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FINAL REPORT ON THE EVALUATION OF THE HALON SECTOR

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Executive Summary

(a) Overview

1. This report summarizes the findings of evaluation missions to five Article 5 countries (P.R. China, India, Brazil, Venezuela and Malaysia) and UNEP/DTIE. Its structure reflects the heterogeneous composition of projects in the halon sector.
2. The most important and unique one is the halon sector plan in China, approved at the 23rd meeting of the Executive Committee, consisting of a coordinated phase-out of halon production and consumption until 2010. China had about 2/3 of halon consumption of all Article 5 countries and received also about the same share of funding in the sector. It is the only country, with South Korea, that still produces halons.
3. India had some production of halons in the mid-1990ies, but its consumption remained fairly low, as in Article 5 countries in general which introduced the use of halons mostly in the 1990 only when they were already destined for phase-out under the Montreal Protocol. Most projects in India were fire extinguisher projects, supplemented by a relatively small sector plan compensating two halon producers which had stopped production earlier, for the definite dismantling of their facilities.
4. A few other countries received funding for converting some fire extinguisher manufacturers, and during the last years numerous halon banking and management projects were approved (see Annex I). Moreover, UNEP and in early years UNDP, implemented a series of non-investment projects.

(b) Halon Producers

5. The phase-out of halon production in China is proceeding according to, and even ahead, of the agreed schedule under the Halon Sector Phase-out Plan (see Annex II). For example, the phase-out of halon 1301 could be accelerated because annual domestic demand as well as exports are below what was envisioned in the plan. No shortages of halons for critical uses were reported, and the transition to alternative agents has kept pace with the requirements. All halon producers who reduced or discontinued production have expressed general satisfaction with the process and, based on visual evidence as well as on the verification reports by the World Bank auditors, there has been no attempt to produce beyond the allotted quotas or to restart stopped production. The low domestic and international demand for halons provided no incentives for this. Some concerns were expressed by companies visited about low profit margins due to intensified competition and lower selling prices for alternatives.
6. Halon production facilities visited in China have been totally or partially dismantled, in line with the phase-out contracts signed with SEPA. Remaining halon production units are old and would probably require some extended maintenance if they had a long-term future, but this is not the case. The start-up of temporarily idled plants takes every time a considerable period, up to a month, before continuous production of reliable quality is possible again. This is not unusual when halons are produced in campaigns only.
7. Halon 1301 production in China could be terminated earlier than expected in the halon phase-out plan. Accordingly, the feasibility of achieving this earlier closure should be pursued.

8. The two Indian halon producers, SRF and Navin Fluorine (NFI), established their facilities in 1990/1992 (NFI) and 1994/1995 (SRF). Nominal capacities were 500 mt at SRF and 300 mt at NFI. Production reached a maximum level of 95 mt in 1995 at NFI and 109 mt in 1998 at SRF, consisting almost entirely of H1211 as H1301 was not produced in commercial quantities although its production was technically feasible. The low capacity utilization and early stop of production (NFI in 1996 and SRF in 1998) was due to changes of market demand and supply compared to the original planning. Demand in India decreased faster than expected due to awareness raising activities and conversion projects and the ready availability of substitutes, most of them expensive, however. Remaining demand for halon is covered by low cost imports from China, and, in perspective, from recovered and recycled halons from phased-out installations in the country, once the halon banking project will become operational.

9. The two halon plants in India have been dismantled and verification done by an independent audit team hired by the World Bank. Both enterprises have completed their environmental assessments and have submitted the reports. These were also reviewed by an independent auditor hired by the Bank.

(c) Fire Extinguisher Manufacturers

10. Under the Halon Sector Phase-out Plan in China, a total number of 56 conversion and closure contracts have been concluded with fire extinguisher and a few system manufacturers. 46 of them have been executed, most of them ahead of time or on schedule, while some delays occurred in the 2000 programme. The volume of phase-out contracted and funding allocated has significantly decreased in 2001 and 2002, reflecting that there are less and less companies to convert from the original list of 72 fire extinguisher manufacturers and 22 systems manufacturers, and that the remaining manufacturers are more difficult to motivate to proceed with the conversion. The average cost-effectiveness is US\$ 0.45 per kg of ODP phased-out, much below the threshold of US\$ 1.48 per kg, if 100% use of H1211 is assumed (factor 1:3), not taking into account the use of H1301 in fixed systems. The higher conversion factor of H1301 (1:10) would further improve the cost effectiveness.

11. The new technologies, standards and agents have brought about greater interest in the development of the fire equipment manufacturing industry. The diversification of existing manufacturers, new entrants, and a move towards quality and mass production have been the main features. The industry is moving towards a healthy well-diversified manufacturing sector that will meet the fire protection needs in China, while developing also export markets.

12. India had 14 projects approved for the conversion of fire extinguisher and system manufacturers, 13 of them implemented and completed by UNDP and one by the World Bank which was cancelled at the 39th Meeting of the Executive Committee although the conversion had taken place. Total funds disbursed are about US \$1.2 million, and the average actual cost effectiveness is US \$0.93 per kg of ODP phased out. The first batch of projects was completed with several months of delays but most projects of the second group approved by the 28th meeting of the Executive Committee were completed 13 months ahead of schedule.

13. Equipment supplied to fire extinguisher manufacturers in India has considerably enhanced their production capacities. There is an apparent gross under-utilization of equipment supplied, however, particularly of the numerically controlled machine tools for the production of high pressure valves, being under wraps most of the time. Companies visited complained about lack of orders. It is probable that demand has been hampered by the high prices of the new ABC fire extinguishers sold. The high cost of fire extinguishers in India deters potential buyers to replace existing extinguishers including BC extinguishers. Inadequate coverage by installing less than the required minimum number of extinguishers is the result.

(d) Technical Assistance for New Standards

14. The timely development of standards for substitute products and new building codes is very important for achieving a rapid and smooth transition to the production and use of halon replacements. While international standards and codes are readily available, larger Article 5 countries like China and India want to develop their own, adapted to local traditions and peculiarities of industrial manufacturing and construction business.

15. Several Technical Assistance activities were funded before and under the halon sector phase-out plan in China to revise standards for fire extinguishers and systems, essentially for enhancing existing standards that have been applied in China for some time. The development of new standards in particular for fixed systems using for example HFC 227 ea and water mist, is nevertheless not yet completed. Water mist, although supported by initiatives of the Fire Fighting Bureaus (FFB) is slow to expand for lack of National Standards. In the absence of National Standards the provincial FFB have introduced their own, based on foreign codes, to classify and restrict the use of new extinguishing agents until their aptitude and safe use is proven. While this improved quality of products locally, country-wide marketing is limited. Technical skills of fire officers were up-graded through organized training programmes.

16. For India, a project to be implemented by UNDP was approved to revise national fire codes and related fire equipment standards. The activities which were planned to be completed until December 2002 were delayed, due to slow cooperation from the Indian Bureau of Standards. Changes and amendments to the National Building Codes have been proposed for consideration and approval by the relevant authorities. About 30 standards and codes of practice were reviewed, of these 12 would be new Indian standards. Eight of these standards are said to have been sent out for public comments and should come up for adoption soon. No details were provided, but indications are that they should come into force by mid 2003. Project completion is now foreseen for August 2003.

17. Venezuela is an example of difficulties which may arise when international standards are adopted without proper understanding of all implications. The local standard which requested a minimum of 55% of phosphate content was replaced in 1998 by the ISO standard, which does not prescribe the chemical content of the dry chemical powder. Instead it stipulates a performance rating for the extinguishers. The adoption of the ISO standard has now resulted in low quality ABC powders with 15% phosphate content being imported from China. Caking of this powder in the cylinders seems to be a common phenomenon. This eroded the confidence in the ABC dry chemical powder fire extinguishers, the usually preferred replacement for halon 1211 fire extinguishers.

(e) Halon Banking, Recovery and Recycling (HBR&R)

18. HBR&R projects have a key role to play in sustaining existing fixed halon fire installations and to a limited extent portable fire extinguishers. During the transitional period of adjustment from ODS to non-ODS fire fighting, fire suppression and fire control agents and technologies, halon banks are expected to provide the buffer needed. The HBR&R will allow for maintaining critical levels of occupants safety and property protection during the transition. This period could extend for many years. Total quantity installed in use and needed to sustain these systems would gradually diminish.

19. HBR&R projects are complex in the sense that their success depends on many stakeholders and factors. Besides the basic fact that price differences between new and recovered/recycled halons must be large enough to cover the cost of operation (if no subsidies are provided), the viability mainly depends upon the cooperation with user industries and government agencies. A careful evaluation of the peculiarities of the country, its needs and plans are required in each case to establish the size, location and modalities of HBR&R projects. To build a national consensus for a strategy might not be easy and will take time. Lessons learnt from implementation of earlier projects, as outlined in this report, should be taken into account in implementing on-going projects and preparing new ones.

20. Training programmes, in order to be effective and sustainable, have to be tailored to the needs of the recipient country. The training should include information about troubleshooting, identification of local sources for spares, repairs and maintenance of the equipment supplied, as well as on local practices in halon servicing, marketing, installation, management and national laws.

(f) UNEPs Halon Related Activities

21. UNEP has played an early catalytic role in the halon sector, particularly in halon banking as a result of Parties, decision IV/26 requesting UNEP to function as a clearinghouse for information relevant to international halon bank management. UNEP's halon-sector assistance to Article 5 countries to date under the Multilateral Fund has comprised three types of activities: the International Halon Bank Clearinghouse (TAS), Publications (TAS), and Workshops (TRA/TAS).

UNEP, in consultation with the HTOC, designed and launched a Business-to-Business web portal, the Online Halon Trader (www.halontrader.org) in 2001. This web site is designed for companies that use halons in "critical" applications and it provides a virtual marketplace where offers can match demand for banked halon. While to date UNEP has not identified any confirmed transactions resulting from postings on the Online Halon Trader, as business transactions remain private, the continued postings by organisations (in some cases multiple) and comments from users indicate the usefulness of this service.

22. UNEP has also produced and disseminated six publications and two information papers related to the halon sector. Some Ozone Officers and representatives of financial intermediaries of the World Bank interviewed who have been active for years in the Halon phase-out programme in Article 5 countries had recollection of UNEP publications, while those involved only recently were quite vague about their awareness of the publications or the technical and general guidelines available from UNEP. They recalled no specifics or details and admitted that they have only occasionally used them as resource material. Technical informations provided a universal approach initially, but the need now is for brief technical information sheets, specific to the topic.

23. UNEP should ensure through publicity and awareness programme that Article 5 countries disposing of halon stocks are not sacrificing their strategic and national safeguards of the future. Information about halon management should provide guidance for Article 5 countries to work out the needs of critical and strategic sectors.

Recommendations

24. Based on the findings of the evaluation, it is recommended:
- (a) China and India to accelerate the completion of standards and codes for halon substitutes, in cooperation with the World Bank in China and UNDP in India.
 - (b) China to consider to conduct a full and impartial market survey for present and anticipated halon substitutes using national and international expertise. This should help to guide investment planning in a broad sense. For example, rather than in investing in small ABC powder projects when the total capacity is already at some 100,000 mt per year, companies investing in substitutes such as HFC236fa and HFC227ea might be supported. Any funding of substitute production under the HSPP, which is covered by the flexibility clause, should be based on clear and credible business plans in order to ensure viability in a rapidly changing market while avoiding to distort the competition. Savings realized in conversion and closure projects might also be preserved to cover later cost for halon banking and destruction.
 - (c) China to re-examine the timing and approach to the planned halon bank in Guangdong province, with a view to increase prospects for reaching viability.
 - (d) India, Brazil and Malaysia, in cooperation with the IA concerned to review the institutional set-up and policy framework for their Halon Banking, Recovery and Recycling Projects under implementation, with a view to enhance viability and national coverage.
 - (e) More comprehensive evaluation of halon banks covering small, large and regional halon banks should be undertaken by the Secretariat with the objective of assessing their sustainability.
 - (f) UNEP to prepare brief technical information sheets, specific to the topic, for the use of Ozone Officers. Information about halon management should, with the support of the halon CAP officer under recruitment, provide country specific guidance for Article 5 countries to work out the needs of critical and strategic sectors.

I. Introduction

25. This report gives an overview of the evaluation approach and provides a synthesis of the main findings and recommendations of the evaluation consultants, who visited 3 countries in Asia (PR China, India, Malaysia) and two in Latin America (Brazil, Venezuela). (For details about the sample of projects visited see Section IV below).

26. The country evaluation reports (CER) and project evaluation reports (PER) are available on request, and will also be placed on the Secretariat's web site, in the section "Executive Committee", evaluation reports. The Executive Summary of the China Country Evaluation Report is presented in Annex V, in order to enable readers to get a more comprehensive view of the largest programme in the halon sector funded by the MLF.

II. Evaluation Process

27. The evaluation proceeded with the following steps:

- (a) In-depth desk review by a consultant studying the documentation, identifying evaluation issues and proposing projects for field visits;
- (b) preparation of a summary by the Senior Monitoring and Evaluation Officer and presentation to the Monitoring, Evaluation and Finance Sub-committee at the 37th Meeting of the Executive Committee (Document UNEP/OzL.Pro/ExCom/37/6), which took note of the proposed evaluation approach;
- (c) preparation by the consultants of draft evaluation reports on each project and country reports on each country visited; the country reports analyze the halon sectors of the countries in terms of past achievements and remaining tasks for ODS phase out;
- (d) Sending draft country evaluation reports (CER) and draft project evaluation reports (PER) to the countries and Implementing Agencies concerned for comments.
- (e) Integrate the comments received into the final versions and prepare the draft synthesis report by the Senior Monitoring and Evaluation Officer.
- (f) Sending the draft synthesis report to the Implementing Agencies concerned for comments, and integrating comments received into the present final synthesis report.

III. Evaluation Team, Support by the Ozone Offices and Implementing Agencies

28. The lead consultant was the former Deputy Fire Chief of Malaysia and former member of the Halon Technical Options Committee (HTOC). He participated in all visits. In China, two more consultants focused on the production sector and institutional issues of the halon sector plan. The Senior Monitoring and Evaluation Officer coordinated the evaluation missions in PR China, India and Brazil, and the Senior Programme Management Officer responsible for halon projects in the Fund Secretariat participated in PR China and Venezuela as resource person.

29. The governments of all countries visited had been informed beforehand, and their concurrence had been obtained. The evaluation missions were very well received and supported by the Ozone Offices in the countries visited. The Ozone Officers prepared the visits to the companies and accompanied the evaluation team. Information requested on companies and national policies, including experiences gained during project implementation, were readily provided. Representatives of the companies were cooperative and accessible.

30. The World Bank specialist dealing with halon sector projects joined the evaluation mission in China, and staff of the World Bank's financial intermediary in China met the mission and accompanied them on all company visits. A UNDP Project Officer accompanied the mission during some project visits in India. Discussions were held with UNEP/DTIE as well as with Environment Canada and their halon consultant before and after the field visits to Brazil and Venezuela. Germany's GTZ provided an analysis of experiences gained so far with the implementation of regional halon banking projects.

