - ⇒ regulation on production quota is effective (1998 only)

Second disbursement -- 50 percent of funds allocated to enterprise activities

- Condition --
 - ⇒ China confirms that halon production has not exceeded production target set for the preceding program year or halon production during the first nine months of the preceding year has not exceeded 80 percent of the production target set for the preceding program year (not applicable to 1998), and
 - ⇒ any other conditions as specified in the current annual program

Third disbursement -- 30 percent of funds allocated to enterprise activities

- Condition --
 - ⇒ China reports that actual halon agent production has not exceeded the production target set for the preceding year (not applicable to 1998),
 - ⇒ all contracts for closure, conversion and other enterprises activities have been signed,
 - ⇒ signed closure contracts or appropriate government actions (e.g., quota allocation) which indicate that production target set for the current program year is achievable,
 - ⇒ progress report on annual program implementation is satisfactory to the Bank, and
 - ⇒ any other conditions as specified in the current annual program

Fourth disbursement -- 20 percent of funds allocated to enterprise activities

- Condition --
 - ⇒ China announces production quota of following year to remaining halon producers,
 - ⇒ production audit (for 1998 only) and performance audits (1999 and after) are satisfactory to the Bank,
 - ⇒ progress report satisfactory to the Bank, and
 - ⇒ any other conditions as specified in the current annual program

If the Bank finds implementation progress unsatisfactory, either by reviewing the progress reports or during supervision missions, there would be no further disbursements. The Bank would resume disbursement only after China and the Bank agree on remedial actions to rectify implementation deficiencies.

112. *Chinese Government allocation of funds to halon enterprises for phaseout activities --* For enterprise phaseout activities, funds will be allocated to halon producers and halon extinguisher and system manufacturers *through a bidding system*. The bidding system as a means of grant allocation is new to both China and the MLF²⁴, thus it is expected that the system will evolve over time as experience is gained. The first bidding would be offered at the end of 1997 following MFEC approval of the 1998 annual program. Since early 1997, the Government of China has been laying the ground work for the grant bidding system, including preparation of bidding documents, introducing the bidding process to local environmental protection bureaus, fire fighting bureaus and halon enterprises, and preparing the regulation on production quota which is the basis of the bidding process. All is in place for the bidding to proceed in late 1997. Preparation of bidding in subsequent years will start in the second half of each year and would be concluded after MFEC approval of following year's annual program and funding (e.g., bidding for funds for activities to be undertaken in 2000 would be completed by the end of 1999).

113. After bidding is concluded, winning enterprises would sign "ODS reduction contracts" with the Government. As defined in the Umbrella Agreement, under an "ODS reduction contract" the Government of China agrees to pay the beneficiary a specified amount per unit of ODS consumption or production to be reduced. In this way, grant allocation and payment are linked directly to enterprise-level ODS phaseout activities which have been agreed as part of the Annual Program.

114. *Disbursement from MOF's ODS phaseout account to grant recipients.* Grant funds would be disbursed directly from the ODS account to recipients based on terms contained in "ODS reduction contracts" or, in the case of technical assistance activities, the terms contained in consultant or training contracts. For example:

- (a) Closure projects -- ODS reduction contracts would specify disbursement as follows:
 - (i) 10 percent -- initial payment upon signing of ODS reduction contract,
 - (ii) 70 percent -- payment following dismantling of production equipment, and
 - (iii) 20 percent -- payment upon NEPA's confirmation that enterprise decommissioning is complete
- (b) Conversion projects -- ODS reduction contracts would link disbursement to purchase of equipment necessary for conversion or other appropriate milestones.
- (c) Technical assistance activities -- grant funds would be disbursed to consultant firms or institutions in charge of training based on implementation progress.

115. If project implementation is lagging behind schedule, appropriate government authorities would be notified to take necessary actions. Disbursements would proceed only after progress toward project implementation and halon phaseout is evidenced.

²⁴ A bidding scheme for grant allocation is being piloted in Chile with MLF support through the World Bank, but results are not yet available. Moreover, the differences between the two economies are so substantial, lessons learned from the Chile experience may or may not have application in China.

C. Management And Coordination

116. This Halon Sector Phaseout Plan will be executed by the Government of China. Two Chinese government agencies: the National Environmental Protection Agency (NEPA) and the Fire Protection Bureau of the Ministry of Public Security (MPS) will manage and coordinate execution of each year's annual program. In addition, NEPA has selected a qualified firm²⁵ to help manage day-to-day enterprise-level activities. The World Bank will supervise overall implementation of this sector phaseout plan, replenish the local project bank account, report to the MFEC on implementation progress, and submit future funding requests to the EC.

117. The national execution management and coordination functions are as follows:

- (a) **Government Project Management Office (PMO)** is an administrative office within the National Environmental Protection Agency (NEPA) with overall responsibility for implementation of China's ODS Phaseout Country Program including the Sector Plan for Halon Phaseout. In June 1997, the PMO established a Halon Unit comprised of officials from the Fire Protection Bureau of the Ministry of Public Security, NEPA's PMO, the consultant team who helped design the overall policy framework for China's halon phaseout plan, and the domestic implementing agency (DIA). With support from the PMO, this Unit will handle the following work related to the halon sector plan:
 - (i) set up and implement a monitoring and reporting system including an MIS to track implementation of annual programs and all activities related to halon phaseout;
 - (ii) report to the World Bank quarterly on annual program implementation;
 - (iii) review bid winner selection;
 - (iv) authorize disbursement requests to enterprises, as prepared by DIA;
 - (v) monitor and enforce the halon production quota system;
 - (vi) implement technical assistance activities with MPS and other relevant ministries, and
 - (vii) verify halon phaseout for completed enterprise-level activities oversee preparation of performance and financial audit reports.

On a day-to-day basis, the local environmental protection bureaus and fire protection bureaus will, on behalf of the PMO and MPS, conduct random visits to beneficiary enterprises to confirm halon phaseout.

- (a) **The Domestic Implementation Agent (DIA)** -- In May 1997 a DIA was selected by the PMO through a competitive bidding process.²⁶ Under the guidance of the PMO, it will carry out day-to-day supervision of enterprise-level activities, including:

²⁵ NEPA will sign a contract with the firm following approval of funds for the 1998 Annual Program.

²⁶ The DIA was selected by NEPA from a short list of consultant firms agreed with the World Bank that are experienced in financial and project management.

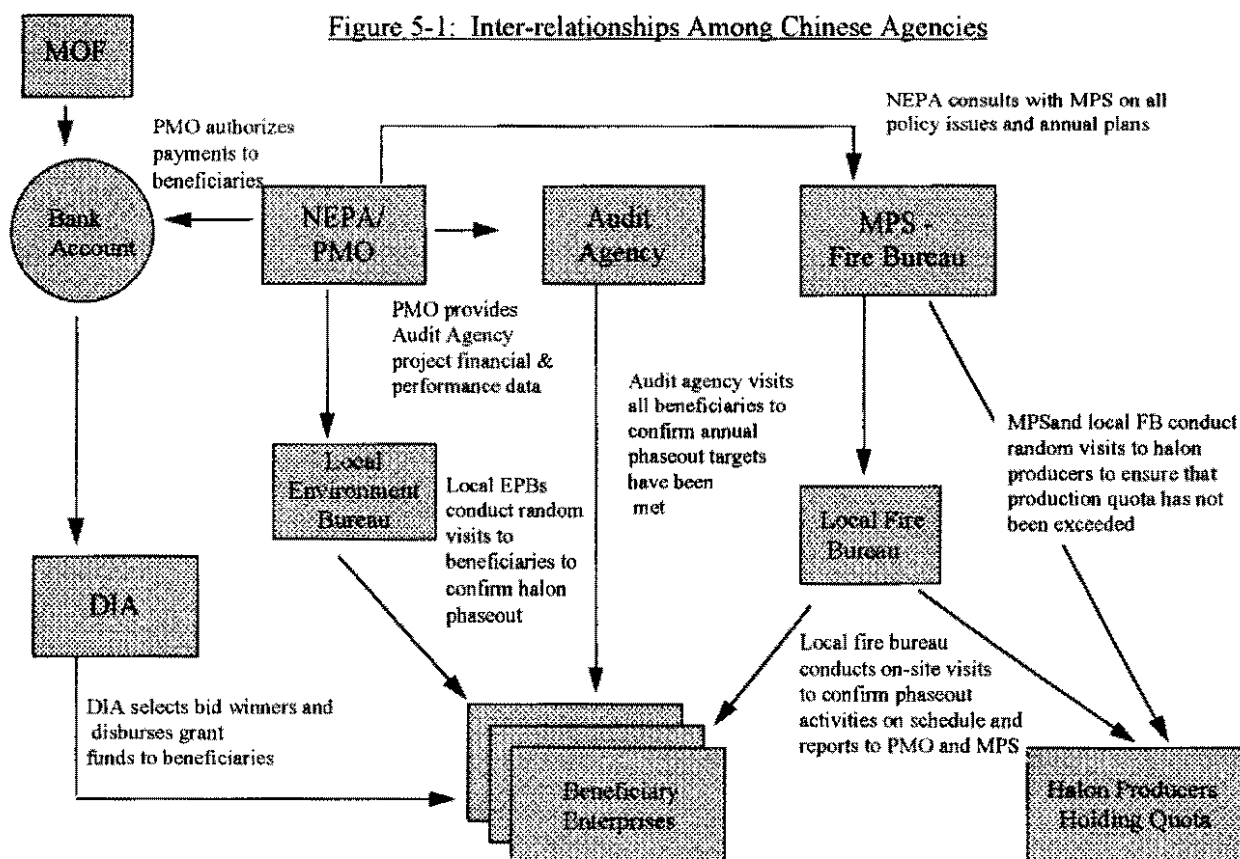
- (i) run the annual bidding process and evaluate bid documents to select winners according to lowest bid following bidding principles;
 - (ii) supervise implementation of enterprise-level activities selected through the bidding process;
 - (iii) review disbursement requests from beneficiaries and prepare disbursement requests to PMO for authorization;
 - (iv) report to PMO on status of enterprise project implementation; and
 - (v) identify and alert PMO to any issues identified during its supervision of enterprise-level activities.
- (c) **The Fire Protection Bureau of the Ministry of Public Security (MPS)** -- Working closely with the PMO, MPS will play an important role in preparation and implementation of each year's Annual Program. Specifically, MPS and its research institutes will be active in:
- (i) halon substitute chemical development²⁷ and application to China;
 - (ii) development, implementation, and enforcement of halon phaseout policies including the ban of halon extinguishers and systems in non-essential uses;
 - (iii) monitoring halon producer compliance with quota system; and
 - (iv) ensuring that adequate fire fighting capabilities are maintained throughout the country.

On a day-to-day basis, the local fire bureaus will monitor compliance with policies and on behalf of the PMO will conduct random visits to beneficiary enterprises to confirm project progress.

118. The inter-relationships among Chinese agencies involved in halon sector plan implementation are diagrammed in Figure 5-1.

²⁷ Multilateral funds are not being requested for the development of chemical substitutes for halon.

Figure 5-1: Inter-relationships Among Chinese Agencies

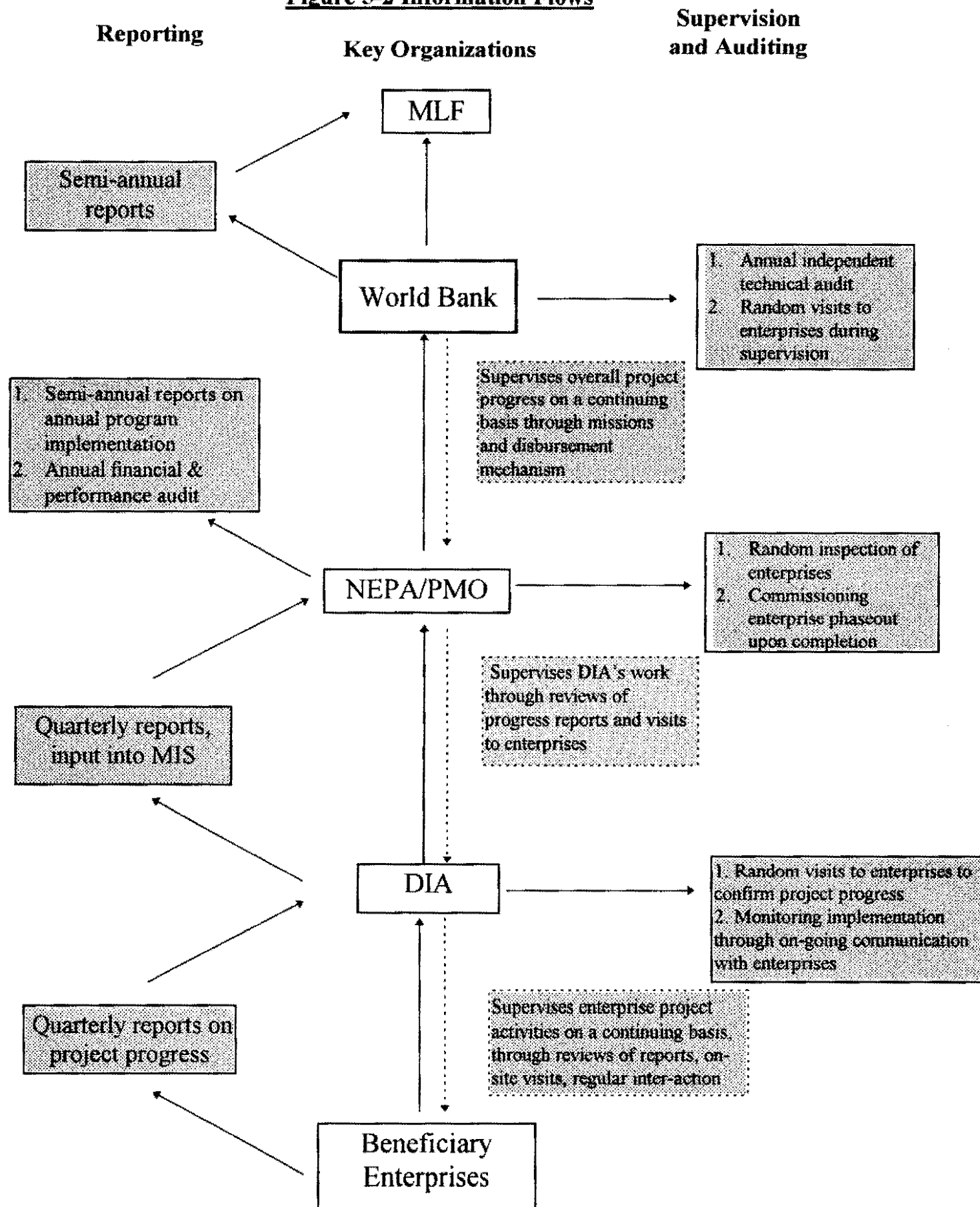


Monitoring and Evaluation

119. The PMO is the focal point for monitoring implementation of annual halon sector phaseout plans and reporting to the World Bank. Figure 5-2 (on the page 47) diagrams information flows related to project monitoring, reporting, supervision, and evaluation. Progress on halon reduction projects (which have been selected through the bidding scheme) will be tracked by the DIA who will submit written progress reports to the PMO four times a year. Implementation of policy measures and technical assistance activities will also be tracked by the PMO. The PMO will formally report to the Bank four times a year. Initially, 11 reporting tables to be prepared by NEPA have been agreed between the Bank and China. These will be revised each year as needed during Annual Program preparation as more experience is gained. The World Bank will report twice annually to the MFEC based on indicators agreed in the Annual Program. A mid-year progress report would be submitted each year along with the Annual Program funding request for the next year. The end-of year report would be submitted along with the Bank's technical audit report by July of the next year.

120. Throughout implementation of this halon sector plan, as agreed in the Umbrella Agreement, the Government of China will commission an independent performance audits of each year's Annual Program and an independent financial audit of the ODS phaseout account. In

addition, the Bank will commission yearly independent technical audits to verify annual halon production and consumption levels. The World Bank will supervise implementation of Annual Programs including spot checks of program records in China and random visits to halon sector enterprises.

Figure 5-2 Information Flows

Technical Annex I to Chapter III

"Incremental Cost Analysis For Phaseout of Halon In China"

I. Key Model Inputs

Production, Export and Stock

Baseline halon 1211 production (reported 1995)	9,950 MT
Export of halon 1211 (1995)	1,400 MT
Stock of halon 1211 extinguisher (1995)	23,023 MT
Stock of halon 1211 systems(1995)	496 MT
Baseline halon 1301 production (1995)	750 MT
Export of halon 1301 (1995)	450 MT
Stock of halon 1301 (halon 1301 imported in systems not included):	760 MT

Halon 1211 Extinguisher Market and Servicing

Major halon 1211 extinguisher service centers	1000
Servicing rate (as a percentage of extinguisher stock)	3.0 percent
Basic demand for clean agent fire extinguishers	15.0 percent

Chemical Prices (in constant 1997 US\$)

Halon 1301 (China)	US\$ 8,500/MT
Halon 1211 (China)	US\$ 2,706/MT
FM 200 (International)	US\$25,000/MT

Capital and Equipment Costs (in constant 1997 US\$)

Capital costs of small 1211 extinguisher enterprise conversion to CO ₂ +ABC	US\$ 72,500
Capital costs of medium 1211 extinguisher enterprise conversion to CO ₂ +ABC	US\$208,500
Capital costs of large 1211 extinguisher enterprise conversion to CO ₂ +ABC+AFFF	US\$286,500
Cost of halon 1211 recycling machine (with compressor)	US\$ 6,000/unit
Cost of halon 1211 reclamation equipment	US\$20,000/unit
Cost of halon 1301 recycling machine	US\$10,000/unit
Cost of halon 1301 reclamation equipment	US\$75,000/unit
Capital cost for halon banking (storage capacity)	US\$800/MT
Capital cost for new equipment to service ABC, CO ₂ and AFFF (avg.)	US\$ 6,000/service center

Growth Assumptions and Discount Rate

Fire protection demand projected growth 1996-2000	15.0 percent
Fire protection demand projected growth 2001-2010	10.0 percent
Discount rate	10.0 percent

Explanations Related To Key Model Inputs

1995 halon 1211 and 1301 production and exports: Based on national survey by MPS of all halon 1211 and 1301 producers. All halon production facilities in China were established before July

1995 and are 100 percent locally owned. Capacity has not been expanded at any of the plants since July 1995. According to survey data collected from the enterprises, newly produced halon exports in 1995 were being made to only Article 5 countries in South America, SE Asia, and the Middle East.