IV. Sample of Projects Visited

31. In China, 5 of former 14 halon producers were visited, as well as 4 fire equipment and systems manufacturers, and six producers of halon substitutes. In India, one of two halon producers and 7 fire equipment and systems manufacturers were included in the sample.

32. Halon banking and recovery and recycling centers were visited in all five countries visited. In contrast to the planning (see para. 37 of the desk study, document UNEP/OzL.Pro/ExCom/376), it was not possible to include similar projects in low-volume consuming countries in the sample, due to lack of time. The particular features of regional halon banks could thus only briefly be analyzed based on available documentation, but are not included in this report. They would merit an evaluation, jointly with other halon bank management projects, once they are more advanced in their implementation.

33. In all countries visited, the development of standards and codes for substitute products as well as policies to enforce and monitor their introduction was discussed with fire fighting authorities, research and testing institutes, and industry associations.

34. The sample selected covered the main types of projects (halon producer, fire extinguisher and systems manufacturer, R&R and halon banking), which were implemented in various years and by several implementing agencies. China received the largest amount of funding for the halon sector plan (so far US \$46.8 million in six annual tranches of US \$62 million approved in principle), followed by a sector plan for India (US \$2.6 million). 16 of the 23 fire extinguisher projects approved are in China and India. China and India are also implementing halon banking and recovery and recycling projects, as do Brazil, Venezuela and Malaysia, and a number of other countries (see the Overview of Projects and Funds Approved for Halon Phase-out in Annex I).

35. In view of the above, the sample is seen as sufficiently representative to allow for formulating conclusions and lessons learnt for this sector, which has almost finalized the conversion in the manufacturing industry. On-going projects are mostly halon banking and management projects, as mentioned above.

V. Evaluation Issues and Data Collection Approach

36. Detailed evaluation issues and terms of reference for the evaluation were presented to the 37th Meeting of the Executive Committee (Document UNEP/OzL.Pro/ExCom/37/6, paragraph 38). For the China Halon Sector Phase-out Plan, specific evaluation issues were formulated before the mission to address the particular features of the sectoral approach.

37. Data were collected mainly in semi-structured interviews with beneficiary companies, Ozone Units, fire authorities and other stakeholders. The information obtained was then compared with the documentation (project documents, Secretariat's comments, PCRs, annual work programmes for sector plans and verification reports). After the visits, project evaluation reports (PER) were prepared for individual projects and interview notes for activities under sector plans and non-investment projects as well as general discussions.

38. UNEP/DTIE provided data and material as well as their views with regard to the halon related activities completed and under implementation.

VI. Halon Production

(a) PR China

39. China and India are the only Article 5 countries with facilities for producing halons 1211 and 1301. For China, the phase-out of both halon production and consumption was agreed upon in a sector plan which was approved by the 23rd meeting of the Executive Committee with total funding of US \$62 million. Under the sector plan, total phase-out of consumption and production of halon 1211 will be realized in 2006, and of halon 1301 in 2010. So far, six annual funding tranches amounting to US \$ 46.8 million have been approved by the Executive Committee for the implementation of the work programmes from 1998 to 2003.

40. In 1997, there were 14 H1211 producers with a total production of 11,664 metric metric tonnes, and one H1301 producer with a production of 618 metric tonnes. In 2002, H1211 production was down to 2,469.4 metric tonnes, representing a phase-out of 9,174.6 metric tonnes (27,523.8 ODP metric tonnes), and production was limited to two producers. In 2002, H1301 production was zero metric tonnes. There was no production because stocks were adequate. Demand could be quantified as 176.70 metric tonnes, which was served from existing stocks (see Annex II).

41. The reduction in the production of halons is occurring according to plan and even ahead of the agreed schedule. Apparently, the phase-out of halon 1301 could be accelerated because annual domestic demand and exports are well below the annual capability to produce H1301. In other words, the time will come soon when one sustained production run will meet actual and anticipated remaining needs for H1301, following which the plant could be closed down ahead of schedule.

42. Funds allocated to the reduction of halon production totalled US\$ 13,602,733 from 1998 to 2002, making it the largest area of funding under the HSPP.

Table 1: Overview of Funding and Phase-out in Halon Producer Projects

Year	Phase-out (mt)	Funds (US\$)
1998	3,068.4	4,605,880
1999	1,942.0	2,900,374
2000	1,990.0	3,149,553
2001	730.0	1,392,926
2002	798.0	1,554,000
Total	8,528.4	13,602,733

Source: Based on data from SEPA

43. No shortages of halons for critical users were reported and the availability of alternatives has kept pace with requirements. All phased-down and discontinued producers have expressed general satisfaction with the process and, based on visual evidence as well as on the verification reports of the auditors engaged by the World Bank, there has been no attempt to produce beyond quotas allotted or to restart stopped production. Some concerns were expressed by former halon producers about low profit margins due to lower selling prices and more competition for alternatives, in particular ABC powder.

44. The two projects funded for producing ABC powder (one before and one as part of the sector plan) have generated 4-6% of the total estimated present production capacity for ABC powder in China. Capacity utilization in these two projects was in 2002 about 35%. ABC powder Beijing is focussing on other products, in particular fire trucks, while Foshan is planning to increase the production capacity to 10,000 mt per year, hoping to realize thereby considerable economies of scale to become more competitive.

45. Halon production facilities visited in China have been totally or partially dismantled, in line with the phase-out contracts signed with SEPA. Remaining halon production units are old and would probably require some extended maintenance if they had a long-term future, but this is not the case. The start-up of temporarily idled plants takes every time a considerable period, up to a month, before continuous production of reliable quality is possible again. This is not unusual when halons are produced in campaigns only.

(b) India

46. For India, the Executive Committee approved at its 34th meeting a sectoral phase-out plan for US \$2.6 million to close down production capacities for halon 1211 and 1301 as well as to convert 5 remaining fire extinguisher companies.

47. The two Indian halon producers SRF and Navin Fluorine (NFI) established their facilities in 1990/1992 (NFI) and 1994/1995 (SRF). Nominal capacities were 500 mt at SRF and 300 mt at NFI. Production reached a maximum level of 95 mt in 1995 at NFI and 109 mt in 1998 at SRF, consisting almost entirely of H 1211 as H 1301 was not produced in commercial quantities although its production was technically feasible.

48. The low capacity utilization and early stop of production (NFI in 1996 and SRF in 1998) was due to changes of market demand and supply compared to the original planning. Demand in India decreased faster than expected due to awareness raising activities and conversion projects and the ready availability of substitutes, most of them expensive, however. Remaining demand for halon is covered by low cost imports from China, and, in perspective, from recovered and recycled halons from phased-out installations in the country, once the halon banking project will become operational.

49. At the mission's visit to SRF in September 2002, the company declared its readiness to proceed rapidly with the destruction of the critical components of its halon production facility which had been mothballed under nitrogen cover since 1999. However, delays occurred for three main reasons: firstly, it took nine months to reach an agreement with the other halon producer about how to divide the funds approved by the 34th meeting of the Executive Committee which were considerably reduced in comparison to the project proposal; secondly, the consultant company hired by the World Bank raised a number of concerns, mainly with regard to ecological issues related to the dismantlement plan presented by the company; and thirdly, the Grant Agreement between India and the World Bank needed an amendment.

50. The Grant agreement amendment has recently been signed by the Financial Intermediary (FI) and the Bank. FI is in the process of signing the Sub-Grant agreements with the 2 beneficiary enterprises. This process is expected to be completed very soon, after which the disbursements can be made. The two halon plants have been dismantled and verification done by an independent audit team hired by the Bank. Both enterprises have completed their environmental assessments and have submitted the reports. These were also reviewed by an independent auditor hired by the Bank.

VII. Fire Extinguisher and Systems Manufacturers

(a) Main Features of Enterprises

51. Fire extinguisher and systems manufacturers in large Article 5 countries are composed of the following types of activities:

- (a) Manufacture of different fire extinguishers varying in terms of size and extinguishing agent used. These manufacturing establishments also generally carry out ancillary works associated with manufacturing like coating operations, painting, etc. Most of the establishments have quality control procedures, testing laboratories (analytical) and testing facilities (mechanical, electrical and electronic).
- (b) Fixed installations. These companies may also manufacture extinguishers as separate operation. Systems are using CO₂, HFC 227, Foam, Low Pressure CO₂, Inergen, etc. Some of the system manufacturers are also involved in systems design and installation.
- (c) Valves and components, in particular outer shells for portable fire extinguishers and fixed installations.

- (d) Valves and components for larger, normally water-based systems (automatic sprinklers, deluge systems, multisifier systems, and water mist installations). It is possible that sprinkler head and water mist head production will become a sub-group because of large volumes involved.
- (e) Alarm, electronic and electrical systems. This sector is usually a sub-sector that also involves security alarms, smoke detectors and heat sensors and other monitoring and control devices.

52. Larger cylinders used for fixed installations, chemicals (Dry Powder, Foam, HFC, CO₂, N₂, Aqueous Film Forming Foam (AFFF), etc.), electronic/electrical control and actuation device panels, and specialised fittings (stainless steel fittings, water mist heads, etc.) are supplied by specialist manufacturers or they are imported. In smaller countries, specialized parts are usually imported, especially those designed to be used with high pressure.

(b) PR China

53. Table 2 below gives an overview of funding provided to Halon fire extinguisher and system manufacturers under the Halon Sector Phase-out Plan (HSPP) in China. Contracts have been awarded to eligible enterprises for the conversion and/or closure of 56 enterprises. Under the Halon Sector Phase-out Plan in China, a total number of 56 conversion and closure contracts have been concluded with fire extinguisher and a few system manufacturers. 46 of them have been executed, most of them ahead of time or on schedule, while some delays occurred in the 2000 programme. The volume of phase-out contracted and funding allocated has significantly decreased in 2001 and 2002, reflecting that there are less and less companies to convert from the original list of 72 fire extinguisher manufacturers and 22 systems manufacturers, and that the remaining manufacturers are more difficult to motivate to proceed with the conversion. The average cost-effectiveness is US\$ 0.45 per kg of ODP phased-out, much below the threshold of US\$ 1.48 per kg, assuming that only H1211 with a conversion factor of 1:3 is phased out, thereby neglecting H1301 with a higher conversion factor (1:10). Including it would show an even better cost-effectiveness.

Table 2: Halon Fire Extinguishers and System Manufacturers

Year	Phase-out (MT)	Funds (US\$)	Cost-Effectiveness (US\$/kg of ODP)*
1998	2,616.7	3,609,337	0.46
1999	1,301.1	1,423,888	0.36
2000	1,138.4	1,711,629	0.50
2001	221.8	385,310	0.58
2002	187.8	301,942	0.54
Total	5,465.8	7,432,106	0.45

* Assuming an ODP conversion factor of 1:3 by taking into account H1211 only and not H1301 which has a conversion factor of 1:10.

Source: Based on data from SEPA

54. The absence of National Standards for many of these systems prompted the sourcing of foreign standards and codes and technologies on local and provincial level which had very positive effects on quality of products but hampered country-wide marketing. On the other hand, Chinese manufacturers started to be contacted by foreign traders as a valuable source of inexpensive, good quality fire extinguishers and systems. This is a reversal of the initial approach when China was thought to be a potential market. The new pattern is in its early stages and is still consolidating but has been one of the greatest effects of the phase-out on Chinese Fire Equipment Manufacturers.

55. The level of investments, development of new products, and innovations in using different agents as additives to improve extinguishing properties and their potency are very encouraging. It is almost certain that 95% of the previous halon applications would be replaced by alternatives, except for a small sensitive sector, mainly military hardware including aircrafts, the civil aviation and parts of oil industry installations.

56. The new technologies, standards and extinguishing agents have brought a restructuring of the fire equipment manufacturing industry. The diversification of existing manufacturers, new entrants, and a move towards quality and mass production have been the main features. The industry is moving towards a healthy well-diversified manufacturing sector that will meet the fire protection needs in China, while developing also export markets.

(c) India

57. India had 14 projects approved for the conversion of fire extinguisher and system manufacturers, 13 of them implemented and completed by UNDP and one by the World Bank which was cancelled at the 39th Meeting of the Executive Committee although the conversion had taken place (see table 3 below).

58. Total funds disbursed are US \$1,216,025; funds approved for the 13 implemented project were US \$1,371,380, the average actual cost effectiveness is US \$0.93. The first batch of projects was completed with several months of delays but most projects of the second group approved by the 28th meeting of the Executive Committee were completed 13 months ahead of schedule.

Table 3: Overview of India Fire Extinguisher

	Number of Projects	Total Funds Approved (US\$)	Funds Disbursed (US\$)	ODP To Be Phased Out (ODP Metric tonnes)	ODP Phased Out (ODP Metric tonnes)	Approved Average Cost-Effectiveness (US\$/kg)	Actual Average Cost-Effectiveness (US\$/kg)	Average Delays (Months)
Completed	13	1,371,390	1,216,075	1,306	1,307	1.05	0.93	-0.4
Cancelled	1	251,736		462	462	0.54	N/A	N/A
Total	14	1,623,126	1,216,075	1,768	1,769	0.92	0.69	-0.4

Source: Inventory

59. Equipment supplied to fire extinguisher manufacturers in India has considerably enhanced their production capacities. There is an apparent gross under-utilization of equipment supplied, however, particularly of the numerically controlled machine tools for the production of high pressure valves, being under wraps most of the time. Companies visited complained about lack of orders. It is probable that demand has been hampered by the high prices of the new ABC fire extinguishers sold. The high cost of fire extinguishers in India deters potential buyers to replace existing extinguishers including BC extinguishers. Inadequate coverage by installing less than the required minimum number of extinguishers is the result.

60. Rapid conversion of halon fire extinguishers manufacturing is also hampered by inadequate support from laws and regulations for the use of alternative technologies and agents (see also section VIII b below). CO₂ fire extinguishers have been identified very early as a possible substitute for Halon 1211 fire extinguishers. The valves and design used in the manufacturing of CO₂ fire extinguishers were so antiquated, however, that it was not only a deterrent to those who wanted to change over from Halon 1211 but also cumbersome for the users which limited the effectiveness.

61. The funding for the required technology for the modernized squeeze grip valve for CO₂ high pressure cylinders, should have helped to quicken the phase-out of Halon 1211. Though every fire extinguisher manufacturer seems to have acquired the blue prints for the valves and established manufacturing capabilities at considerable project cost by installing modern numerical machine tools, they are unable to proceed due to missing regulations. The required amendments and development of standards are said to be still in drafting stages. The relevant authorities are not able to test and approve high pressure valves in the absence of these standards, delaying the conversion to high pressure CO₂ fire extinguishers.

62. The change over from Halon 1301 to alternative agents for fixed installations is hindered by high cost of FM 200 which is subject to 67% duty. It costs Rs1800 per kg whereas Halon 1301 from China is marketed at Rs600 per kg. In addition, permissions to continue servicing halon systems are easy to obtain.