Future halon exports: Export of halon 1211 is assumed to decline by 200 MT/yr from 1997 to 2002 and remain at 100 MT/yr from 2002 to 2004. Estimates of future exports of halon 1301 balance domestic demand and export earnings. (Annual halon 1301 export 1997-2002: reduced by 25 MT/yr. from 1997-99; by 50 MT/yr. 99-00; and by 100 MT/yr. 00-02 Annual halon 1301 export 2000 -2008 constant export of 100 MT/yr.)

1995 stock of halon 1211 and 1301 in fire extinguishers and systems: For halon 1211, based on annual production during the past decade and estimated retirement rates. For halon 1311, based on annual production in the last five years. (The halon 1301 figure excludes halon 1301 imported into China in systems which is estimated to be 1,000-1,500 MT. Because halon 1301 imports are excluded from the models stock calculations servicing demands are underestimated.)

Servicing rate: Assumed to be 3 percent of installed fire extinguishers per annum, based on a study carried out by MPS.

Chemical costs: Based on quotations from chemical suppliers

Capital costs of extinguisher facility conversion: These costs are based on the eligible cost categories in document UNEP/OzL.Pro/MFEC/20/66. Although these cost categories have not yet been endorsed by the MFEC, the implementing agencies have been asked to use them when preparing projects for the halon fire extinguisher subsector (Decision 20/46).

Cost of recycling machines and reclamation equipment: Based on recent price quotations provided by FRC and Getz. (recycling machines are also used to recover halon.)

Capital cost for storage of halon for banking: Assumed to be US\$800 per metric ton of halon, and equivalent to the cost of a storage tank with capacity of 20-40 m3. Capital costs do not include labor costs for installation, civil works or land.

II. Specific Model Inputs, Calculation Methodology, and Output By Cost Component

A. Premature Closure Of Halon 1211 Producers

Output. Eligible Economic Incremental Cost (EEIC) to be met by Multilateral Fund (MLF) stated as the net present value (NPV) in constant 1997 dollars = US\$15.3 million

Additional Inputs

Profit rate for small halon 1211 producers:	9.00 percent
Profit rate for large halon 1211 producers:	11.94 percent
Compensation for labor:	US\$488/ton halon
Remaining life for small halon 1211 producers:	8 yrs (production until end of 2004)

Remaining life for large halon 1211 producers: 13 yrs (production until end of 2009)

Profit rates for halon 1211 producers: Profit rates used are the average of individual profit rates for all similar enterprises based on financial information provided by enterprises. There are only two large producers (Shouguang fire Extinguishing Agent Plant and Dongyang Chemical Plant). Their profit rates are higher due to superior technical processes, distance from raw material suppliers, and economies of scale. The profit rates take into account the higher maintenance costs for large producers needed to keep the plants running another 10 to 20 years and social obligations for retired workers.

Compensation for labor per ton of halon produced: Compensation for labor is calculated on the basis of the average number of workers per ton of halon 1211 produced in the whole industry in 1995 and the average 1995 salary; these figures are taken from financial information provided by all halon 1211 producers. The calculation produces an estimate of the annual labor cost per ton of halon produced (\$256/MT), and since Chinese law requires two years of compensation to be paid, the figure for compensation estimated in the model is the NPV of two years' labor cost.

Remaining life of halon 1211 producers: Most plants were established between 1986-1989, but due to better equipment and greater investment in maintenance at the two large facilities, their plant life is expected to be about five years longer than that of the smaller facilities (average remaining life for large plants is 13 years, whereas it is eight years, on average, for smaller plants).

Calculation Methodology

Incremental costs for premature closure of halon 1211 producers are calculated as lost profit plus labor compensation (that is, value-added). Lost profits are calculated within the model as the NPV of the difference between, on the one hand, the stream of profits that would have been made assuming that production continued at 1995 levels until the end of plant life (as explained above) and, on the other hand, the stream of profits made on production under the phaseout scenario. Labor compensation costs were calculated as the tonnage of halon production to be reduced in each period times the NPV of two years of the annual cost of labor per ton of halon produced.

B. Conversion or Closure Of Halon 1211 Fire Extinguisher Producers

Output EEIC to be met by the MLF stated as NPV in constant 1997 dollars = US\$18.8 million

Additional Inputs

20 small enterprises (up to 20,000 extg/yr.) 1995 halon 1211 consumption	404 MT
25 medium enterprises (20,000 to 75,000 extg/yr.) 1995 halon 1211 consumption	1,814 MT
27 large enterprises (more than 75,000 extg/yr.) 1995 halon 1211 consumption	5,091 MT
Annual incremental operating savings for halon to ABC	US\$3.00/kg halon 1211
Annual incremental operating cost for halon to CO ₂	US\$5.10/kg halon 1211
Annual incremental operating savings for halon to AFFF	US\$2.30/kg halon 1211
Duration for incremental operating costs/savings	six months
Compensation for labor:	US\$488/ton halon

Incremental operating costs for conversion from halon to ABC extinguishers: assumed to be a

cost saving of US\$1.5 per kg for a six-month period as per UNEP/OzL.Pro/20/66 (derived from Table 2 on p. 6).

Incremental operating costs for conversion from halon to CO2 extinguishers: assumed to an incremental cost of US\$2.55 per kg as per UNEP/OzL.Pro/20/66 (derived from Table 2 on p. 6).

Incremental operating costs for conversion from halon to AFFF extinguishers: assumed to be a cost saving of US\$1.15 per kg as per UNEP/OzL.Pro/20/66 (derived from Table 2 on p. 6).

Duration of Incremental Operating Costs: six months is used as per the decision on agenda item 10 at the 16th Meeting of the MFEC.

Compensation for labor per ton of halon consumed in extinguisher manufacture: The model assumes the same level of labor compensation (per ton halon) as halon production.

Calculation Methodology

Reduced halon availability. Halon is divided among various competing demands. As halon production is reduced, the model gives priority to exports, servicing and new system production. The remainder is the amount of halon 1211 available for halon extinguisher production. The reduced availability of halon 1211 for the fire extinguisher industry would cause enterprises to convert to alternatives or shut down production. The model assumes that the 20 small enterprises would be closed and that conversion of medium and large would provide sufficient capacity without additional investment.

Closure. The model only includes compensation for workers at 20 small plants that would be closed. Lost profits are not requested.

Future market structure: Based on MPS assessment, the model assumes that the 15 percent of the future portable extinguisher market will be covered by clean gaseous agents (compared to the current halon 1211 share of 22 percent). To achieve 15 percent clean agent extinguishers in the market, the current production of halon 1211 extinguishers must be converted to produce 65 percent clean agent and 35 percent non-clean agent extinguishers. Following MPS estimates, the model assumes that CO2 will be the clean agent used in portable fire extinguishers. Of the 35 percent non-clean agent, the model again follows MPS estimates that 31 percent will be ABC powder and 4 percent will be AFFF. Thus, the conversion rate is 65 percent CO2, 31 percent ABC, and 4 percent AFFF.

Incremental capital costs: The eligible capital cost per enterprise (given above) is multiplied by the number of enterprises (e.g., for the small enterprise category, the calculation is US\$72,500 * 20). The total capital cost for the size category is then divided by the total annual halon consumption in 1995 for that category of enterprises to yield a unit incremental capital cost in terms of US\$/kg of halon to be phased out by that group of enterprises.

Incremental operating costs/savings for small, medium and large enterprises: Given the calculated conversion rate, six months incremental operating costs for small and medium enterprises converting to ABC and CO2 extinguishers will be US\$1.19 per kg of halon phased out and for

large enterprises converting to ABC, CO₂ and AFFF extinguishers US\$1.14 per kg of halon phased out.