63. Capability and competency to service and maintain installed fixed systems using non-ODS technology is very good. Quality of equipment is guaranteed by the suppliers from overseas. However, non-ODS agents are sometimes found to be mixed with other substances. Therefore, according to consultants and engineers representing client companies, fire authorities should identify facilities and outline procedures for verifying the quality of non-ODS agents used in fixed installed systems.

64. Halon refilling equipment that has been retained for use in on-going servicing and refilling of Halon 1301 needs to be monitored. Its application should be limited to those installations that have been referred to and approved by the Ozone Cell and fire authorities.

VIII. Development and Revision of National Standards and Codes of Practice

65. The development of standards for non-ODS fire extinguishers and systems and related building codes for their installation and use are an essential element to facilitate the conversion process. In the absence of such standards and codes, manufacturers are not sure whether their new products will be accepted by fire authorities and insurance companies. This may block the necessary investments and efforts for converting manufacturing equipment and products. The choice is between adopting international standards or adapting them to local conditions or developing new ones.

66. UNEP published a handbook on “*Standards and Codes of Practice to Eliminate Dependency on Halons: Handbook of Good Practices in the Halon Sector*” (www.uneptie.org/ozonaction/library/policy/main.html#halstand). The handbook is designed for National Ozone Units, governments and fire protection communities. It identifies the types of standards and codes of practice that are relevant to the Protocol and provides step-by-step guidance on how to establish new, or revise existing, standards and codes of practice to promote the halon phase out.

(a) China

67. Already in June 1993, the 10th meeting of the Executive Committee approved two projects to be implemented by UNDP with the Tianjin Fire Research Institute for the revision of national fire codes and standards. These projects with a total funding of US \$555,875 were completed with two resp. three years delay in September 98 and June 99, resulting in 4 revised national codes and extended training programmes. Moreover, several Technical Assistance activities were funded under the halon sector phase-out plan to revise standards for fire extinguishers and systems using CO₂ as agent, essentially for enhancing existing standards that have been applied in China for some time.

68. Nevertheless, the development of new standards for substitutes such as HFC 227 and water mist is not yet completed. Too much effort has been expended in investigating details of components and equipment necessary for testing, grading and classification, while basic standards are still pending. Water mist, although supported by initiatives of the FFB, is slow to expand for lack of National Standards. The programme has been repeatedly deferred. The contract was supposed to be signed in the second quarter of 2001 and was to take 12 – 24 months to draft.

69. The splitting up of contracts for drafting standards for CO₂ (8) and HFC 227 (3) between various institutes seems to be repeated for gaseous fire fighting systems, aerosol fire extinguishing agents, Inert Gas and other applications. This has caused considerable delay in the introduction of the Codes and Standards creating a setback for a more aggressive introduction of the non-ODS-substitutes.

70. The lack of National Standards delayed the introduction of non-ODS-substitutes in particular for fixed systems. In the absence of National Standards the provincial FFB have introduced their own, based on foreign codes, to classify and restrict the use of new extinguishing agents. The introduction of provincial standards, that differed from province to province, made it difficult for consultants and manufacturers of fire installations to sell nation wide. The FFB would like greater in-depth study and more detailed feedback on the new alternative agents as there is no proven track record for these products. The FFB's concern is public safety. In the absence of convincing proof, the FFB adopt a cautionary approach.

71. The Fire Fighting Bureaus (FFB) visited explained that the pressure and demand for suitable non-ODS systems was high due to rapid urban growth and construction of many new high-rise buildings in China. The Mission did not have an opportunity to examine in depth the effect of urban growth on fire fighting capability. From observation it appears that fire fighters are coping adequately. The building by-laws for high-rise buildings and basements have been amended to address the problem of safety and property protection. Technical skills of fire officers were up-graded through organized training programmes.

72. Most of the funds spent on standards, codes and research seem to be more an exercise of institution building than a prioritized effort to expediting the halon phase-out in China. Even though the training, publicity, and enforcement measures for restricting use of halons and promoting use of alternatives have been effective, the results could have been better if National Standards and Codes had been introduced earlier.

(b) India

73. An early project approved at the 13th meeting of the Executive Committee and implemented by UNDP and the Defense Institute of Fire Research in New Delhi (Project No. IND/HAL/13/DEM/28) had the task to demonstrate and evaluate alternative fire extinguisher technologies, and to develop a sectoral strategy for halon phase-out. The fire testing laboratory was established, the tests and a series of demonstration workshops conducted and the strategy presented to the 28th meeting of the Executive Committee in July 1999. The project was completed in December 1999.

74. Another project (IND/HAL/29/TAS/243), also implemented by UNDP, was approved to revise national fire codes and related fire equipment standards. The activities which were planned to be completed by December 2002 were delayed, due to slow cooperation from the Indian Bureau of Standards. Changes and amendments to the National Building Codes have been proposed for consideration and approval by the relevant authorities. Details were not made available. About 30 standards and codes of practice were reviewed, of these 12 would be revised. Eight of these standards are said to have been sent out for public comments and should come up for adoption soon. No details were provided, but indications are that they should come into force by mid 2003. Project completion is now foreseen for August 2003.

75. Indian standards for CO₂ fire extinguishers are said to be in the final stages of development. Problems mentioned by manufacturers of CO₂ extinguishers in obtaining approvals from the relevant authorities for high-pressure cylinders and fittings should be overcome, if the new Indian Standards proposed are introduced rapidly. This needs to be monitored and verified.

76. Currently many contractors design fire protection systems for water mist and FM200 systems based on design criteria and parameters provided by their manufacturers. Many consultants and contractors have acquired the technical know-how to design and install these systems but are subject to high license fees imposed by the manufacturers. This inflates the cost of alternative systems currently being installed.

77. Nevertheless, many new industries and major companies have opted for new alternative technologies; for example, the Reliance Refinery opted for FM 200. Private wireless and telephone companies are very sensitive to preventive and damage control measures and have adopted non-ODS systems for fire protection. Many have expressed concern and anxiety on the need for verification of the authenticity of the products used in these installations. It may be necessary to establish procedures for quality control of products being introduced as alternatives to halon.

(c) Venezuela

78. Under the new constitution adopted in 2000, a new standards organization, SENCAMER, was created to monitor consumer safety and labelling. However, the standards used for fire protection are essentially those of ISO. Industry representatives indicated that the standards were minimal standards, but that the standards for the petroleum industry, airline and other essential users were often based on those required by the United States. Insurance companies did not apply different standards but are almost totally dependent on standards of insurance companies from the USA and Europe.

79. There is some controversy over the standards for ABC dry chemical powder fire extinguishers. The earlier standard requested a minimum of 55% of phosphate content. The standard was replaced in 1998 by the ISO standard, which does not prescribe the chemical content of the dry chemical powder but stipulates a performance rating for the extinguishers. The adoption of the ISO standard has now resulted in low quality ABC powders with 15% phosphate content being imported from China. Caking of this powder in the cylinders seems to be a common phenomenon. This eroded the confidence in the ABC dry chemical powder fire extinguishers, the usually preferred replacement for halon 1211 fire extinguishers.

IX. Halon Banking, Recovery and Recycling (HBR&R)**(a) Need for Country Specific HBR&R Projects and Training Programmes**

80. Halon Banking, Recovery and Recycling (HBR&R) projects have a key role to play in sustaining existing fixed halon fire installations and to a limited extent portable fire extinguishers. During the transitional period of adjustment from ODS to non-ODS fire fighting, fire suppression and fire control agents and technologies, halon banks are expected to provide the buffer needed. The HBR&R will allow for maintaining critical levels of occupants safety and property protection during the transition. This period could extent for many years. Total quantity installed in use and needed to sustain these systems would gradually diminish.

81. The complete phase-out will depend on the sustainability, availability and adoption of the new non-ODS agents, new technologies and replacement cost. Some of the industries and sectors, for example the civil and military aviation industry, will take a very long time to opt for alternative agents and technologies unless there is a concerted effort by the regulating authorities and governments to force the pace. Most of the airlines in developed countries maintain a 'young' fleet of between 5 to 7 years. The 'aging' fleets are often taken over and operated by the developing nations who stretch their life to 20 or more years. Even if the aircraft manufacturers opt for new technologies and would phase-out halons which is not the case so far, the developing countries will have to service these aircrafts and their halon systems for the next 20 years to retain their airworthiness certificate if they would not proceed to very costly retrofitting.

82. The military sector in non Article 5 countries has been among the most innovative in developing alternative systems for explosion suppression and fire extinguishment for both the new machines being developed and retrofitting the existing hardware. However, most of the existing military hardware in the developing countries was purchased with halon systems and will probably continue to serve for about twenty years. The halon systems in the equipment will have to be maintained. Retrofitting would be too expensive for most of the countries.

83. For the programme to be effective and sustainable, the training has to be tailored to the needs of the recipient country operating the halon bank. Technical training provided for example in Germany, U.S.A or Australia is not sufficient as the halon bank operation and management in these countries is very different from the realities of developing countries. The training should include troubleshooting, identification of local sources for spares, repairs and maintenance of the equipment supplied as well as local practices in halon servicing, marketing, installation, management and national laws. There should be guidance how to identify critical uses for which demand for halons will likely continue for some time, how to develop a country specific phase-out programme and how to design an HBR&R project to meet the strategic needs.

(b) MLF Projects and Guidelines for HBR&R

84. The MLF has very early on recognized the importance of recovery and recycling of halons. Particularly bilateral agencies, partly in cooperation with UNDP, initiated and implemented from 1992 onwards a series of R&R projects in several countries, which later on were combined with halon management and halon projects. So far, US \$12.7 million have been approved for projects in 26 countries (see overview in Section 5 of the Report on the Desk Study on Halon Projects, document UNEP/OzL.Pro/ExCom/37/6, and up-dated statistics in Annex I of the present report).

85. The 18th Meeting of the Executive Committee approved on an interim basis guidelines for the type of equipment and volume of funding eligible for high, medium and low-level consuming countries (Decision 18/22, para. 51):

- (i) countries with high-level installed capacities exceeding 250 MT of Halon 1301 and 1,000 MT of Halon 1211 should qualify for reclamation facilities for Halon 1301 and Halon 1211, respectively;
- (ii) countries with a medium level of installed capacity{ XE "capacity" } (250 MT of Halon{ XE "Halon" } 1301 and 1,000 MT of Halon 1211) should be supported{ XE "classified" } for servicing{ XE "servicing" } requirements with Halon 1211 and Halon 1301 recycling{ XE "recycling" } and recovery{ XE "recovery" } machines;
- (iii) countries with a low level of installed capacity{ XE "capacity" } should qualify for a one time funding of US \$25,000.

86. Pre-condition for approvals is that regulations{ XE "regulations" } facilitating production{ XE "production" } and import bans{ XE "bans" } should be established within six months after the reclamation{ XE "reclamation" } centre is set up. It was further stipulated that the costs for providing capital equipment{ XE "equipment" } and management would{ XE "management" } range from US \$250,000 to US \$500,000{ XE "US \$500,000" }. Funds for Halon{ XE "Halon" } 1211/Halon 1301 reclamation{ XE "reclamation" } centres could, if appropriate, be provided on a concessional{ XE "concessional" } basis containing a 25 per cent grant component. In order to facilitate a final decision{ XE "decision" } by the Executive Committee on halon{ XE "halon" }-banking{ XE "banking" } guidelines{ XE "guidelines" }, the Secretariat and the Implementing Agencies should closely monitor{ XE "monitor" } these projects as a basis for assessing the interim{ XE "interim" } guidelines in terms of their commercial{ XE "commercial" } viability and their financial impact on the Fund, and for assessing the possibility of establishing a regional{ XE "regional" } halon-banking programme, including the possibility of a concessional{ XE "concessional" } loan{ XE "concessional loan" }{ XE "loan" } component.

(c) Lessons Learnt in Implementing HBR&R Projects

87. The country case studies which are summarized in Annex III showed that HBR&R projects are complex in the sense that their success depends on many stakeholders and factors. The main positive effect of HBR&R projects in Brazil and Venezuela was that it helped to convince users, that halon phase-out and stop of imports is inevitable and acceptable, because recycled halons would still

be available during a long transition period for essential uses and the servicing of installed capacities, particularly fixed installations.

88. The following lessons learnt in the case studies should be taken into account in implementing on-going HBR&R projects and preparing new ones:

- (a) Government agencies may be able to legislate and regulate the operations but often lack the necessary marketing skills and mechanisms necessary to successfully operate and sustain HBR&R facilities.
- (b) A private company operating the project has to have the facilities, logistics, knowledge, background, contacts with clients and technical expertise to successfully operate and maintain the facilities. There must also be support from the industry (related associations, fire protection industry and fire equipment manufacturers). Though the operator may be viewed as a competitor, the terms and conditions must be made conducive to bring about the cooperation.
- (c) The operator may find it difficult or uneconomical to operate the HBR&R facility as an independent operation, in particular, if virgin halons at low prices are still available, as in China. To be economically viable it should form part of other fire protection or service operations, as in Venezuela and Brazil. This situation will make it also difficult to find contractors interested to take a loan, even a concessional one, for the equipment.
- (d) The operator must have sufficient incentives through the pricing mechanism like buy-back schemes, trade-off etc. The pricing should be conducive for the clients to want to use the facilities (in Brazil the main airline finds it cheaper and quicker to use services in Miami, U.S.A. than in Sao Paulo).
- (e) Given the limited size of demand, even in relatively large countries like Brazil and Venezuela, one reclamation facility is more than enough to satisfy the demand. This implies that the government must play an active role in installing control mechanisms, jointly with the main users of recycled halons, so that a monopoly situation would not be abused and taken advantage of by the operator. Also imports of recycled halons should be allowed to maintain competition and keep prices at reasonable levels.
- (f) The intended regionalization of the halon banking projects in Brazil and Venezuela did not take place and was not seriously pursued mainly because of trade restrictions, halons being considered as hazardous waste, in spite of the provisions of the Basle Convention allowing to trade recovered halons under certain conditions. While other regional halon banking projects were not analyzed, for lack of time and because they are in their early stages of implementation, they should take into account the difficulties encountered by Venezuela and Brazil and should be evaluated once their implementation has further advanced.

- (g) Halon bank operators must keep proper records of quantities received, recycled, stored or sold. Spot checks must be made to verify the authenticity of the records and operations. Some clients in Brazil and Malaysia have alleged manipulation of figures and unfair practices. A small commission may be charged by the responsible government agency per kg of halon recycled, as it is practiced by FONDOIN in Venezuela. This will foster sustained agency interest and supervision.
- (h) There must be continuous monitoring of the quality of recovered halons. User industries, particularly in India, frequently reported that cheaper products had been found added to recovered halons in order to make its sale more profitable.
- (i) The establishment of an inventory of all installations with halons must be viewed as a very necessary aspect of halon management. In large countries, this represents a significant and complex task, which requires collaboration of central and provincial government agencies, fire authorities and the private sector. A comprehensive coverage of all sectors and installations may not be a practical proposition. There is need to prioritize the operations which will vary from country to country. Coverage of certain critical regions and industries (army, aviation and oil industry), would provide coverage of 75% to 80% initially. When the scope is extended at later stages, it would cover 95% of recoverable halon. This would allow for better management, control, and more economical and successful operations.
- (j) A gradual phase-out of halon installations is preferable to a rapid pace forced by administrative decree. The latter could overburden R&R facilities and cause unnecessary costs for users, as the experience of Malaysia showed.
- (k) Government support might be needed and should be considered to sustain the halon bank operation. When national interests and strategic needs require it, government subsidies should be considered. Critical sectors like civil aviation, military, petroleum and electricity generation should be asked to support the banking operations and halon storage costs based on their current needs and projected requirements. With industry involvement and cost sharing there will be serious and continuous self-evaluation of future needs of the industry and from the beginning the commitment to phase-out. The awareness of the limited quantity available and the cost of maintaining halon in stock will be a deterrent for continued usage. There will be a serious attempt on the part of the industry to find suitable alternatives and phase-out all existing installations.