Annual conversion cost calculation: The model assumes that the small enterprises will convert first followed by the medium and then the large. Thus, the first 404 tons of halon 1211 to be phased out are cost on the basis of capital costs for small enterprises (in terms of US\$/kg halon phased out) plus six months of incremental operating costs. Likewise, the incremental cost of phaseout of the next 1,814 tons is based on US\$/kg costs for medium enterprises, and so on.

C. Conversion Of Halon 1211 Systems

Output EEIC to be met by the MLF stated as NPV in constant 1997 dollars = US\$7.9 million

Additional Inputs

Phaseout schedule:	50 tons reduction per year between 1997-2004 ²⁸
Substitute for halon 1211:	FM 200
Conversion ratio between halon 1211 and FM 200:	1:1.7

Conversion ratio between halon 1211 and FM 200: assumed to be 1.7 kg of FM 200 for each kg of halon 1301, based on current international design standards for FM 200 fire systems.

Calculation Methodology

The annual reduction of halon 1211 production is assumed to have some impact on the availability of halon for fixed system manufacturers. The reduced availability of halon 1211 for the fire extinguishing systems would cause enterprises manufacturing them to convert to alternatives or shut down production. The model calculates the incremental cost of these reductions based on one year of incremental operating cost; that is, the incremental cost of substituting FM 200 for halon in new systems for that year. Although actual use of halon 1211 in new systems may rise from 1995 levels, the model only calculates incremental cost of phaseout for the baseline halon 1211 consumption in 1995. No incremental costs are calculated for conversion of installed systems or for conversion of system manufacturers. (As the model ignores the capital costs of conversion, it makes no assumptions as to the number of halon system manufacturers that would shut down as halon is phased out.)

The model uses FM 200 as a proxy for substitute system costs. According to HTOC members, the incremental installed cost of halon substitute systems such as Inergen and CO₂ is either more expensive or roughly equivalent to FM 200.

D. Conversion Of Halon 1301 Systems

Output EEIC to be met by the MLF stated as NPV in constant 1997 dollars = US\$6.6 million

Additional Inputs

²⁸ A 100 ton reduction is assumed between 2000 and 2001 and 100 ton consumption in 2005 -- the last year.

Substitute for halon 1301	FM 200
Conversion ratio between halon 1301 and FM 200	1:1.7

Conversion ratio between halon 1211 and FM 200: assumed to be 1.7 kg of FM 200 for each kg of halon 1301, based on current international design standards for FM 200 fire systems.

Calculation Methodology

Produced halon is divided among various competing demands. As halon 1301 production is reduced, the model gives priority to exports (which are also reducing) and servicing. The remainder is the amount available for new systems. The reduced availability of halon 1301 for the fire system industry would cause systems manufacturers to convert to alternatives or shut down production.

Essentially the same as for halon 1211 systems described above. No incremental costs are calculated for conversion of installed systems or for conversion of system manufacturers. (As the model ignores the capital costs of conversion, it makes no assumptions as to the number of halon system manufacturers that would shut down as halon is phased out.) As noted under halon 1211 system costs, the model uses FM 200 as a proxy for substitute system costs.

E. Modification of Halon 1211 Extinguisher Servicing Stations To Handle New Substitutes

Output EEIC to be met by the MLF stated as NPV in constant 1997 dollars = US\$0.9 million

Additional Inputs

First year modification	2001
Rate of modification	Proportional to the decrease in halon stock

First year of modification: This is assumed to be the same year that stock of halon stored in extinguishers begins to decrease. The decrease in stock is a result of conversion of halon extinguisher manufacturers combined with retirement.

Calculation Methodology

As stock of halon goes down, a proportional number of servicing stations are assumed to convert. For example, if the stock decreases by 10 percent from 2005 to 2006 then 100 service stations would be modified in 2006 (the stock actually decreases about 3 percent per year). By the year 2010, about one-third of the service stations are modified.

F. Recovery, Recycling and Reclamation Of Halon 1211 From Extinguishers

Output EEIC to be met by the MLF stated as NPV in constant 1997 dollars = US\$3.0 million

Additional Inputs

Major servicing centers lacking recycling equipment	850
Required number of reclamation centers	5
IOS from recycling halon 1211 from extinguishers during servicing:	US\$1.70/kg
IOC from recovery and reclamation of halon 1211 from old retired ext.:	US\$0.30/kg

IOC of recovery and reclamation of halon 1211 from prematurely retired ext.:	US\$2.14/kg
Re-useable percentage recovered from old retired extinguishers:	20 percent
Recycled percentage from extinguishers during servicing:	10 percent
Re-useable percentage from halon in stock of extinguishers recovered from prematurely retired extinguishers:	0.15 percent
Retirement rate:	3 percent increasing to 7 percent

Extinguisher retirement rate (replacement rate): Assumed to be 3 percent per annum through 1999; 4 percent through 2004; 5 percent through 2009; and 7 percent through 2015 on the basis of estimates of the current and previous situation by MPS. The increasing retirement rate is due, in part, to the aging life of the stock and also due to premature retirement of halon extinguishers from non-essential uses beginning in 2003.

Re-useable percentage of halon 1211 from retired extinguishers: 20 percent of the halon originally charged in the retired extinguishers is assumed to be recoverable. In 2003, the Chinese government will begin to retire halon 1211 extinguishers installed in non-essential use applications so that their halon can be made available for essential uses. It is assumed that 0.15 percent of halon originally charged in the stock of halon extinguishers will be recovered and reclaimed for re-use from prematurely retired extinguishers.

Incremental operating savings/benefit from recycling re-useable halon 1211 during servicing of extinguishers: Net operating cost to recycle 1 kg of halon 1211 from extinguishers is about US\$1.00 (including labor, energy and maintenance costs). Because halon 1211 sells for US\$2.70 per kg in China, the servicing centers have a net incremental benefit of US\$1.70 per kg of halon recycled. Because halon is refilled into the extinguisher from which it was removed, the halon need not be reclaimed.

Incremental operating savings/benefit from recovery and reclamation of re-useable halon 1211 from old retired extinguishers: The incremental operating costs associated with recovery and reclamation would be greater than for simple on-site recycling, thus an additional cost of US\$2.00/kg is assumed to cover transport to reclamation and operating costs for reclamation facility.

Incremental operating cost of re-useable halon 1211 recycled from prematurely retired extinguishers: This incremental operating cost is based on the same assumptions for labor, energy and maintenance used for on-site recycling (even those these underestimate the costs of recovery and reclamation), and also includes the costs of replacing the prematurely retired extinguisher with a new ABC powder extinguisher. The incremental operating cost of recovering and reclaiming halon 1211 from prematurely retired extinguishers is thUS\$4.84 per kg. Because halon 1211 sells for US\$2.70 per kg in China, the reclamation centers would have a net incremental cost of US\$2.14/ kg recycled halon. Premature retirement begins in 2003 coinciding with ceasing of production of new halon 1211 extinguishers.

Installation of recycling machines and reclamation equipment: China has already installed about 150 halon 1211 recycling units with MLF support. For the model, only recycling from additional recycling machines and reclamation equipment are considered. These are assumed to be installed in 2002 so that recycling, recovery and reclamation can begin in 2003. This additional halon is

needed for servicing to offset reductions in halon 1211 production.

Number of reclaiming centers/machines for halon 1211: MPS has decided to make the halon 1211 reclamation sites the same as those for halon 1301. As stated below, MPS decided to locate these reclamation centers in geographically strategic locations to cover major halon 1301 use areas around China. Preliminary decision is to locate centers in Beijing, Shanghai, Tianjin, Guangdong and Sichuan Province. (On average, one center would service a stock of halon 1211 in extinguishers greater than 8,000 MT)

Number of major halon 1211 extinguisher service centers: There are 1000 halon 1211 licensed service centers in China according to MPS. Of these, 150 have already received halon 1211 recycling machines with MLF support. Thus, only the remaining 850 require halon 1211 recycling equipment.

Calculation Methodology

The capital costs for the recycling machines and reclamation equipment are assumed to be required in 2002. Beginning in 2003, the net operating costs and savings are calculated for each year until 2010 based on the amount of halon recycled or reclaimed.

G. Recovery and Reclamation Of Halon 1301

Output: EEIC to be met by the MLF stated as NPV in constant 1997 dollars = US\$0.3 million

Inputs

Re-useable percentage of halon recovered from retired of 1301 systems	50 percent
Required number of halon 1301 recovery centers (one machine per center)	20
Required number of halon 1301 reclamation centers	5
IOS for recovery of 1301	US\$ 0.50/kg

Re-useable percentage of halon 1301 from retired of systems: assumed to be 50 percent, on the basis of estimates made by MPS and experience of developed countries.