89. The viability of a sustained operation would depend upon the industry, the role of the agencies (government) and careful evaluation of the peculiarities of the country, its needs and prevailing situation. There cannot be a single formula, but the basic criteria listed above need to be given weight. To build a consensus for a strategy might not be easy and will take time.

X. Halon-related Activities Implemented by UNEP

(a) Overview

90. UNEP has played an early catalytic role in the halon sector, particularly in halon banking as a result of Parties decision IV/26 requesting UNEP to function as a clearinghouse for information

relevant to international halon bank management. UNEP was requested to liaise with and coordinate its activities with the Implementing Agencies to encourage Parties to provide pertinent information to the clearinghouse.

91. UNEP's halon-sector assistance to Article 5 countries to date under the Multilateral Fund has comprised three types of activities: the International Halon Bank Clearinghouse (TAS), Publications (TAS), and Workshops (TRA/TAS) (see Table 4 below). Total funds disbursed were US \$711,595 of US\$718,000 approved. In some cases, significant delays occurred.

Table 4: Overview of Halon- Related Activities Implemented by UNEP

Category	Year Approved	Number of Projects Approved	Number of Projects Completed	Total Funds Approved (US\$)	Total Funds Disbursed (US\$)	Delays (Months)
Handbooks	1994	1	1	40,000	40,000	32
	1995	1	1	25,000	25,000	9
	1999	1	1	75,000	75,000	17
Information Clearing House	1993	1	1	100,000	100,000	26
	1994	1	1	50,000	50,000	0
	1995	2	2	35,000	35,000	8 and 26
	1996	1	1	29,000	29,000	0
	1997	2	2	174,000	174,000	0 and 1
Meeting/Workshops	1993	1	1	80,000	80,000	-2
	1995	1	1	50,000	50,000	0
	2000	1	Ongoing	50,000	43,595	N/A
Translation	1994	1	1	10,000	10,000	12
Total		14	13	718,000	711,595	

*Excludes one cancelled project

Source: Inventory

92. UNEP has also:

- (a) Supported bilaterals (i.e. Canada, France and Germany) in the implementation of regional halon bank projects in West Asia and the Caribbean;
- (b) Disseminated information related to national halon management strategies in Article 5 countries (as per Decision X/7) in co-operation with the Ozone Secretariat; and
- (c) Assisted the Halon Technical Options Committee with data collection activities.

93. In addition to specific guidance provided by the Executive Committee, UNEP also follows the technical guidance of the Halons Technical Options Committee (HTOC) for its activities related to this sector. It regularly consults the HTOC Co-Chairs in the design of major projects and has involved them and HTOC members in various projects undertaken in the past, e.g. as lead authors or quality reviewers. UNEP also refers to and disseminates HTOC reports and HTOC Technical Notes to Article 5 countries.

94. To date, UNEP has relied on external technical experts related to the halon sector. Under the Compliance Assistance Programme (CAP), one Halon Phase-out Officer will be recruited in UNEP's Regional Office for West Asia in Bahrain in 2003 to provide technical and policy services to all

Article 5 countries in the halon sector. The function and duties of this officer are available at www.uneptie.org/ozonaction/aboutus/va/waho.htm.

(b) Publications

95. UNEP has produced and disseminated six publications and two information papers to date as part of approved projects for the halon sector:

- (a) Halon Management: Banking for the Future
- (b) Eliminating Dependency on Halons: Self-Help Guide for Low-Volume Consuming Countries
- (c) Eliminating Dependency on Halons: Case Studies
- (d) Standards and Codes of Practice to Eliminate Dependency on Halons: Handbook of Good Practices in the Halon Sector
- (e) Report and Proceedings of Regional Halon Conference and Workshop (Kuala Lumpur, 18-20 January 1994)
- (f) List of National Halon Banks
- (g) List of Halon Recycling, Recovery and Reclaim Equipment Manufacturers

96. UNEP has also produced and disseminated the following publications as part of other projects (i.e. not halon sector) but with some halon-related content:

- (a) OzonAction Newsletter
- (b) Up-date of Regulations to Control ODS
- (c) Maintaining Military Readiness by Managing Ozone Depleting Substances: Guidelines for Armed Forces in Developing Countries
- (d) Two Challenges, One Solution: Case Studies of Technologies that Protect the Ozone Layer and Mitigate Climate Change

97. Some interviewed Ozone officers and representatives of financial intermediaries of the World Bank who have been active for years in the Halon phase-out programme in Article 5 countries had recollection of UNEP publications, while those involved only recently were quite vague about their awareness of the publications or the technical and general guidelines available from UNEP. They recalled no specifics or details and admitted that they have only occasionally used them as resource material.

98. The initial need was for general information, understanding and technology guidance. The publications, for example “Eliminating Dependency on Halon – Case Studies”, provide a wealth of information and seem adequate to provide the guidance needed to formulate a legal and policy framework. They are useful even though there are country specific peculiarities advocated in some of the publications with regard to the adoption of laws, regulations and control measures.

99. Some difficulties were reported in sourcing specific information from the different documents and publications of UNEP. Specific answers are more in demand now than general technical information, in particular with regard to on-going activities like halon banking, recovery and recycling and the introduction of substitute agents and systems. The present need is for technical information sheets, specific to the topic. This format has been adopted by NFPA (USA) and LPC (UK), for example. Their publications normally do not have more than 3 or 4 pages and can easily be compiled in ring files. Additional information as and when necessary can be introduced using the same reference allowing for easy compilation and reference by consultants, fire safety officers, owners and management.

100. There is no clear indication to the extent that information provided on the web has provided assistance to persons involved in the implementation of halon phase-out. About 50 queries related to halons are received each year from persons in Article 5 countries. Ozone officers and representatives of financial intermediaries of the World Bank interviewed, however, rather recalled benefits from workshops and publications for technical knowledge. Though they are aware of the availability of information on the web, there seems to be little recourse to it.

(c) Specific Information about Halon Substitutes

101. Manufacturers and distributors of alternate systems and agents for halon often used pressure groups to promote their products and obtain acceptance or approval. Fire Authority Officers in Article 5 countries, in particular in low volume consuming countries, involved in technical evaluations of ODS-substitutes are not always able to provide a well-informed recommendation. This is often due to insufficient exposure to the technicalities involved in the evaluation of occupant’s safety and property protection needs, and is common when officers change positions frequently.

102. The promoters often try to influence those involved in the approval of substitutes and, with their product knowledge and technical back-up, impress the approving authorities and overcome inexperienced technical evaluators. Many products have been approved for application in Article 5 countries that in developed countries are still pending due to health and life risks and environmental concerns.

103. The UNEP publications provide some guidance with regard to standards and codes for alternative agents but do not inform about specific products. Most of the national and international standards and codes do not adequately address the needs and situations in Article 5 countries and often make reference to manufacturer’s requirements or specifications. These provisions are often taken advantage of promoters of alternative agents and technologies. For example, it is surprising to find so many drop-in substitutes for halon 1301 that are being promoted in Article 5 countries. Lists of alternative agents approved for use sometimes do not specify use in occupied or unoccupied areas, as total flooding or streaming agents, thus leaving fire fighters without clear information about risks for occupants.

104. Standards and codes that are adopted in various countries should be easily accessible from National Steering Committees or the Ozone Units. UNEP documents could provide not only guidance but also specific information that would reflect and take into account various critical requirements, preferably in form of short specific documents and not as part of a larger publication in order to provide easy reference and the necessary impact. Such work should be provided under the CAP Programme, guided by the halon officer under recruitment, and may also use parts of the funding for UNEP's Global Public Awareness Programme.

(d) UNEP's Role in Facilitating Contacts for Halon Trading

105. UNEP, in consultation with the HTOC, designed and launched a Business-to-Business web portal, the On-line Halon Trader (www.halontrader.org) in 2001. This web site is designed for companies that use halons in critical applications, including owners, managers and/or operators of fire protection systems, fire control services and other organizations related to fire protection. Through this free service, companies that need halon for critical applications ("halon seekers") are able to post listings of specific demand in a virtual marketplace. Companies or halon banks that can meet this demand with recovered, reclaimed or recycled halon ("halon providers") can respond or post their own listings about halons available for exchange. UNEP provides the platform for this exchange and does not in any manner become party to the transaction between those who seek halons and those who provide halons.

106. Table 5 below shows the quantities of halons offered and demanded, as of June 2003. In comparison, total halon consumption of Article 5 countries in 2000 was 4,736 ODP tonnes according to the HTOC Report 2002:

Table 5: Offers and Demand on UNEP's on-line Halon Trader

Halon	Number of postings	Quantity of halon (MT) posted	Quantity of halon (ODP tonnes) posted
Providers			
1211	24	1966.26	5,898.78
1301	39	2077.83	20,778.30
2402	4	220.3	1,321.80
Total	67	4,264.39	27,998.88
Seekers			
1211	16	253.1	759.30
1301	28	1226.5	12,265.00
2402	21	1585	9,510.00
Total	65	3,064.60	22,534.30

Source: UNEP/DTIE

107. These postings have been made by registered users reflecting 13 types of organisations from 21 countries (10 Article 5 and 11 non-Article 5). The types of organisations are: Fire equipment manufacturers (18), Halon recovery, recycling and/or reclaim service (10), Fire equipment vendor (10), Other (8), Fire extinguishing agent producer (5), Government agency (3), Halon banks (3), Halon users (4), NOU (1), Research institution (1).

108. UNEP has not identified any confirmed transactions resulting from postings on the Online Halon Trader as the business transactions remain private. However, the continued postings by organisations (in some cases multiple) and comments from users indicate the usefulness of this service. It is noteworthy that halon banks (Australia, Denmark, Spain, UK) and a number of national and multinational fire protection equipment vendors are registered users with postings.

109. Another form of halon trading is through national halon bank clearinghouses which UNEP promotes through the On-line Halon Trader, publications and query responses.

110. The quality of halons from sources advertised on the web is not known. Of the 132 postings on the On-line Halon Trader, 20 were classified as “reclaimed” by the person making the posting and 112 were classified as “recycled”, although there is no way to verify these statements. However, virtually all countries offering halons on the On-line Halon Trader are known to have halon banking and/or recycling facilities.

111. The purchasers are often not countries or agents searching to cover their critical needs to sustain the existing halon systems, but rather traders who obtain halon at low prices and resell later to the highest bidder or build up their halon bank for sale at later date when higher prices will have increased.

112. In designing the On-line Halon Trader, UNEP tried to ensure the integrity of the system by including a mandatory “Terms of Service” agreement that each user must accept before registering with the systems and posting any data. The terms applicable to Halon Providers includes the following statement: “The halons listed by my organization through this web module are recovered, recycled, reclaimed or banked, and they are not newly-produced (“virgin”) halons being sold for the first time”. Statements by Halon Seekers include: “My organization has endeavoured to reduce, avoid, or eliminate the use of halons to the maximum extent feasible, and is seeking recovered, recycled, reclaimed or banked halons for an essential or critical use.” Although there is no enforcement mechanism, this approach is meant to raise awareness about the sources and types of halons being offered and to steer people towards using halons only for critical purposes.

113. The amount of halons offered on the On-line Halon Trader exceeds the current overall halon consumption reported (2000) by Article 5 countries (see Table 5 above), therefore the system has significant potential in supporting the critical uses of halon in those countries. Nevertheless, it is possible that the halon offered in response to demands on the web is not in excess of domestic needs to sustain critical and strategic uses of certain Article 5 countries, as most of them are yet to formulate their essential requirements for the future. Countries like Malaysia have been offered good prices by operators of halon banks in Australia, Britain and USA interested in buying excess halons. These halon banks will offer halons to other countries or users when prices will have increased. However, Article 5 countries which offer halons for sale now while not having a plan for covering their strategic or critical needs could face shortage or non-availability of halons to meet such needs later on.

114. UNEP should take into account such risk, through publicity and awareness programme, to ensure that the countries disposing halon stocks are not sacrificing their strategic and national safeguards of the future. Information about halon management should provide guidance for Article 5 countries to work out the needs of critical and strategic sectors. It should be specific (civil aviation, bunker protection, military application, etc.), with modalities to work out the halon requirements of the critical and strategic sectors over the next 20 years, including recommendations as to how the

strategic stock can be built up from existing systems, imports, regional cooperation or government-to-government agreement.

Annex I

Overview of Projects and Funds Approved for Halon Phase-Out

Country	Sector Plan Funding As Per Agreement (US\$)	Number of Fire Extinguisher Projects	Funding for Fire Extinguisher Projects (US\$)	HB-R&R Projects* (US\$)	Funding for Demonstration Projects (US\$)
China	62,000,000	2	1,225,592	1,864,220	90,437
India	2,600,000	14	1,623,126	579,400	265,381
Brazil				479,329	
Malaysia		1	175,372	798,850	
Venezuela				610,956	34,000
Algeria				259,500	
Argentina				340,620	
Dominican Republic				40,000	
Ecuador				58,000	
Egypt				431,730	
Global				1,771,145	
Indonesia		1	500,000	486,200	
Iran				511,175	
Jordan		1	563,000	382,250	
Macedonia				25,000	
Mexico				527,223	
Nigeria				499,000	
Panama				77,555	
Philippines		1	114,108		
Region: AFR				650,000	
Region: ASP				510,000	
Region: LAC				302,252	
Serbia and Montenegro				249,700	
Syria				343,472	
Thailand		1	568,000	420,750	
Turkey				439,250	
Uruguay		2	62,375	18,000	
Vietnam				25,000	
Total	64,600,000	23	4,831,573	12,700,577	389,818

* Halon Banking and Recovery and Recycling Projects including related Technical Assistance and Training
Source: Inventory

Annex II**Overview of Planned and Actual Phase-out Schedules in the Halon Sector Phase-out Plan for China**

Year	H1211 Production Planned	H1211 Production Actual	H1211 Consumption Planned	H1211 Consumption Actual	H1301 Production Planned	H1301 Production Actual	H1301 Consumption Planned	H1310 Consumption Actual
1997	9950	11664	NA	10849	618	618	NA	NA
1998	7960	7842	7160	7218	618	450	300	-152
1999	5970	5965	5370	5280	618	484	300	304
2000	3980	3978	3580	3650	618	428	300	377
2001	3317	3118	3117	2832	618	213	300	180
2002	2654	2469	2654	2436	600	0	150	-36.35
2003	1990*		1990		600*		150	
2004	1,990		1,890		600		150	
2005	1,990		1,890		600		150	
2006	0	0	0		150		100	
2007	0	0	0		150		100	
2008	0	0	0		150		100	
2009	0	0	0		150		100	
2010	0	0	0		0			

Source: SEPA; all data in metric tons.

Annex III

Review of HBR&R Projects in Article 5 Countries Visited

(1) China

1. R&R machines from early projects implemented by USEPA and UNDP (CPR/HAL/12/INV/59 and 66) were seen and reported as being used in several locations. However, the lessons learnt in implementing these projects and presented in a final report by USEPA were confirmed (See Report on Desk Study on the Halon Projects, document UNEP/OzL.Pro/ExCom/37/6, p. 7-8). The report called for caution in the approach and named several preconditions required for successful R&R operations.

2. The planned halon banking project in Guangdong, funded under the HSPP, had an expected completion date of October 2001 but has not yet started. It is assumed to break even with 145 mt of halons recycled per year assuming a sales price of RMB 50,000/MT or 97MT selling for RMB 75,000/MT. It is very unlikely that the price projections for profitable operations will be realized, even after the closure of all halon production facilities in China. The demand for halon is diminishing with the phase-out and ban on all new installations. The delay in launching the project is intentional to avoid operating at a loss. Operations at the recycling centres at Tianjin and Dalian are also not viable with the prevailing prices and collapsing market for halons.

3. No new halon 1211 and 1301 installations are permitted by Fire Fighting Bureaus (FFB). There is no information from the armed forces to the exact size of their needs or their future policy. The existing systems are being replaced by alternative agents. The only visible need is for systems accidentally discharged. There is no national database to refer to. Limited information available is from the Guangdong FFB which conducted a survey several years ago within their own area of jurisdiction. The policy of the FFBs is to phase-out all existing halon systems in the quickest way possible. The need for a halon Bank is yet being felt.

4. The banking centre in Guangdong will probably be a technically superior facility if brought into operation. Its effectiveness will depend on market forces (supply/demand and prices for halons) and efficiency of operations. It is doubtful that it will ever become a profitable operation. As the introduction of alternate agents will further reduce the demand for halons, even from critical sectors, there will be reduced sales, higher holding costs and longer time periods for the banks' operations.

5. Hopes are currently placed on improved demand and increased prices after halon production will cease. However, it is unlikely that the demand or the prices will improve and that recycling will play a major role, as the scope of applications (essential uses) is diminishing. It will be effective in meeting some of the critical user needs, like for the armed forces, provided the users are willing to pay double the market price, or if the operation is heavily subsidised. The future role of recycling may be rather that of a receiving centre for surrendered halons for storage and destruction.

6. As halon 1211 and 1301 systems go out of service, there is a need to establish a system of collection, storage and facilities for their destruction. Failure to anticipate this situation will result in much of the halon dissipating into the atmosphere. If quantified, the amount could be larger than several years of production phased-out. Not only contaminated halons but also excess quantities flooding the market without buyers have to be collected. There must be a plan in place to recall or collect these halon fire extinguishers at regional centres and provide facilities for its storage and ultimate destruction.

(2) India

7. The halon banking and management project for India, approved at the 32nd meeting of the Executive Committee to be implemented jointly with Australia and Canada, experienced a delay. The Ozone Cell had to organize a process of consultation and consensus building before being able to undertake the commitment requested by the Executive Committee as condition for the approval that India would establish a ban for producing and importing halons within 6 months after the reclamation centre had been set up.

8. At the time of the mission's visit in September 2002, this commitment had been given in writing by the Ozone Cell and first contracts with consulting companies in Canada and Australia had been signed. The Banking and Recycling facilities were under construction and were expected to be ready in the second half of 2003, inauguration is now scheduled for September/October 2003. The planned halon storage capacity is 5 MT.

9. Some uncertainties with regard to future project implementation and sustainability were identified by the evaluation mission. The new director of the project counterpart institution, the Defence Institute of Fire Research (DIFR), declared that DIFR works only for the armed forces but not for civil industries, and it seemed that the DIFR might not be able and willing to establish and maintain a country-wide database which, in any case, would require close cooperation with the authorities in individual states. According to information received by the NOU in June 2003, these issues have been resolved. Once the banking facility is ready and commissioned, the Essential Uses Panel would be set up for working out details for identification of various specific sectors and sub-sectors and their demand for halons. The concrete work will be carried out by national consultants working also with local authorities. It is a pre-requisite towards rationalized decommissioning and management of halon installations.

10. During this work, the following supplementary elements of the halon bank should be considered:

- (a) In situ management of halon banks at various installations after decommissioning.
- (b) Large cooperations and institutions (NTPC, ONGC, Railways, ports, Refineries, Etc.) might manage separate facilities in various regional centres.
- (c) Purchase, sale, and exchange of halon between groups in a region.

- (d) Such regional and in-situ banks need to be monitored by the Ozone Cell, in close cooperation with government authorities in individual states.

11. There seems to be little guidance to contractors on servicing and dismantling of existing halon installations. Halon cylinders removed from installations decommissioned were kept at a contractor's site. The quality of the contents was suspect. They had not been recycled and there was vague indication that they may be used to service approved halon installations. A training course on dismantling halon installations is planned to be conducted once the reclamation centre will have become operational.

(3) Brazil

12. Brazil received R&R equipment for halon 1301 and a recovery pump for halon 1211 through a project implemented with Environment Canada. The company GESPI, which operates the equipment under Government contract seems to well maintain it and keeps it fully operative, after some repairs which they were able to do themselves. The reported quantities of recycled halon 1301 were around 3 metric metric tonnes for each of the last 4 years. These volumes were questioned in later discussions and might actually be only around 50% of the indicated level. In addition to recycling halon 1301, the company imports 500 kg per year of halon 1211 from Belgium for the use of smaller regional airlines and the air force.

13. The NOU reported imports of halon 1301 of 2 metric metric tonnes for 2002. It needs to be clarified whether this is new or recycled halon. Only the latter would be legal under Brazilian legislation (import ban for new halons). Interested customers reportedly renounced on buying halons from Chinese and Indian suppliers after they refused to certify the purity of each batch. Estimations of installed capacities of H1301 and H1211 vary between 250 mt in the country programme and 400 MT according to some sector experts. These figures are significantly below the minimum level required for a country to become eligible for a reclamation center (250 Mt of H1301 and 1000 MT of H1211). The exception was justified with the demonstration character of the Brazilian project which was approved intersessionally between the 18th and 19th meeting of the Executive Committee, just after approval of the Halon Banking Guidelines at the 18th Meeting.

14. The main Brazilian airline Varig has recently installed their own recovery equipment which came as a surprise to all other stakeholders. So far Varig had used mainly servicing facilities in the USA. There was apparently a break up with GESPI over high prices charged by GESPI for recycled halons resulting in Varig looking for other service providers. GESPI had asked for up to US \$100 per kg of recycled halon before lowering the price about two years ago. Currently the service fee is US \$15 per kg. Petrobras on the other hand uses the services of GESPI. In 2001, Petrobras lost an oil platform due to a major fire which could not be contained because the installed halon based fire fighting system was not operational. After that incident which cost the life of 9 workers, Petrobras organized a full check up and upgrade of all installed fire fighting equipment resulting in some orders for GESPI. Some other important halon users like commercial banks have either converted already, mainly to FM 200 or INERGEN or are waiting for the price of recycled halon to rise in order to lower the conversion cost.

15. The fire fighting authorities see halon as being used for property protection and therefore falling under the full responsibility of the property owners. They consider themselves responsible only for personnel safety and life saving and focus on water based systems. They do not check the halon based equipment and do not provide certificates. Halon equipment is checked by internal staff of companies and by consultants working for insurance companies. There are no Brazilian standards for halon based equipment and systems, so either ISO or US standards are applied. Currently a working group is preparing standards for FM 200 and INERGEN. Finalization is expected to take 2 to 3 years.

16. Project implementation was delayed by conflicts between the former project implementing agency CETESB (the State Environment Protection Agency of Sao Paulo) and the federal environment protection office IBAMA which has a branch office in Sao Paulo and is reactivating the project now. CETESB renounced on further carrying out project activities and supervising GESPI in autumn 2001. Meetings of the steering committee were stopped and no further training programmes took place. This continued throughout 2002 and until today, partly also as result of uncertainty with regard to the change of government at the beginning of January of this year. There are still about 20,000 US \$ left in the project account which is subject to dispute between CETESB and IBAMA and blocks the full transfer of project implementation responsibilities to IBAMA.

17. IBAMA and the NOU are currently discussing how to finalize the project. Besides arranging the outstanding issues with CETESB, they consider organizing a bidding for the R&R equipment which had been given to GESPI without an open tender. However, they would need to find a similarly qualified company which is well connected to potential and actual users of recycled halons. It might be more promising to reactivate the steering committee or to form a supervisory group of main users in order to monitor price levels charged by GESPI. In addition, imports of recycled halons should be authorized also for other companies in order to allow some competition in the market and to keep prices at reasonable levels. Furthermore, an awareness campaign to inform main users of the long term availability of recycled halons at reasonable prices would be useful.

(4) Malaysia

18. Until 1990, about 150,000 units of Halon 1211 fire extinguishers were manufactured each year, 30% of which were exported. An estimated 1,000,000 units (2 kg and 3 kg) were installed in Malaysia with a total capacity of about 2,500 MT. As per administrative order, from 1990 onwards there were no more new halon 1211 fire extinguishers installed and existing halon fire extinguishers were not certified for further use but had to be recovered within a 2 year period. As fire stations were also fire extinguisher servicing centres, the R&R project to be implemented by the World Bank was to place 50 units of halon 1211 R&R machines at fire stations and train 100 trainers and 500 technicians (firemen). Even the 50 units would have been hard pressed to service 1,000,000 extinguishers at 80 units per day over 1 year or 40 units per day over a two-year period.

19. However, the Government changed the project concept and decided to set up a halon bank with a H1310 recycling machine instead of distributing 50 R&R units for H1211 to the fire stations. Thus, only 2 R&R machines for H1211 were left which had been received under a global project implemented by UNDP but they have not been used either.

20. The result was that thousands of halon fire extinguishers piled up at fire stations. Many fire stations refused to accept the fire extinguishers and so they were just discarded by the owners. It is reported that these extinguishers were found leaking at many of the fire stations. Of the estimated 2,500 MT of halon 1211 only 4.3 MT was recycled for the Electricity Board. These were part of the earlier fixed installations and not from portable fire extinguishers.

21. Of the estimated 2,000 to 2,500 MT of halon 1301 in installations 553 MT or 25% has been registered, 83 MT collected and 3.7 MT recycled. According to the contractor, 35.8 MT halon 1301 was collected and 5 MT was recycled. The contractor claimed that the recovery rate for Halon 1301 was only 50% and that there were no contaminants. He admitted not being able to use the Gas Chromatograph to identify the pollutants, however.

22. The halon bank operator had no appreciation of the policy objectives of the project, but rather viewed it as an opportunity to enhance his business. Fifty percent recovery rate reported by the contractor is incomprehensible. It lends weight to allegations that halon collected was illegally exported, sold to service existing halon systems and passed on as HFC 227 ea through unscrupulous contractors. Contractors and suppliers interviewed indicated that this was common market knowledge.

23. As already indicated by the previous R&R evaluation in 2000, (see document UNEP/OzL.Pro/ExCom/31/18 para. 49), the Government took over the Halon Bank Management in January 2000 and the equipment was moved in May 2000 to the Central Fire Training School. However, since the transfer, the Halon 1211 recycling machines are unused, and the Halon 1301 recycling machine has been out of order. Attempts to repair it did not succeed.

24. The Halon Taskforce Committee (HTC) was set up in 1999 and chaired by the Fire Services Department. At the moment, only 2 applications are approved by HTC as "essential uses", i.e military and civil aviation. The Environmental Quality (Halon Management) Regulation 1999 came into force by January 2000. A Standard Operating Manual was established under HTC to verify the quality of recovered halons.

25. Most of the training programmes, awareness programmes and seminars conducted in Malaysia have had no lasting effect, beneficial to the halon phase-out. Instead, they became a platform for promotion of alternative products without proper understanding. Alternative products or applications, that have been restricted or rejected in other countries due to their inherent risks for occupants safety in case of fires, for example HCFC-123 for total flooding, have been approved, sometimes under pressure.

26. There is no national programme policy or strategy formulated to meet the critical and strategic needs of the country for halon. Malaysian operators should have identified the main sectors (electricity generation, telecommunication, petroleum/ chemical industries, civil aviation and armed forces), established a detailed inventory and introduced monitoring and reporting of these installations. The Fire Services Act and The Uniform Building By-laws stipulate maintenance in accordance to the relevant standards and codes and as per directive and requirement of the Fire Services Department. There should have been a planned withdrawal (dismantling) by way of prior notice to owners in line with the R&R capacity of equipment installed. As per information received, the capacity for recycling H1301 is 100kg/day. Working 300 days per year, 30 MT could be processed each year.

27. The funding for the continued (prolonged) operation of the HBR&D project and the holding costs should have been subsidised by the government. A phased retirement of existing halon fixed installations, as alternative agents become available, is better than a hasty decommissioning following an administrative decree.

(5) Venezuela

28. Halon banking and recovery recycling in Venezuela consists of the operation of one halon 1301 reclamation centre, including a halon 1211 recovery pump, provided under a project implemented by Environment Canada, and two halon 1211 recovery and recycling machines provided by an earlier project implemented by USEPA, with associated training and other equipment.

29. Neither of the two halon 1211 recovery and recycling equipment delivered under the USEPA project are currently working. Technofuego, a systems manufacturer, has one of the two machines and has tried to replace some of the aluminum parts of the equipment that have corroded. It also tooled a replacement pump for the one in the machine that had corroded, but it was not possible to make the machine run. The other 1211 machine has been contracted to another firm, but it does not work. The operator selected did not fare well because he lacked experience in servicing of halon fire extinguishers and systems, did not have enough finances to sustain the operation or provide the necessary inducements, could only provide limited service, and could not extend his services to all regions of the country. Moreover, it is estimated that only about 800 units with approx. 1,200 kg of halon are still in service and are being phased-out through natural attrition, resulting in little demand for R&R of halon 1211.

30. The halon 1301 reclamation equipment, scale, and mass-spec testing equipment were all functional. Technofuego is the contractor. The company had trouble with a leak in the reclamation equipment that resulted in the emission of 40 lbs of halon 1301. The leak was repaired and there have been no further problems. Filters need to be replaced frequently but they can be purchased locally.