Number of recovery machines for halon 1301: assumed to be 20, located in the main cities and industrial centers throughout China.

Number of reclaiming centers/machines for halon 1301: Based MPS decision to locate reclamation centers geographically strategic locations to cover major halon use areas around China. Preliminary decision is to locate centers in Beijing, Shanghai, Tianjin, Guangdong and Sichuan Province. (On average, one center would service a stock of halon 1301 greater than 600 MT)

IOS for recycling halon 1301: Net operating cost to recycle and reclaim 1 kg of halon 1301 from extinguishers is about US\$8.00 (including labor, energy and maintenance costs). Because halon 1211 sells for US\$8.50 per kg in China, the servicing centers have a net incremental benefit of US\$0.50 per kg of halon recycled. As halon 1301 is taken from retired units, reclamation is required prior to re-use.

H. Banking Of Halon 1211 (From Extinguishers) and Halon 1301

Outputs EEIC to be met by the MLF stated as:

NPV in constant 1997 dollars for halon 1211 and 1301= US\$2.7 million

Additional Inputs

Incremental operating costs for halon banking: US\$0.50/kg/yr.

Operating Costs for halon banking: assumed to be US\$0.50 per kg, based on maintenance and day-to-day handling costs, including labor.

Calculation Methodology

The capital cost of establishing the bank is considered for the year in which the halon is banked. For example, if 100 tons of halon 1211 are banked in 2007, then both the capital cost (\$800/MT) and the operating cost would be included in costs for 2007. In subsequent years, additional capital costs are only considered for new halon added to the bank. Operating costs, on the other hand are considered for all halon in the bank.

I. Destruction of Halon 1211 (From Retired Extinguishers)

Output: EEIC to be met by the MLF stated as NPV in constant 1997 dollars = US\$0.4 million

Additional Inputs

Contaminated percentage of reclaimed halon

5.0 percent

Incremental operating cost for halon destruction

US\$ 6.00/kg

Cost of destroying contaminated halon: Assumed to be US\$6 per kg. Cost includes labor and energy.

Percentage of recovered halon that is contaminated and destroyed: Assumed to be 5 percent of recovered halon, on the basis of estimates made by MPS.

Calculation Methodology

Halon recovery from retired extinguishers begins in 2003 after halon 1211 production has been reduced by 80 percent from 1995 baseline. The amount of recovered halon 1211 is calculated by the model based on assumptions about extinguisher retirement and the stock of halon 1211 stored in extinguishers. Five percent of this recoverable amount is assumed to be contaminated and require destruction each year. Only the incremental operating cost is considered in calculating the eligible incremental costs for halon 1211 destruction.

J. Premature Idleness Of Halon 1301 Plant.

Output: EEIC to be met by the MLF stated as NPV in constant 1997 dollars = US\$0.9 million

Profit rate for halon 1301 producer:

12.0 percent

Remaining life for halon 1301 producer: 13 yrs (production until end of 2009)

Profit rates for halon 1301 producer: Profit rates is the profit rate of the halon 1301 manufacturer.

Calculation Methodology

Incremental costs for premature idleness of the halon 1301 producer is calculated as lost profits were production to instead continue at 1995 baseline of 750 tons. Since the plant will remain in operation, though output is reduced, no request is made for labor compensation. Lost profits are calculated within the model as the NPV of the difference between, on the one hand, the stream of profits that would have been made assuming that production continued at 1995 levels until the end of plant life (as explained above) and, on the other hand, the stream of profits made on production under the phaseout scenario.

**Annex II
to Chapter III****Incremental Cost Comparison: Sector Phaseout Vs. Project-By-Project Approach****1.0 Introduction²⁹**

1. In 1995, the view that complete phaseout of ozone depleting substances (ODS) in a given sector could be accomplished at a lower cost than the project-by-project approach led to the initiation of preparation of the Sector Plan for Halon Phaseout in China. The resulting phaseout plan which incorporates comprehensive policy and competitive grant allocation measures supports such a view.

2. China's proposed Sector Plan for Halon Phaseout accelerates the phaseout of 30,000 ODP tons of halon 1211 from 2010 to 2006 greatly enhancing the global environmental benefits of phaseout. The accelerated halon 1211 phaseout achieves incremental emission reductions totaling 236,000 ODP tons compared to a project-by-project approach³⁰. As elaborated below, these important ozone layer benefits would be achieved for less than US\$1.00 per kg of ODP phased out and would save money compared to individual project implementation. China's halon sector plan would also achieve an additional phaseout of 7,500 ODP tons of halon 1301 by 2010, however, as more is known about halon 1211 phaseout costs, cost savings is established comparing halon 1211 project-by-project costs with sector approach costs.

3. Under the traditional project-by-project approach, individual projects must be submitted and accepted before funds are assured. To meet the 2002 Montreal Protocol halon production and consumption freeze requirements, a government would only need to introduce controls by that time. Absent up-front funding guarantees, it is unlikely that governments would put in place binding ODS controls in advance of Protocol requirements, especially in cases where substitute technologies are not widely available, are more expensive, and/or require capital investments by enterprises. Under a sector approach, incremental costs for the complete phaseout program would be agreed up-front. Confident in the level of Multilateral Fund support for halon phaseout year-by-year, the Government of China would, according to its sector plan, impose production quotas starting in 1997 for an accelerated halon 1211 phaseout. In addition, competition for grants under the sector approach would encourage more strategic use of funds than the project-by-project mechanism which awards grants on a first-come-first-serve basis.

²⁹ This note should be considered as an addendum to the Sector Plan for Halon Phaseout in China has been submitted to the Executive Committee of the Multilateral Fund.

³⁰ Using project-by-project "base case" assumptions; 10 percent conversion/closure and 5 percent growth per year through 2001 and then following MP schedule.

2.0 Key Elements of the Incremental Cost Comparison Analysis

1. By comparing the phaseout costs of halon 1211 under China's sector approach with a project-by-project approach, the MLF would save about 27 percent by supporting the sector plan.

Table 1: SECTOR APPROACH SAVINGS COMPARED TO PROJECT APPROACH

Cost Component	Sector Approach US\$	Project Base Case US\$	Percent Savings
Closure Halon 1211	14.69	17.18	14 percent
Conversion Halon 1211 Extg. Plants	19.37	26.94	28 percent
Banking Halon 1211	3.70	7.72	52 percent
Total NPV	37.76	51.85	27 percent ³¹

2.c0P Key elements of the incremental cost analysis and comparison are as follows:

- (a) Comparison based on three cost components of halon 1211 phaseout - more than 80 percent of eligible incremental costs. The savings which would accrue to the Fund through approval of the sector approach are best understood by comparing costs for three of the major cost components in the halon sector plan: closure of halon 1211 producers, conversion of halon 1211 extinguisher manufacturers, and halon 1211 banking. These three cost components comprise 81 percent of the halon 1211 investment phaseout costs and provide a good indication of the relative difference between a project and sector approach. Moreover, the approaches adopted to calculate the eligible incremental costs for recycling, systems, service stations, do not lend themselves easily to comparison with project approach.
- (b) Project-by-project assumes 10 percent conversion per year and growth of 5 percent prior to MP controls. The base case project-by-project approach assumes that about 10 percent of halon 1211 extinguisher production would be converted each year and that production would be closed down by a corresponding amount.³² Beginning in 2002, conversions and closures would be done sufficient to meet the Montreal Protocol controls. At the same time, it was assumed that funding for halon phaseout projects would increase the effectiveness of policy measures, such as the ban on non-essential use and prohibitions on new halon producers and extinguisher manufacturers thereby limiting halon growth. Instead of historical rates of 15 percent growth per year in the fire protection sector, the base case assumes that halon extinguisher production would grow at only 5 percent per year until the year 2001 (the additional 10 percent anticipated growth would be covered by substitutes) after which reductions would follow Montreal Protocol controls.
- (c) Funding based on existing plant capacity. Under the base case conversion and

³¹ Adjusting growth rate from zero to 10 percent. The percent savings ranges from 23-29 percent.

³² Exports and new system demands were assumed to be the same as under the sector approach.

growth assumptions, peak halon production and consumption would not exceed the capacity of existing plants. Given the assumptions for exports and servicing used in the sector approach analysis, halon 1211 production would, under the base case, grow until the year 2000 when production would peak at 11,173 MT. Consumption of halon 1211 in new extinguishers would peak in 2001 at 8,666 MT. In both cases, these peaks are within the capacity of existing facilities that would remain after implementation of conversion and closure projects up to those years. In other words, the base case only considers financing of halon capacity installed before July 25, 1995. Moreover, because capital costs in the sector approach are based on per enterprise cost, these capital costs do not increase in the base case despite increased production of halon 1211 extinguishers.