31. All of the equipment is owned by the Government through FONDOIN who signs annual contracts with commercial equipment manufacturers and servicing centres to operate the equipment. The contractor charges about US \$18-25/lb. for reclaimed halon 1301 and pays US \$3/lb. for halon 1301 that it buys from excess supplies and then reclaims through the Fund-purchased equipment. Technofuego is required to pay US \$0.10 per lb of halon that it buys to FONDOIN. FONDOIN requires monthly reporting on the amount of halon purchased, sold and being held by Technofuego.

32. The quantities of recycled halon 1211 reached a peak of about 1,700 lbs in 1998, varied between 800 and 1,100 lbs from 1999 to 2001 and came down to about 500 lbs in 2002, with a further decline in 2003. For halon 1301 the figures were significantly higher, mostly between 5,000 and 8,000 lbs between 1999 and 2001 before declining sharply to less than 1,000 lbs in 2002 and shrinking further in 2003.

33. There was no import of halon since 1994, although there is no import ban as required by the guidelines. Nevertheless, there is an effective ban since regulations require the approval of the Ministry of the Environment for any imports or exports of both new and recycled halon which is not granted. The Government also had indicated early on that there would be no further imports of halon equipment, which made all equipment suppliers realize that they had to pursue alternatives. The halon ban is now in the office of the President for signature. The ban will extend also to imports and exports of equipment containing halon which currently require a license from the Ministry of Environment.

34. A key factor for the success of the halon bank project was to find a private contractor having the confidence of its competitors who in turn agreed to the level of service fees charged, jointly with FONDOIN. Another key factor was that the project focused on R&R of H1301 for fixed systems in the critical use sectors: petroleum industry, airlines, Caracas metro, banks, electricity suppliers, armed services, and the mining industry.

35. Concern was expressed about the quality of imported substitutes, in particular FM-200 from China. In general, FM-200 is the alternative of choice for fixed systems although Inergen is also available at a similar price. Water mist systems have not been purchased largely due to the poor quality of water. Fire Authorities were not concerned about halon or its alternatives since their use had mostly to do with protecting capital investments instead of occupants safety. For the latter, they prefer water-based systems.

36. Neither FONFOIN nor the halon bank contractor pursued the regionalization of the project, mainly because of import restrictions for recovered halons which are classified as hazardous waste.

Annex V

Executive Summary of the Evaluation of the Halon Sector Phase-Out Programme in the PR China

(a) Context of the Evaluation

1. The evaluation of halon projects in China is part of the halon sector evaluation foreseen in the 2002 and 2003 Monitoring and Evaluation Work Programmes.

2. 34,187 ODP tonnes of halons was the baseline consumption in China which obtained 72.2% of all approved funding in the halon sector of Article 5 countries. Early investment and non-investment projects only partly succeeded, as described in the Desk Study on Halon Projects. At its 23rd meeting in November 1997, the Executive Committee approved in principle US \$ 62 million for a sector plan to approach the phase-out in a comprehensive manner. Under the sector plan, total phase-out of consumption and production of halon 1211 will be realized in 2006 and of halon 1301 in 2010. So far six annual tranches with a total funding of US \$ 46.8 million have been approved by the Executive Committee.

(b) Methodology

3. The participatory evaluation approach was used, in line with the terms of reference. This approach which focuses on dialogue and inputs from all stakeholders is compatible with the flexibility clause which implies national decision-making and reporting of overall results rather than detailed accountability. In addition, the participatory approach enhances the distinctiveness of an evaluation exercise as contrasted to an audit.

4. The evaluation mission to China took place in March 2002. halon producers, fire extinguisher and systems manufacturers, fire research institutes, fire bureaus, and halon recycling centers were visited in various provinces. Extensive discussions were held with representatives from SEPA and MPS (Ministry for Public Security) who were very helpful to provide information and support the organization of the mission. The Fund's Secretariat actively participated throughout the evaluation exercise. Likewise, the World Bank, as implementing agency, also provided support before and during the evaluation mission.

5. Data collection methods used were those applicable to evaluate results at sector rather than project level, with a focus on outcomes in terms of halon phase-out achieved and supporting activities completed.

(c) Main Findings and Lessons Learnt

6. The halon phase-out process proceeds in line with the agreement approved at the 23rd meeting of the Executive Committee. halon production and consumption is now below the allowed levels, the market for halon 1301 seems to be particularly depressed. The only remaining 1301 producer in Zheijiang stopped production about a year ago and still has 500 mt in stock. The reactor can be reactivated any time but needs one month of preparatory work before actual production could start. The annual production capacity is about 1,000 mt of halon 1301. Theoretically halon 1211 could also be produced but there are no indications that this is intended.

The two remaining halon 1211 producers work likewise on a campaign-basis, with an estimated two weeks of preparations needed each time before production is started.

7. The Audit Reports (which focus on the production sector) and the World Bank's Annual Reports (dealing with the previous year's status of implementation and the following year's annual programmes) provide reliable and sufficient information to the ExCom to decide on the proposed annual tranches. No deviations from KPMG audit reports were observed, and KPMG answered satisfactorily questions sent to them by the production sector consultant after the mission.

8. There is adequate availability of alternatives to halons at sufficiently attractive prices to fire equipment manufacturers and to consumers, to enable the continued phase-out of halons without damaging the country's fire fighting capability. However, enterprises which have invested in ABC powder production capacity, especially those which have converted from halon 1211 manufacture, generally have been disappointed by the poor profitability due to strong competition and similarity with low-priced BC powder. This was reported by manufacturers of ABC powder as well as of fire extinguishers. As a result, some dissatisfaction with the conversion was reported, although this disappointment also demonstrates a lack of sound business planning by the companies. For example, there seems to be limited market research conducted by companies with the result that investments are made based on what they are able to produce rather than what might be needed in terms of future market demand. Similarly, the insistence on use of equipment suited to highly industrialized societies, under Chinese conditions, may be a cost burden which could inhibit success.

9. The assumed viability of halon banking was based on certain price projections running the halon bank, and market volumes. Due to the shrinking internal demand and low prices for halons in China and in the international market the strategy must be reconsidered. The enterprise foreseen for running the halon bank, one of the largest manufacturers of fire extinguishing equipment based in Guangdong, did not start recycling operations yet and will most likely not do so before a price increase of halons would make it more attractive. National security concerns, might overrule the economic viability criteria, but it may be necessary that the banking operations will be subsidised. However, critical applications will have to be reduced to a minimum due to the high holding costs of halon in centralized storage facilities.

10. The bidding process worked well in the first year, with numerous halon producers participating. However, when halon prices increased temporarily the remaining producers complained about lost profits but were pushed to accept similar compensation levels as the previous bid winners. There is no illegal production as the market demand is lower than the production quotas. The capacities of the 2 remaining producers of halon 1211 and one of 1301 could produce in one year stocks sufficient for several years of consumption. Complete phase-out ahead of the agreed schedule could be negotiated. For the companies, this would be more economical than occasional short production runs. However, it would require an amendment of the phase-out agreement.

11. The Halon Unit was established by the PMO in 1997. It comprises officials from the Fire Protection Bureau of the MPS, SEPA's PMO, and CNCCC, the domestic implementing agency (DIA). It is headed by a senior official delegated from MPS and has its offices in SEPA which greatly facilitates interministerial coordination.

12. The provincial and municipal environmental protection authorities (EPA) and fire fighting bureaus (FFB), on behalf of SEPA and MPS, conduct random visits to beneficiary enterprises to confirm halon phase-out. CNCCC as the DIA carries out supervision of enterprise-level activities, under PMO's supervision.

13. The leadership of MPS and SEPA was a decisive factor for the HSPP's successful implementation. The WB played a catalytic role in building on existing capacities, strengths and experiences from SEPA, MPS, FFB and others, by coordinating and linking initiatives through partnerships. This amplified national and local ownership of the HSPP.

14. The installed institutional infrastructure, together with the policies and economic instruments applied, has been the decisive factor for the on-going success of HSPP. Because such an effective institutional infrastructure is indispensable, it remains uncertain as to whether the Sector Approach can universally be the best means to achieving ODS phase-out. The economic liberalization in China allowed to combine a strong central leadership and oversight with market mechanisms like the auction system which enhanced transparency and cost-effectiveness.

15. The conversion of enterprises was made easier by the PR China's unparalleled economic growth in the last two decades which provided new business opportunities in or outside the fire fighting sector. The phased elimination of halons created opportunities for substitutes which were seized upon by commercial organizations which built in recent years with large scale investments at least five HFC227ea plants and three HFC236fa installations, as well as a number of HFC23 units. This could be contrasted with MLF funding for two small and presently underutilized ABC powder plants which form only a fraction of installed production capacities in excess of 100,000 mt per year.

16. The halon phase-out has brought with it grant funding for modernizing the fire equipment manufacturing industry but it was also, along with the market liberalization, instrumental in up-rooting many of the old entrenched manufacturers who enjoyed a closed and protected market. With increasing competition and decreasing profit margins, only those producers who were able to expand their production and to realize sizable economies of scale survived and flourished. The sustainability of the converted companies depends on the quality, diversification and innovativeness of their products with the home market providing the volume and the export market providing the margins. Many of those who emerged as leaders have taken to globalization, quality production, market-orientated product line and volume production. The market-orientated economy also brought about a profit-motivated approach. The enforcing agencies have to face new challenges, as the manufacturing sector is increasingly profit-orientated and less focused on moral and social obligations.

17. The training of enterprises in bidding procedures seemed well targeted and user-friendly. Likewise, the campaign in awareness raising has been successful as most stakeholders contacted are clearly convinced of the long-term benefits of halon phase-out to the environment. Most of the efforts concerning public education, awareness and technical support resulted in successful outputs, such as the 2000 National Proceedings on Halon Phase-Out.

18. By contrast, the development of new building and product standards and codes, though vital in the context of the HSPP, appeared less successful. It was not possible to identify the timing of the expected outputs. The failure of developing and implementing national standards and codes resulted in provincial governments introducing their own standards and codes. Their FFB had to individually evaluate and decide the acceptability and applicability of the substitute agents. This gave rise to a multiplicity of codes and standards. Therefore, the enforcement of the phase-out differed between regions, resulting in situations where a ban on halon in one area could be circumvented by sourcing elsewhere. In the absence of national standards and codes for the introduction of new agents and systems like Inergen, HFC 227 and water mist, their development should have been addressed first and put on the fast track.

19. Funds committed for completed and on-going projects have amounted to US\$ 13,602,733 for phase-down and closure of halon producers, US\$ 7,432,106 for the conversion or closure of fire extinguisher and systems manufacturers, US\$ 1,727,253 for technical assistance, and US\$ 8,2165,000 for halon substitutes. This adds up to US\$ 30,927,092 which represents 66% of the funding of US\$ 46,800,000 approved in six annual tranches.

20. The average cost-effectiveness for fire extinguisher and system manufacturers is US\$ 0.45 per kg of ODP phased-out, much below the threshold of US\$ 1.48 per kg, assuming that only H1211 with a conversion factor of 1:3 is phased out, thereby neglecting H1301 with a higher conversion factor (1:10). Including it would show an even better cost-effectiveness.

(d) Recommendations

21. Consider a negotiated earlier phase-out date of halon production, in particular of halon 1301. This would require the companies to produce one or two years above their current quotas and build up a stock pile which would serve until 2006 for halon 1211 and until 2010 for halon 1301. Verification of such production and stockpiling would need to continue until 2010.

22. Accelerate the development of National Standards and Codes so that the industry moves forward with increasing step. The new standard for ABC powder at 75% phosphate content is being sidelined for 50% because the margins are better. There is need for greater awareness of the situation and for stricter enforcement. The pursuit of national standards for CO₂ will require more investments in CO₂ production facilities, testing and certification.

23. Prepare an in-depth feasibility study on halon banking, taking into account the following findings: (1) current trends indicate that, left to the market forces, halon banking and recycling operations may not be viable, (2) banking and recycling operations may have to be heavily subsidised to meet strategic needs, (3) if volumes become unmanageable, in-situ banking would be an option to reduce operational costs. Give the highest priority to the problem of collection, storage and safe disposal of halon in order to avoid substantial emissions due to leakages and venting.

24. Conduct a full and impartial market survey for present and anticipated halon substitutes using national and international expertise. This should help to guide investment planning in a broad sense. For example, rather than investing in small ABC powder projects when the total capacity is already at some 100,000 mt per year, companies investing in substitutes such as HFC236fa and HFC227ea might be supported. Any funding of substitute production under the HSPP, which is covered by the flexibility clause, should be based on clear and credible business plans in order to ensure viability in a rapidly changing market while avoiding to distort the competition. Savings realized in conversion and closure projects might also be preserved to cover later cost for halon banking and destruction.

25. Analytical laboratories should be properly equipped to test all key specification elements of the intended chemicals, and, where appropriate, performance parameters as well (e.g. in the case of ABC Powder, which should be tested for tendency to caking, and moisture content). The retention of batch samples should be encouraged so that eventual market problems can be properly tracked.

26. Hong Kong has already phased out the use of halons in accordance with the schedule for non Art.5 countries. Lessons learnt in this process should be considered by SEPA.

27. To enable tracking data and analysis of documentation, ensure all documents are properly dated and referenced in a header/footer format and indicate if they are draft, approved, or superseding a previous document. A source or sponsor reference would also be helpful (e.g. World Bank, UNMFS, UNIDO, etc.) This procedure would be useful for facilitating follow-up by all stakeholders, in particular for evaluations.