- (d) Sector approach additional savings. In addition to the MLF savings expected from an accelerated halon 1211 phaseout, China expects further savings from the sector plan's policy incentives (including the grant bidding scheme) which would encourage enterprises to phaseout in more cost effective ways. As potential costs, savings, and benefits are best known to the enterprises themselves, it is difficult if not impossible to estimate savings in advance. However, the sector plan funding request captures the savings by excluding any request for contingency. The project-by-project base case includes 10 percent contingency (as is the practice in current projects).
- (e) Sensitivity to growth rate assumptions. The project-by-project approach costs are relatively insensitive to changes in the assumptions about rate of conversion vs. rate of growth. For example, if conversion before MP controls were to take place at a rate of 5 percent per year while halon extinguisher growth continued at 10 percent per year, the savings would increase to 29 percent. On the other hand, if conversion were to increase to 15 percent per year with growth at zero the savings would be reduced to 23 percent. Thus, even if government control were successful under a project-by-project approach, a sector approach would still yield savings of over 20 percent by comparison.

3.0 Halon Phaseout Costs Relative to Other Sectors

1. The sector approach would save funds compared to a project-by-project approach. But putting the issue of savings aside, China's Sector Plan for halon Phaseout is one of the most cost effective proposals to be considered by the Fund. Through June 1996, the Multilateral Fund had financed projects that would, when complete, eliminate consumption of about 75,000 ODP tons with an average cost effectiveness of about US\$5.50/kg of ODP phased out. The proposed halon sector approach would add an additional 37,500 ODP tons of both production and consumption to the MLF portfolio at a cost effectiveness of less than US\$1.00/kg ODP. Table 2 below lists total cost effectiveness of the program and also provides the cost effectiveness for two of the programs largest cost components -- halon 1211 production closure and halon 1211 extinguisher manufacturer conversion.

Table 2: SECTOR PLAN FOR HALON PHASEOUT IN CHINA: COST EFFECTIVENESS

	Production Phased Out (ODP MT)	Consumption Phased Out (ODP MT)	Grant (US\$ million)	Cost Effectiveness
Overall Sector Approach	37,350	29,150	59.7 NPV	US\$0.90/kg ODP ³³
Closure Halon 1211	29,850		14.9 NPV	US\$0.50/kg ODP ³⁴
Conversion Halon 1211 Extg. Plants		22,032	19.4 NPV	US\$0.88/kg ODP ³⁵

³³ If the cost effectiveness is considered for the sum of present values for each year of the program (US\$87.9 million), the cost effectiveness would be US\$1.32/kg ODP.

³⁴ Cost effectiveness of sum of PVs (US\$19.7) would be US\$0.66/kg ODP.

³⁵ Cost effectiveness of sum of PVs (US\$22.9) would be US\$1.04/kg ODP.

PART II

Structure of an Agreement regarding the Implementation of a Sector Phaseout of Halon in China

October 1997

INTRODUCTION

1. At its meetings in Montreal on the 18th and 19th of September, 1997, the Sub-Committee on Project Review, "requested the Fund Secretariat and the World Bank to draft a document containing what they viewed as the broad structure of an agreement between the Executive Committee (EC) and the Government of China regarding the implementation of a sector phaseout of halon in China, and to circulate this document for comments by members of the Sub-Committee as soon as possible (UNEP/OzL.Pro/ExCom/SCPR/11/4, page 6, para 6)." The World Bank agreed with the Fund Secretariat to take the lead on drafting this "broad structure."
2. After consulting with the legal counsel of the World Bank Environment Department and others involved in the Halon Sector Phaseout Program, we would suggest for the reasons that follow that a more expeditious manner of handling this matter would be to draft a set of "Conditions of Approval" rather than an "agreement between the EC and the Government of China" as such. These "Conditions of Approval" (see attached) could provide the necessary framework to ensure that each party involved, i.e., the EC, the Government of China and the World Bank would carry out the actions essential to the success of the Halon Sector Phaseout, without creating a new and potentially complex tripartite legal agreement.
3. In addition, a new legal agreement might be redundant as it appears that all necessary legal agreements are already in place. First, a legal agreement exists between the World Bank and the Executive Committee which lays out the Bank's responsibilities, fiduciary and otherwise, as an implementing agency. This would govern the Bank's responsibility to the ExCom with regard to the Halon Sector Phaseout as it does in other approved projects. Second, an umbrella grant agreement has been negotiated between the World Bank and the Government of China which sets out the relationship and concomitant responsibilities of both parties. Like the agreement between the EC and the World Bank, this grant agreement will provide the overarching framework and would allow for the necessary exchanges and responsibilities under the Halon Sector Phaseout Program just as it does for other projects.
4. The EC's use of "Conditions of Approval" is already well-established. Through such conditions the EC may provide funds to the receiving party (in this case the Government of China) as long as the receiving party completes the required conditions/actions. Conditions also indicate the policy position of the EC for future funding considerations. Conditions have been placed on numerous approvals and have been relied upon to elicit the desired result even in difficult circumstances, e.g., the Tongxiang project in China.
5. A draft set of "Conditions for Approval" is attached. As proposed, these "conditions" could delineate the needed actions on the part of the Government of China in accordance with the proposal which is to be presented to the Executive Committee for the full program of Halon Sector Phaseout, while still providing the flexibility for changes in the specific program structure to take place should that be necessary to meet the phaseout targets.

SECTOR PLAN FOR HALON PHASEOUT IN CHINA DRAFT "APPROVAL CONDITIONS"

6. After reviewing the Sector Plan for Halon Phaseout in China's "sector approach" proposal, the Executive Committee (EC) has decided to commit in principle to approve future funding requests for implementation of the program at the annual funding levels which have been agreed in Annex xxx. The EC has also decided to approve \$xxx for implementation of the first Annual Program to be carried out in 1998.
7. The total level of funds which have been agreed represent the maximum amount of grant for which China is eligible from the Multilateral Fund for phaseout activities in its halon sector. The EC undertands that its acceptance of the proposed program and its approval of Annual Program funding requests binds the Government of China to the phaseout schedules for production and consumption of halon 1211 and halon 1301 which have been agreed in Annex xxx. Continued funding of the program is conditioned on acheivement of those phaseout targets.
8. The EC also decided on the following as conditions for subsequent approvals of funds for implementation of Annual Programs that would acheive halon phaseout targets agreed under the Sector Plan:
- (a) *Annual Programs.* Annual Programs would be submitted to the last meeting of the EC in the year prior to their implementation. Each program would include policy initiatives, enterprise-level activities, and technical assistance activities that would be carried out to achieve the phaseout targets under the Sector Plan. Funding levels for enterprise-level activities and technical assistance would be baed on the totals agreed in Annex xx. The However, China would have flexibility in each Annual Program to allocate funds within enterprise-level or TA activities to best acheive phaseout targets. Performance indicators for monitoring the Annual Program activities and targets would also be included.
 - (b) *Technical Assistance.* Technical assistance amounts agreed in Annex xx represent the maximum that could be requested for each year through annual programs. Funding for specific TA activities would be based on terms of reference approved by the World Bank. TA funds which are not committed during the year, would be returned to the Multilateral Fund.
 - (c) *Reporting.* Timely reciept of semi-annual progress reports based on indicators agreed in each Annual Program. Progress on policy initiatives and enterprise-level actions should be sufficient to indicate that annual phaseout targets would be achieved by the end of the year.
 - (d) *Verification.* Timely receipt of annual technical audit reports on levels of halon production and consumption (production plus imports minus exports) from an independent auditor commissioned by the World Bank. The auditors would confirm production, imports and exports as specified in the annual programs.

- (e) *Remedial Actions.* Should production of halon exceed the amount agreed in the phaseout schedule for a given year, remedial actions should be undertaken so that the amount of halon production in the subsequent year is reduced by the same amount. In this way, total production for the two years would not exceed the combined production target. A remedial action plan would be submitted along with the next year's Annual Program. The EC would either approve funding for the next year's Annual Program based on the remedial action plan, or would condition approval upon verification that production levels for the two years did not exceed combined targets.
 - (f) *Reduction of Future Funding Obligation.* In the event that over production is not rectified as described in paragraph four above, the funding schedule in Annex xx would be modified to reflect a decrease in funding eligibility. As production phaseout is based on compensation for lost profits and plants have continued to produce reducing the level of profits that would be foregone, grant compensation could be reduced proportionally. [may be desirable to agree on formula for grant reduction up-front]
 - (g) *Repayment of Funds.* In general, the Government of China could continue to use grant funds approved to achieve Annual Program targets even in the face of delay. However, if it becomes clear that a delay is persistent and the phaseout targets would not be achieved within the schedule of Montreal Protocol controls, funds proportional to phaseout shortfall would be reimbursed to the Multilateral Fund.
8. No additional conditions will be imposed on funding during implementation of this program.