Annex IV
Details of Halon Projects in Article 5 Countries Visited

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Country	Code	Agency	Status *	Type	Sector	Subsector	Project Title	Project Description	ExCom Provision	Consumption ODP To Be Phased Out	Consumption ODP Phased Out*	Production ODP To Be Phased Out	Production ODP Phased Out*	Date Approved	Approved Date of Completion	Revised Approved Date of Completion for Implementation Delays*	Date Completed *	Planned Date of Completion for Ongoing Projects*	Original Approved Funds	Total Funds Approved including Adjustments	Funds Disbursed*	Approved Cost-Effectiveness	PCR Received
Brazil	BRA/HAL/19/TAS/47	Canada	FIN	TAS	HAL	Technical assistance/support	Halon recycling and bank management	Establishment of a halon bank clearinghouse and provision of recycling and refurbishment facilities available. It includes establishment of the Advisory Group, provision of halon 1301 and halon 1211 recycling and reclamation equipment and laboratory analysis equipment (by others), development of a Halon Management Programme, training program and a workshop, and follow-up technology transfer. Implemented in cooperation with the Director of Environmental Quality, Companhia De Tecnologia De Saneamento Ambiental (Cetesp).		0.0				May-96	May-98	Sep-98	May-99		499,360	479,329	479,329	0	X
China	CPR/HAL/06/TAS/09	UNDP	FIN	TAS	HAL	Technical assistance/support	Technical study on halons usage and applications of halons substitutes	Study tour to examine the use of halon alternatives, practical problems on replacing halons in critical applications and new technologies developed. The information gathered has been used by the Ministry of Public Security the development of the halon phase-out strategy.		0.0	0.0			Feb-92	Jun-93		Jun-93		40,000	43,345	43,345		X
China	CPR/HAL/07/INV/17	IBRD	FIN	INV	HAL	Extinguisher	Zhejiang halon extinguisher conversion	Installation of ABC powder production and filling equipment, testing equipment, leak detectors and siphon valves, light-water foam agent testing and corrosion resistance for internal walls of the cylinders. The enterprise is currently producing 30,000 units/year of ABC dry powder extinguishers. The plant's capacity will increase from 1000,000 units to 250,000 units.		1,200.0	1,200.0		0.0	Jun-92	Dec-93	Nov-96	Nov-96		797,000	730,000	730,000	0.5	X
China	CPR/HAL/07/INV/18	IBRD	FIN	INV	HAL	Halon conversion	Beijing ABC powder production project	Transfer of technology to manufacture ABC dry powder at Beijing Fire Protection Equipment factory, increase production of sodium carbonate dry powder by 1,000 tonnes, ensure replacement of halons by ABC powder, and training. This project is related to the Zhejiang halon extinguisher conversion project.		1,200.0	1,200.0		0.0	Jun-92	Jun-93		Apr-96		403,000	900,000	930,000	0.75	X
China	CPR/HAL/10/TAS/40	UNDP	FIN	TAS	HAL	Technical assistance/support	Implementation of the halon phase-out plan for China: current situation, revision of national codes, and education and training	Revision of national codes and standards, drafting and adoption of new standards for handling of halons, education and training through national and regional seminars and training courses. Implemented by the Fire Bureau of the Ministry of Public Security and the technical work by the Tianjin Fire Research Institute.		0.0	0.0		0.0	Jun-93	Jun-96		Sep-98		280,000	255,875	255,875		X
China	CPR/HAL/10/TAS/41	UNDP	FIN	TAS	HAL	Technical assistance/support	Implementation of the halon phase-out plan for China: transfer of technology on alternatives to halon fire protection systems	Assessment of the performance and capability of halon alternative systems including fast response sprinkler system, nitrogen/argon fire extinguishing system and fine water mist systems, and training programme. Implemented by the Tianjin Fire Research Institute.		0.0	0.0		0.0	Jun-93	Jun-96		Jun-99	Jun-99	300,000	300,000	300,000		X
China	CPR/HAL/11/TAS/53	USA	FIN	TAS	HAL	Technical assistance/support	Halon management resource manual	Development of a resource manual on halon uses and alternatives, global halon reduction activities, analytic framework for gathering and organizing country-specific information, and a strategy for planning emission reduction activities.		0.0				Nov-93	Nov-94		Nov-94		32,000	32,000	32,000		X
China	CPR/HAL/11/TRA/57	USA	FIN	TRA	HAL	Training programme/workshop	Halon-1211 recovery/recharge training workshops	Plan, prepare materials (in Chinese), organize and conduct 3 workshops to improve maintenance and servicing of fire extinguishers to prevent halon emissions into the atmosphere, a training programme in the use of halon recovery and recharge equipment, deploy machines, and start-up. Implemented in co-operation with the Ministry of Public Security, the USA Navy and UNDP-Global Halon Project.		0.0				Nov-93	Nov-94		Nov-94		271,000	271,000	271,000		X
China	CPR/HAL/12/INV/59	USA	FIN	INV	HAL	Recovery/recycling	Deployment of halon-1211 recovery/recharge machines	Establishment of a demonstration network of halon recovery and recharge machines, training on extinguisher maintenance and servicing procedures, equipment operation and other conservation measures. Procurement of 127 compressors for the recovery and recharge machines will be done through UNDP.		200.0	231.0			Mar-94	Dec-95		Dec-95		735,000	807,000	807,000	3.67	X
China	CPR/HAL/12/INV/66	UNDP	FIN	INV	HAL	Recovery/recycling	Acquisition of local air compressors for halon recycling machines	Procurement of 127 air compressors for the 127 halon-1211 recovery/recharge machines to be procured through the USEPA (bilateral cooperation). The amount of halons to be phased out are considered in the recovery/recharge machines and training project.		0.0	0.0		0.0	Mar-94	Mar-95		Dec-96		155,000	155,000	155,000		X
China	CPR/HAL/15/INV/104	UNIDO	FIN	INV	HAL	Extinguisher/fixing system	Conversion from halon-1211 to ABC dry powder and foam water spray at Nanjing Fire Fighting Equipment Factory	Installation of new equipment manufactured in the country for: (a) ABC powder extinguishers (shearing machine, blank cutting, 3 high-performance presses, manipulators and conveyers, air-tightness tester, phosphating and cleaning facility, jigs, fixtures and tools), and (b) foam/water spray fixed systems (nozzle assembly line, valve body machining, valve body spinning machine, air-tightness tester), and imported equipment (filling machine, frozen storage and stoppage), technology transfer and training.		1,110.0	1,480.0			Dec-94	Dec-96		Dec-96		496,000	495,592	495,592	0.34	X

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Country	Code	Agency	Status *	Type	Sector	Subsector	Project Title	Project Description	ExCom Provision	Consumption ODP To Be Phased Out	Consumption ODP Phased Out*	Production ODP To Be Phased Out	Production ODP Phased Out*	Date Approved	Approved Date of Completion	Revised Approved Date of Completion for Implementation Delays*	Date Completed *	Planned Date of Completion for Ongoing Projects*	Original Approved Funds	Total Funds Approved including Adjustments	Funds Disbursed*	Approved Cost-Effectiveness	PCR Received
China	CPR/HAL/16/DEM/121	USA	FIN	DEM	HAL	Technical assistance/support	Halon leak reduction demonstration	Procurement of equipment, training workshop, demonstration of emission procedures to other factories, development and translation of training materials, and a report on results. Project implementation will result in the reduction of 3.5% of halon 1211 emissions during the production process.		221.7	74.0			Mar-95	Mar-96		Dec-96		90,437	90,437	90,437	0.41	X
China	CPR/HAL/23/INV/231	IBRD	COM	INV	HAL	Sectoral phaseout plan	Sector plan for halon phaseout in China, 1998 Annual Programme	The ExCom at its 23rd Meeting (Nov 1997) decided to approve in principle US \$62 million in total funding for the implementation of the China Halon Sector Strategy, as per the general and specific conditions indicated in Decision 23/11 (UNEP/OzL.Pro/ExCom/23/68). NOTE: The indicated total phase out of 21,378 ODP tonnes is comprised of 9,939 ODP tonnes of halon 1211 in the consumption sector and 11,739 ODP tonnes in the production sector	The Executive Committee recalls its decision 22/75 and understands that this decision and the China Halon Sector Strategy embody a specific agreement with the Government of China. In the context of that agreement, several factors that are specific to China have been taken into account. In that regard, and while the Executive Committee welcomes this innovation for phasing out production and consumption of halons in China, the Executive Committee agrees that this agreement establishes no specific precedents (including audits and eligibility or ineligibility of funding for specific levels or specific items).	9,939.0	9,939.0	11,739.0	11,739.0	Nov-97	Dec-98		Dec-98		12,400,000	12,400,000	12,400,000	0.58	
China	CPR/HAL/26/INV/261	IBRD	COM	INV	HAL	Sectoral phaseout plan	Sector plan for halon phaseout in China, 1999 Annual Programme	The ExCom at its 23rd Meeting (Nov 1997) approved in principle US \$62 million for the implementation of the China Halon Sector Strategy. This project relates to the 2nd tranche for implementation of the 1999 annual programme in accordance with Condition B of decision 23/11, to ensure that the target for halon production is a maximum of 5,970 tonnes and halon consumption is a maximum of 5,370 tonnes per Condition A of decision 23/11.	The World Bank was requested to provide details on the use of the administrative costs approved in the first tranche.	5,370.0	5,370.0	5,826.0	5,826.0	Nov-98	Dec-99		Dec-99		9,700,000	9,700,000	9,700,000	0.87	
China	CPR/HAL/29/INV/309	IBRD	COM	INV	HAL	Sectoral phaseout plan	Sector plan for halon phaseout in China, 2000 Annual Programme	During this phase, halon 1211 production will be reduced to a maximum of 3,980 MT and its consumption to a maximum of 3,580 MT in 2000. The halon 1301 production will be maintained at the agreed maximum level of 618 MT and consumption will be 300 MT. It will also continue actions to ensure that the fire fighting capacity is not undermined as the result of an insufficient supply of substitutes of satisfactory quality. The following activities are envisioned: (i) \$4 million to buy back quotas and as a result closing 3-5 halon agent producers; (ii) \$5.3 million to close and convert 10-15 fire extinguisher manufacturers; (iii) \$0.4 million to convert 2-3 fire extinguishing system manufacturers; and (iv) \$0.9 million for technical assistance activities to ensure that fire protection requirements can be met. The following policies/measures will continue to be implemented: (i) the bidding system will continue to be improved (bidders with the highest scores will be awarded grant funds after bid evaluation); the Government will sign closure/conversion contracts with the winners.		3,712.0	3,712.0	5,970.0	5,970.0	Nov-99	Dec-00		Dec-00		10,600,000	10,600,000	10,600,000	1.09	
China	CPR/HAL/32/INV/364	IBRD	COM	INV	HAL	Sectoral phaseout plan	Sector plan for halon phaseout in China, 2001 Annual Programme	Halon-1211 production will be reduced to a maximum of 3,317 tonnes and its consumption to a maximum of 3,117 tonnes in 2001. Halon-1301 production will be maintained at the agreed maximum level of 618 tonnes and consumption will be 300 tonnes. It includes the following activities: \$1.6 million to be used for buying back quotas and as a result closing 2-3 halon agent producers; \$2.1 million to be used for closing and converting 7-10 fire extinguisher manufacturers; \$0.4 million to be used for converting 2-3 fire extinguishing system manufacturers; and \$0.4 million to be used for technical assistance activities in order to support the halon phase out programme and ensure that existing fire protection requirements can be met. The Government will continue to implement bidding for closure/conversion contracts for halon phase out activities and the tradable production quotas, and to strengthen the ban on new installation of halon extinguishers for non-essential uses through, inter alia, a gradual tightening of the definition of essential uses. The ban on non-essential uses will at	To request that future technical audits required under the agreement be submitted by the World Bank no later than 8 weeks prior to the meeting of the Executive Committee at which approval of funding was being sought	1,389.0	1,389.0	1,980.0	1,980.0	Dec-00	Dec-01		Dec-01		4,500,000	4,500,000	2,450,000	3.24	

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China	CPR/HAL/35/INV/383	IBRD	COM	INV	HAL	Sectoral phaseout plan	Sector plan for halon phaseout in China, 2002 Annual Programme	China halon 1211 production and consumption will be reduced to a maximum of 2,654 metric tonnes, each. The halon 1301 production will be reduced to a maximum level of 600 metric tonnes and consumption will be reduced to 150 metric tonnes. These reductions will lead to a phase out in 2002 of 2,169 ODP tonnes in production and 2,889 ODP tonnes in consumption of halon. The 2002 Annual Programme includes the following activities: (a) US\$1.4 million to be used for buying back quotas and will result in the closing of one halon-1211 agent producer; (b) US\$800,000 to be used for closing and converting 8-10 fire extinguisher manufacturers; (c) US\$300,000 to be used for converting 1-2 fire extinguishing system manufacturers; and (d) US\$890,000 to be used for technical assistance activities in order to support the halon phase out programme and ensure that existing fire protection requirements can be met. The Government will continue to implement bidding for closure/conversion contracts for halon phase out activities; tradable production quotas and strengthen		2,889.0	2,889.0	2,160.0	2,160.0	Dec-01	Dec-02		Dec-02		3,700,000	3,700,000	890,000	1.28	
China	CPR/HAL/38/INV/395	IBRD	ONG	INV	HAL	Sectoral phaseout plan	Sector plan for halon phaseout in China: 2003 annual programme	China halon 1211 production and consumption will be reduced to a maximum of 1,990 tonnes and 1,890 tonnes respectively. The halon 1301 production will be maintained at a maximum level of 600 tonnes and consumption will be maintained at 150 tonnes. The Government will continue to implement and improve bidding for closure/conversion contracts for halon phase-out activities based on the experiences gained from the first five annual programmes. It will continue to implement tradable production quotas and strengthen the ban on new installation of halon extinguishers for non-essential uses through a gradual tightening of the definition of essential uses. It Government will ensure that the details of the ban will be disseminated to prospective consumers through the news media, bulletins, etc.; local fire bureaux and environmental protection bureaux will inspect consumers on a regular basis, and submit regular reports to the Ministry of Public Security and the State Environmental Protection Agency; and introduce stricter control the sale of halons.		2,292.0	0.0	1,992.0	0.0	Nov-02	Dec-03		Dec-03		5,900,000	5,900,000	0	2.57	
India	IND/HAL/13/DEM/28	UNDP	COM	DEM	HAL	Technical assistance/support	Demonstration and evaluation of alternative technology for halon fire protection system and technical assistance for sectoral strategy for ODS phase out	Demonstration of the following fire extinguisher alternative technologies: (i) fast response sprinkler system, (ii) water mist/fog system both low pressure and high pressure, (iii) inert gas such as inergen system or nitrogen, argon system, (iv) dry chemical powder system, (v) in cabinet and sub floor CO2 system, (vi) fine powder particle-aerosol type systems (combustion generated aerosols). It also includes preparation of sectoral strategy for halon phase out. To be undertaken at the Defense Institute of Fire Research, Delhi.		0.0	0.0	0.0	0.0	Jul-94	Jul-97	Jun-99	Dec-99		309,000	265,381	264,889		
India	IND/HAL/18/INV/60	IBRD	CLO	INV	HAL	Extinguisher	Conversion from halon-1211 to ABC dry chemical powder (ABC-DCP) and carbon dioxide (CO2) in portable extinguishers at Real Value Appliances Ltd.	Installation of equipment for the ABC-DCP filling line and CO2 line, valve manufacturing plant, CO2 storage tank, miscellaneous equipment for ABC-DCP and CO2 lines. Selected equipment component will be manufactured in-house to meet the Indian Standards. Implemented under the retroactive reimbursement modality.		462.0	462.0	0.0	0.0	Nov-95	May-97	Dec-00		Dec-03	251,736	251,736	0	0.54	
India	IND/HAL/24/INV/163	UNDP	COM	INV	HAL	Extinguisher	Conversion of halon-1211 fire extinguisher production and elimination of its consumption of virgin halon-1301 at Steelage Industries Limited Minimax Division/ Chennai	Installation of ABC dry chemical powder and CO2 filling equipment, storage tanks and piping, provision of a halon 1211/1301 reclamation equipment to be provided in the request by relying on recovered 1301 halon for servicing existing systems, technology transfer and license agreement fees and certification. The project should be undertaken within the context of the sector strategy prepared by UNDP, and the strategy should be submitted to the Executive Committee. Project implementation should not go forward until a list of equipment to be destroyed or made unusable has been prepared, and an undertaking given by the enterprise concerned that the dismantling or destruction will be carried out.	Approved under the condition that the conversion to CO2 should be maintained, at the ratio specified, after implementation, or the operating costs associated with CO2 should be recalculated and any ineligible costs returned.	116.0	116.0	0.0	0.0	Mar-98	Apr-00		Jan-02		131,915	131,915	89,763	1.14	X