PART III

THE HALON SECTOR

1998 ANNUAL PROGRAM

October 1997

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THE HALON SECTOR 1998 ANNUAL PROGRAM

A. Phaseout Schedule

1. "The Sector Plan for Halon Phaseout in China" as revised in October 1997 has been presented to the Executive Committee of the Multilateral Fund for consideration at its 23rd Meeting. This first year implementation plan would be revised to reflect the phaseout targets and funding levels which are agreed in the overall Sector Plan. As proposed, there are three stages in the complete phaseout of the sector:

- (a) *First stage:* During 1998-2000, the Chinese government will phase out 60% of halon 1211 production through a production quota system with a bidding mechanism for efficient fund allocation. Correspondingly, China will close and convert some halon 1211 fire extinguisher manufacturers and convert certain fire extinguishing system manufacturers. During this period, China will retain production of halon 1301 to meet halon demand in essential uses.
- (b) *Second stage:* During 2001-2005, the Chinese government will continue to implement its halon phaseout plan for the fire protection sector by closure and conversion of facilities. At the end of the second stage, China will have stopped completely production and export of halon 1211 and will have introduced the use of recovered halon and halon recovery equipment in service stations. In addition, the quantity of stored halon 1211 in the halon bank will have reached 3,000 MT.
- (c) *Third stage:* During 2006-2010, the Chinese government will continue its programs for recovering halon 1211 and will draw from the halon 1211 bank to minimize premature retirement of halon 1211 fire extinguishers and systems. By the end of this stage, China will have stopped completely the production and export of halon 1301 and will have converted all halon 1301 system manufacturers. In addition, the quantity of stored halon 1301 in the halon bank will have reached 500 MT.

B. Objectives of the 1998 Annual Program (from January 1 to December 31)

2. At the conclusion of the 1998 Annual Program, China will have phased out 1,990 MT of halon 1211 production (from agreed baseline of 9,950 or the amount of phaseout needed to ensure that production target is not exceeded) and 1,790 MT of halon 1211 consumption (or amount needed to ensure consumption target is not exceeded). China is applying for US\$13.1 million¹ from the Multilateral Fund as agreed in the overall Sector Plan to achieve these goals.

3. Out of these funds:

- (a) US\$3.6 million will be used for closing 7-8 halon agent producers;
- (b) US\$6.9 million will be used for closing and converting 20-25 fire extinguisher manufacturers;

¹ This amount will be adjusted based on amounts agreed in the overall Sector Plan.

- (c) US\$1.1 million will be used for converting 2-3 fire extinguishing system manufacturers; and
- (d) US\$1.55 million will be used for technical assistance projects.

C. Program activities during the Year

Policies initiatives

4. In 1998, the following policies and measures will be promulgated by the Chinese government. These are considered as necessary in the implementation of the first annual program and to the success of total halon phaseout in China.

- (a) *Bidding* -- A bidding system will be introduced following approval of this 1998 Annual Program. Preparatory work has been underway since early 1997. Recipient enterprises will be determined through a bidding procedure administrated by the government. The lowest bidders will be awarded grant funds after bid evaluation. The government will sign closure/conversion contracts with the winning enterprises. The contracts will be implemented to help fulfill the halon phaseout plan
- (b) *Tradable production quota* -- A regulation on a tradable production quota will be introduced following approval of this 1998 Annual Program. A draft regulation has been prepared and reviewed by the World Bank and is ready for promulgation. The production quota will cap halon production at the national level and violators will be severely penalized. This is the key policy instrument for accomplishing the phaseout objective. It also offers halon agent producers flexibility as the regulation allows producers to trade their quota among themselves. This would induce enterprises to participate actively in the implementation process of the halon phaseout plan.
- (c) *Ban on new installation of halon extinguishers for non-essential uses and a gradual tightening of the definition of essential uses* -- Implementation processes are:
 - (i) On Nov. 11, 1994, MPS and NEPA jointly promulgated the Notice on "The Ban on New Installation of Halon Extinguishers in Non-essential Areas". This notice clearly defines 3 categories and 51 kinds of non-essential places for halon extinguishers. The notice establishes that --
 - new installation of halon extinguishers in non-essential areas is prohibited; and
 - enterprises that do not have a halon production license issued by MPS are not permitted to produce halon extinguishing agent and extinguishers.
 - (ii) The notice became effective from October 1, 1995, and there are indications that it has had a restraining effect on the demand for halon-based fire extinguishers.

- (iii) In order to implement the ban on non-essential uses in the most effective manner, the Chinese government will ensure the following:
- the government will disseminate details of the ban to all prospective consumers through various channels (news media, bulletin, propaganda, etc.);
 - local fire bureaus and environmental protection bureaus will jointly inspect consumers on a regular basis. If any consumer is found to be using the newly-installed halon fire extinguishers in non-essential areas, the consumer will be required to change within a definite time; and
 - joint inspection teams of the local fire bureaus and environmental protection bureaus will be required to submit regular reports to MPS and NEPA about the situation and measures in implementation of the Ban.
- (d) *Fire code revisions* -- Revision of the following fire regulations for construction will be promulgated in 1997 and implementation will be emphasized in 1998:
- (i) Code for Design of High-rise Civil Building;
 - (ii) Code for Design of Ground Construction;
 - (iii) Fire Protection Building Design Code; and
 - (iv) Building Fire Extinguisher Installation Design Code

D. Enterprise-level activities

5. Through the production quota and bidding systems described above, bid winners would be granted funds for closure and conversion activities. All contracts are expected to be signed in the first half of the year. Closure projects are expected to be completed within the program year while conversion projects may take longer than a year, but conversion activities would start during the year.

E. Technical assistance (TA) activities

6. TA activities envisaged under the sector phaseout plan concentrate on strengthening: (i) the overall institutional framework, (ii) management, monitoring & evaluation capabilities of participating institutions, (iii) more importantly, technical personnel involved in halon phaseout activities, and (iv) in the development of alternative technology. These are essential to the success of the phaseout objectives. All terms of references and detailed work scheduled are to be agreed with the World Bank before implementation. Main TA activities in 1998 include:

- (a) *Development of a Management Information System (MIS) for halon phaseout in the fire protection sector* -- The MIS is an important tool in the management and supervision of all phaseout activities. It is also a basic instrument to generate progress reports on the implementation of the halon sector approach required by the EXCOM and the World Bank. It is used to monitor performance in the halon phaseout. A computer-based information management center will be established in the Project Management Office at NEPA, and sub-stations in the Fire Fighting

Bureau of MPS and the Ministry of Finance (which will monitor and authorize disbursement from the ODS phaseout account).

- (b) *Study of feasible alternatives for managing imports and exports of halon* -- China's halon production is sufficient to meet domestic demand and thus China does not import halon. Moreover, most other nations with the ability to produce halon have ceased limiting possible sources of imports. Stoppage of halon production in other nations has also created markets for halon exports. As China phases out halon production and consumption, monitoring of both imports and exports will become increasingly important to prevent illegal trade. This study will look comprehensively at China's halon import and export regime and design feasible policy options for improved management of halon trade which could be implemented at the earliest possible date.
- (c) *Training of personnel involved in implementation of phaseout activities* -- In order to implement the phaseout plan effectively, it is necessary to train staff of local environmental protection bureaus, local fire bureaus and halon enterprises. Training is needed to prepare enterprises to bid in the following year, to supervise halon production and consumption, to manage the tradable production quota system, and to learn operating procedures in the halon sector phaseout approach. This type of training will need to be repeated every year in the first few years of implementation.
- (d) *Revision and implementation of ABC dry powder production standards* -- BC powder, and to a lesser extent ABC powder, have been available in the Chinese market for some time. Yet despite the lower costs of powder, it has not been able to compete with halons, which still cover about 25% of the extinguisher market. Aside from not being a "clean" fire extinguishing agent, the lower quality of BC and ABC powder and limited lifetime of powder in fire extinguishers are limiting factors in its market acceptance. Furthermore, the handling of powder in the service sector have added to the poor performance of powder extinguishers.
- (e) The original standard for ABC powder needs to be revised to improve the powder quality and significant technical assistance would be needed to provide to all levels in the fire protection industry (powder manufacturers, extinguisher manufacturers and service shops). Implementation of the revised ABC powder standard will require significant technical assistance and training.
- (f) *Preparation for the development of a halon management plan* -- The Halon Sector Phaseout Plan lays out the principles for the establishment of a halon management plan, including emission during servicing and setting up a recovery and halon banking system. This represents only the first stage of development to initiate all preparatory work. Some issues and activities are highlighted below:
 - (i) The combination use of halon fire extinguishers for non-essential areas and high leakage/failure rates of halon fire extinguishers result in unnecessary emission of halon 1211. In order to reduce emission, the use of service-type recovery and recycling and recycling equipment is part of the halon

management program. The program was initiated by MPS and USEPA through a bilateral cooperation. Additional equipment is covered under the halon sector phaseout plan. The requested TA would cover training of and technical assistance to service workshops.

- (ii) One of the results of the rapid phaseout schedule of halon production in China would be that some demand after year 2003 would have to be covered by recovered halons. This makes it imperative that preparation work for the development of a halon recovery and halon banking system program to start in 1998.
- (iii) Preparation of the plan will draw on experiences from developed countries and main essential users who presently are running halon banks. A main concern is the foreseen continued demand for halons for essential uses in China, such as aviation, defense, oil industry, telecommunication and ships.
- (g) *Formulation of the Design Code Regulation on Inert Gas Fire Extinguishing Systems* -- Inergen fire extinguishing systems and FM200 fire extinguishing systems are already being used in some places in China. According to the Chinese regulations, fire extinguishing system installed throughout the country should meet established Chinese national standards. Therefore, it is necessary to finish the formulation of the Design Regulation on Inert Gas Fire Extinguishing System as soon as possible in order to regulate the design, construction and supervision of the inert gas and HFC fire extinguishing systems.
- (h) *Formulation of the national standard for Property Requirements and Test Methods for Spare Parts of Air Fire Extinguishing Systems* -- To facilitate the transformation to other air substitute fire extinguishing systems, technical standards for spare parts of this kind of fire extinguishing system must be completed as soon as possible to regulate the quality of the spare parts of inert gas and HFC fire extinguishing systems in order to monitor and provide for inspection of the quality of products.

7. The above policy initiatives, enterprise-level and technical assistance activities are summarized in Table 1 below.

TABLE I: 1998 ANNUAL PROGRAM

HALON PHASEOUT TARGETS & ACTIVITIES						
	Estimated MLF \$ mill. requested	Start of program (MT)	Target (MT)	End of program (MT)	Key Actions Required	Key Dates
Halon 1211						
Production phase-out target	13.13	9,950	1,990 reduction	7,960	1. Closures of halon agent producers 2. Appropriate TA activities help phaseout.	1. Jan.-Mar. 1998 2. Early 1998
o.w. Export			800			
Domestic consumption			7,160			
Consumption phaseout target			1,790 reduction		1. Conversion of halon fire extinguishers to non-halon extinguishers	1. Jan. - June 1998
Halon 1301						
Production phase-out target		750	0	750	1. Appropriate TA activities help further phaseout.	
Consumption phaseout target		750	0	750	1. Appropriate TA activities help future phaseout.	
Policy Initiatives						
1. Bidding system					1. Establish bidding system's operating procedures; 2. Determine winning enterprises for 1998; 3. Sign closure/conversion contracts with winners; 4. Implement closure/ conversion contracts. 5. Train enterprises for bid preparation for 1999 bidding	1. Started in early 1997. System in place by end 1997. 2. Dec. 1997 3. Jan. - June 1998 4. Closure -- Jan. to March 1998 Conversion -- starting mid-year for a 12-24 month implementation period 5. Mid- 1998
2. Tradable production quota for halon producers					1. Set up total amount of halon annual production quota ; 2. Issue annual production quota to halon producers for 1998	1. Dec. 1997 2. Dec. 1997
3. The ban on halon extinguisher uses in non-essential areas					1. Promotional campaign on the ban, through various channels; 2. Joint supervision of ban by local Fire Fighting Bureaus and Envir. Protection Bureaus.	1. Through 1998 2. Through 1998
4. Two fire code revisions for building					1. Revise Building Fire Protection Code and Building Fire Extinguisher Setting Code for highrise civil building and underground design.	1. Through 1998

Enterprise-level Activities						
	Estimated MLF \$ mill. requested	Existing enterprises	# of enterprise targeted	# of enterprises at end of 1998	Key Actions Required	Key Dates
1. Closure of halon agent producers	3.6	14	7-8	6-7	Selection through bidding process	1. Bid winners announced- Dec. 97 2. Contracts signed Jan. 1998 3. Completed no later than June 98
2. Closure & conversion of halon extinguisher manufacturer	6.9	72	20-25	52	Selection through bidding process	1. Bid winners announced Dec. 97. 2. Contracts signed no later than June 1998 3. Completed in 12-36 months
3. Conversion of halon fire extinguishing system manufacturers	1.1	22	2-3	20	Selection through bidding process	1. Bid winners and contracts signed no later than June 1998 2. Completed in 12-24 months
Subtotal	11.6					

TECHNICAL ASSISTANCE ACTIVITIES

ACTIVITIES	MLF funding requested (US\$'000)	Actions Required	Key Dates
1. MIS development	150	MIS center will be located in PMO, with substations in the Fire Fighting Bureau of MPS and in the MOF	1. Started preparatory work in mid-1997. 2. Start operational in early 1998. 3. Need further improvements during 1998 and 1999.
2. Import & Export Management Feasibility Study	150	Investigate halon import and export situation and develop feasible options for improved management	1. Contract signed no later than 1Q 1998. 2. Complete report in 1998.
3. Training	50	Training on supervision of halon production and consumption, the management of halon production quota system, and halon operating manual as well.	1. Start no later than mid-1998 for the bidding of 1999.
4. Revision of standards of ABC dry powder production standard	400	Revision of standard will be done by qualified institution	1. Contract signed no later than June 1998 2. To be completed in 24 months
ACTIVITIES	MLF funding requested (US\$'000)	Actions Required	Key Dates
5. Preparation for the development of a halon management plan	200	Detailed design plans will be put forward for two demonstration areas, Shanghai and Guangdong	1. Contract to sign no later than June 1998 2. To be completed in 12-24 months.

6. Formulation of design code on inert gas fire fighting systems	300	Formulation of the code by qualified institution	1. Contract to sign no later than June 1998 2. To be completed 24-36 months
7. Formulation of national standard for property requirements and test methods for spare parts of air fire extinguishing system	300	Formulation of the code by qualified institution	1. Contract to sign no later than June 1998 2. To be completed 24-36 months
Subtotal	1,550		
TOTAL for phaseout activities	13,113		

TABLE II: 1998 ANNUAL PROGRAM - PROPOSED PERFORMANCE INDICATORS

Halon Phaseout Targets				
Halon subsector	Start of program (MT)	Target (MT)	End of program (MT)	Indicators to be reported on in semi-annual progress reports
Halon 1211				
Production phaseout target	9,950	1,990 reduction	7,960	Production levels (national aggregate)
o.w. Export		800		Exports and imports (national aggregate)
Domestic consumption		7,160		
Consumption phaseout target		1,790 reduction		Consumption levels (production plus imports minus exports)
Halon 1301	750	0	750	Production levels (national aggregate)
Production phase-out target				
Consumption phaseout target	750	0	750	Consumption levels (production plus imports minus exports)
Policy Initiatives				
Initiatives				Indicators to be reported on in semi-annual progress reports
1. Bidding system				- Bidding system's operating procedures finalized - Winning enterprises for 1998 selected - Enterprises trained for bid preparation for 1999 bidding
2. Tradable production quota for halon producers				- Production quota regulation promulgated and effective; - Annual production quota to halon producers for 1998 issued - Production reports from enterprises received
3. The ban on halon extinguisher uses in non-essential areas				- Promotional campaigns on the ban undertaken; - Local Fire Fighting Bureaus and Envir. Protection Bureaus engaged in overseeing ban enforcement.
4. Two fire code revisions for building				Revised Building Fire Protection Code and Building Fire Extinguisher Setting Code for high-rise civil building and underground design completed

Enterprise-level Activities				
Activities	Estimated MLF US\$mill. requested	Existing enterprises	# of enterprises at end of 1998	Indicators to be reported on in semi-annual progress reports
1. Closure of halon agent producers	3.6	14	6-7	• Number of ODS reduction contracts signed for closure • Number of closures completed
2. Closure & conversion of halon extinguisher manufacturer	6.9	72	52	• Number of ODS reduction contracts signed for closure or conversion • Number of closures completed • Number of conversions completed and implementation progress
3. Conversion of halon fire extinguishing system manufacturers	1.1	22	20	• Number of ODS reduction contracts signed for conversion • Number of conversions completed and/or implementation progress
Subtotal	11.6			Total disbursement to enterprises
TECHNICAL ASSISTANCE ACTIVITIES				
Activities			Indicators to be reported on in semi-annual progress reports	
1. MIS development				
2. Import & Export Study				
3. Training				
4. Revision of ABC standard				
5. Preparation halon management plan				
6. Formulation of inert gas design code				
7. Formulation of standard and test methods for air fire system parts				
Subtotal	1,550,000		• TA contracts signed • TA activities completed and implementation progress • Total disbursement to TA activities	
TOTAL for Phaseout Activities		\$13.1 million		