*According to the 2002 Progress Reports
Source: Inventory and Progress Reports

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India	IND/HAL/24/INV/165	UNDP	FIN	INV	HAL	Extinguisher	Conversion of halon-1211 fire extinguisher production and elimination of its consumption of virgin halon-1301 at Vijay Fire Protection Systems Ltd.	Installation of ABC dry chemical powder and CO2 filling equipment, storage tanks and piping, provision of a halon 1211/1301 reclamation equipment to be provided in the request by relying on recovered 1301 halon for servicing existing systems, technology transfer and license agreement fees and certification.	Approved under the condition that the conversion to CO2 should be maintained, at the ratio specified, after implementation, or the operating costs associated with CO2 should be recalculated and any ineligible costs returned. The project should be undertaken within the context of the sector strategy prepared by UNDP, and the strategy should be submitted to the Executive Committee. Project implementation should not go forward until a list of equipment to be destroyed or made unusable has been prepared, and an undertaking given by the enterprise concerned that the dismantling or destruction will be carried out.	292.0	292.0	0.0	0.0	Mar-98	Apr-00		Dec-00		219,152	219,152	120,191	0.75	X
India	IND/HAL/24/INV/168	UNDP	FIN	INV	HAL	Extinguisher	Conversion of halon-1211 fire extinguisher production and elimination of its consumption of virgin halon-1301 at Nitin Fire Protection Industries Ltd., Bombay	Installation of ABC dry chemical powder and CO2 filling equipment, storage tanks and piping, provision of a halon 1211/1301 reclamation equipment to be provided in the request by relying on recovered 1301 halon for servicing existing systems, technology transfer and license agreement fees and certification.	Approved under the condition that the conversion to CO2 should be maintained, at the ratio specified, after implementation, or the operating costs associated with CO2 should be recalculated and any ineligible costs returned. The project should be undertaken within the context of the sector strategy prepared by UNDP, and the strategy should be submitted to the Executive Committee. Project implementation should not go forward until a list of equipment to be destroyed or made unusable has been prepared, and an undertaking given by the enterprise concerned that the dismantling or destruction will be carried out.	212.0	212.0	0.0	0.0	Mar-98	Apr-00		Dec-00		165,818	165,818	151,615	0.78	X
India	IND/HAL/24/INV/170	UNDP	FIN	INV	HAL	Extinguisher	Conversion of production halon-1211 fire extinguishers at Atkins, New Delhi	Installation of ABC dry chemical powder and CO2 filling equipment, storage tanks and piping, technology transfer and technical assistance.	Approved under the condition that the conversion to CO2 should be maintained, at the ratio specified, after implementation, or the operating costs associated with CO2 should be recalculated and any ineligible costs returned. The project should be undertaken within the context of the sector strategy prepared by UNDP, and the strategy should be submitted to the Executive Committee. Project implementation should not go forward until a list of equipment to be destroyed or made unusable has been prepared, and an undertaking given by the enterprise concerned that the dismantling or destruction will be carried out.	37.0	37.0	0.0	0.0	Mar-98	Apr-00		May-01		54,760	54,021	54,021	1.48	X
India	IND/HAL/24/INV/175	UNDP	FIN	INV	HAL	Extinguisher	Conversion of halon-1211 fire extinguisher production and elimination of its consumption of virgin halon-1301 at New Age Industries, Bombay	Installation of ABC dry chemical powder and CO2 filling equipment, storage tanks and piping, provision of a halon 1211/1301 reclamation equipment to be provided in the request by relying on recovered 1301 halon for servicing existing systems, technology transfer and license agreement fees and certification.	Approved under the condition that the conversion to CO2 should be maintained, at the ratio specified, after implementation, or the operating costs associated with CO2 should be recalculated and any ineligible costs returned. The project should be undertaken within the context of the sector strategy prepared by UNDP, and the strategy should be submitted to the Executive Committee. Project implementation should not go forward until a list of equipment to be destroyed or made unusable has been prepared, and an undertaking given by the enterprise concerned that the dismantling or destruction will be carried out.	133.0	133.0	0.0	0.0	Mar-98	Apr-00		Dec-00		132,248	131,956	131,956	0.99	X
India	IND/HAL/24/INV/176	UNDP	FIN	INV	HAL	Extinguisher	Conversion of halon-1211 fire extinguisher production and elimination of its consumption of virgin halon-1301 at Vimal Industrial Safety Equipment Corporation Baroda, Gujarat	Installation of ABC dry chemical powder and CO2 filling equipment, storage tanks and piping, provision of a halon 1211/1301 reclamation equipment to be provided in the request by relying on recovered 1301 halon for servicing existing systems, technology transfer and license agreement fees and certification.	Approved under the condition that the conversion to CO2 should be maintained, at the ratio specified, after implementation, or the operating costs associated with CO2 should be recalculated and any ineligible costs returned. The project should be undertaken within the context of the sector strategy prepared by UNDP, and the strategy should be submitted to the Executive Committee. Project implementation should not go forward until a list of equipment to be destroyed or made unusable has been prepared, and an undertaking given by the enterprise concerned that the dismantling or destruction will be carried out.	133.0	133.0	0.0	0.0	Mar-98	Apr-00		Dec-00		186,152	186,152	186,152	1.4	X

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Country	Code	Agency	Status *	Type	Sector	Subsector	Project Title	Project Description	ExCom Provision	Consumption ODP To Be Phased Out	Consumption ODP Phased Out*	Production ODP To Be Phased Out	Production ODP Phased Out*	Date Approved	Approved Date of Completion	Revised Approved Date of Completion for Implementation Delays*	Date Completed *	Planned Date of Completion for Ongoing Projects*	Original Approved Funds	Total Funds Approved including Adjustments	Funds Disbursed*	Approved Cost-Effectiveness	PCR Received
India	IND/HAL/24/INV/177	UNDP	FIN	INV	HAL	Extinguisher	Conversion of halon-1211 fire extinguisher production and elimination of its consumption of virgin halon-1301 at Ashoka Engineering Co., New Delhi	Installation of ABC dry chemical powder and CO2 filling equipment, storage tanks and piping; provision of a halon 1211/1301 reclamation equipment to be provided in the request by relying on recovered 1301 halon for servicing existing systems, technology transfer and license agreement fees and certification.	Approved under the condition that the conversion to CO2 should be maintained, at the ratio specified, after implementation, or the operating costs associated with CO2 should be recalculated and any ineligible costs returned. The project should be undertaken within the context of the sector strategy prepared by UNDP, and the strategy should be submitted to the Executive Committee. Project implementation should not go forward until a list of equipment to be destroyed or made unusable has been prepared, and an undertaking given by the enterprise concerned that the dismantling or destruction will be carried out.	34.0	34.0	0.0	0.0	Mar-98	Apr-00		Dec-00		50,320	50,320	50,320	1.48	X
India	IND/HAL/28/INV/208	UNDP	FIN	INV	HAL	Extinguisher	Conversion of halon-1211 fire extinguisher production to ABC powder and CO2 units at Cascade Counsel Ltd. New Delhi	Installation of a self contained filling machine for ABC powder (scales, air line coiled, vacuum system, leak detectors), a manually operated portable extinguisher CO2 (filling equipment, pumps, scales), modification of welding equipment and testing certification.		54.0	54.0	0.0	0.0	Jul-99	Feb-02		Dec-00		79,920	79,920	79,921	1.48	X
India	IND/HAL/28/INV/209	UNDP	FIN	INV	HAL	Extinguisher	Conversion of halon-1211 fire extinguisher production to ABC powder and CO2 units at Bharat Engineering Works, Mumbai	Installation of a self contained filling machine for ABC powder (scales, air line coiled, vacuum system, leak detectors), a manually operated portable extinguisher CO2 (filling equipment, pumps, scales), modification of welding equipment and testing certification.		49.5	50.0	0.0	0.0	Jul-99	Feb-02		Dec-00		73,260	65,509	65,509	1.48	X
India	IND/HAL/28/INV/216	UNDP	FIN	INV	HAL	Extinguisher	Conversion of halon-1211 fire extinguisher production to ABC powder and CO2 units at Zenith Fire Services, Mumbai	Installation of a self contained filling machine for ABC powder (scales, air line coiled, vacuum system, leak detectors), a manually operated portable extinguisher CO2 (filling equipment, pumps, scales), modification of welding equipment and testing certification.		36.0	36.0	0.0	0.0	Jul-99	Feb-02		Dec-00		53,280	49,971	49,971	1.48	X
India	IND/HAL/28/INV/220	UNDP	FIN	INV	HAL	Extinguisher	Extinguisher production and elimination of its consumption of virgin halon-1301 at New Fire Engineers Pvt. Ltd. Mumbai	The company operates totally in the fixed flooding systems market. It includes a recovery and recycling unit, a gas chromatographer, technology transfer, local approval and certification requirements, technical support.		120.0	120.0	0.0	0.0	Jul-99	Feb-02		Dec-00		130,000	130,000	130,000	1.08	X
India	IND/HAL/28/INV/222	UNDP	FIN	INV	HAL	Extinguisher	Conversion of halon-1211 fire extinguisher to ABC powder and CO2 units together with the use of recycled halon-1301 in lieu of virgin product at Standard Castings Pvt. Ltd. New Delhi, under the name of Pyrosafety	Installation of a self contained filling machine for ABC powder (scales, air line coiled, vacuum system, leak detectors), a manually operated portable extinguisher CO2 (filling equipment, pumps, scales), modification of welding equipment and testing certification.		64.1	64.0	0.0	0.0	Jul-99	Feb-02		Dec-00		92,000	68,916	68,916	1.44	X
India	IND/HAL/28/INV/256	UNDP	FIN	INV	HAL	Extinguisher	Conversion of halon-1211 fire extinguisher production to ABC powder and CO2 units at M/s Kooverji Devshi and Co. Pvt. Ltd., Mumbai	Installation of a self contained filling machine for ABC powder (scales, air line coiled, vacuum system, leak detectors), a manually operated portable extinguisher CO2 (filling equipment, pumps, scales), modification of welding equipment and testing certification.		25.5	26.0	0.0	0.0	Jul-99	Feb-02		May-01		37,740	37,740	37,740	1.48	X
India	IND/HAL/29/TAS/243	UNDP	ONG	TAS	HAL	Technical assistance/support	Technical assistance for revision, preparation and introduction of national fire codes/standards for use of halon alternative technologies in India	Revision of national fire codes and related fire equipment standards. It will provide support to the introduction and management of halon alternative technologies in the country; it will have a direct influence in ensuring the phase-out of halons is sustained and it is also a key part of the halon sector strategy. This will be done through: the establishment of a steering committee composed of government and industry, development of 10 standards (including standards for HFCs and HCFCs), purchase of standards from Australia, the United Kingdom, and United States and assembling technical manuals and dissemination of the results through three workshops and publications.		0.0	0.0	0.0	0.0	Nov-99	Dec-02			Aug-03	88,000	88,000	40,470		

Annex IV
Details of Halon Projects in Article 5 Countries Visited

UNEP/OzL.Pro/ExCom/40/8
Annex IV

Country	Code	Agency	Status *	Type	Sector	Subsector	Project Title	Project Description	ExCom Provision	Consumption ODP To Be Phased Out	Consumption ODP Phased Out*	Production ODP To Be Phased Out	Production ODP Phased Out*	Date Approved	Approved Date of Completion	Revised Approved Date of Completion for Implementation Delays*	Date Completed *	Planned Date of Completion for Ongoing Projects*	Original Approved Funds	Total Funds Approved including Adjustments	Funds Disbursed*	Approved Cost-Effectiveness	PCR Received
India	IND/HAL/32/INV/278	Canada	ONG	INV	HAL	Banking	National halon management and banking programme	It will include the establishment of a halon critical users database; establishment of a halon management group/advisory forum; establishment of a national halon banking operation; technical training for halon bank operators and major halon users; development of public and technical personnel education and awareness activities; development of possible regional halon management and banking participation. The creation of a database will assist with the identification of systems in various segments and would significantly contribute to follow-up planning for amounts required to be retained for critical/essential uses within a potential halon banking structure. Detailed inventories of the halon installed including quantities, site and installation specification, together with the magnitude and estimated quality of halon stocks, could also simplify the overall logistical controls. Jointly implemented with Australia	Disbursement would not take place until a commitment had been given by the Government that regulations facilitating the ban on the production and import of new halon would be established within six months after the reclamation centre had been set up	197.2				Dec-00	Jan-04			Jan-04	245,700	245,700	7,000		
India	IND/HAL/32/INV/281	Australia	ONG	INV	HAL	Banking	National halon management and banking programme	It will include the establishment of a halon critical users database; establishment of a halon management group/advisory forum; establishment of a national halon banking operation; technical training for halon bank operators and major halon users; development of public and technical personnel education and awareness activities; development of possible regional halon management and banking participation. The creation of a database will assist with the identification of systems in various segments and would significantly contribute to follow-up planning for amounts required to be retained for critical/essential uses within a potential halon banking structure. Detailed inventories of the halon installed including quantities, site and installation specification, together with the magnitude and estimated quality of halon stocks, could also simplify the overall logistical controls. Jointly implemented with Canada	Disbursement would not take place until a commitment had been given by the Government that regulations facilitating the ban on the production and import of new halon would be established within six months after the reclamation centre had been set up	197.2	0.0			Dec-00	Jan-04			Jan-04	245,700	245,700	33,950		
India	IND/HAL/34/INV/315	IBRD	ONG	INV	HAL	Sectoral phaseout plan	Halon production and consumption sector phase out plan	Implementation of the immediate, complete and permanent phase-out of production of halons and the complete phase-out of consumption of virgin halons. Funds will be disbursed by the Bank to the enterprises once the halon production plants are dismantled and have been certified. This is the total funding that would be available to the Government from the Fund for the cessation of production of Annex A Group II halons (and all existing and future halons classified as controlled substances) as per the Montreal Protocol phase-out schedule and dismantling of the production plants, which will be completed no later than 12 months after approval of this agreement. With regard to the consumption sector, five enterprises have already been identified and included within the totality of the approved funding. Consumption in these five enterprises, as well as any other remaining halons consumption in the country, will be eliminated within the level of funds provided. The Government agrees to ensure accurate monitoring of the phase-out in the production and consumption sector, to report regularly		556.0	0.0	321.0	0.0	Jul-01	Aug-02			Oct-03	2,600,000	2,600,000	0	4.68	
Malaysia	MAL/HAL/06/INV/04	IBRD	FIN	INV	HAL	Recovery/recycling	Servicing, maintenance and recovery of portable extinguishers (halon-1211) and training programme	Establishment of several maintenance and recovery centres at all major fire stations, a central halon reclamation plant, a training programme for 100 core trainers and 500 technicians, and procurement of 50 halon recycling machines.		900.0	900.0	0.0	0.0	Feb-92	Feb-93	Jun-97	Sep-98	720,000	718,850	718,850		0.8	X
Malaysia	MAL/HAL/09/TRA/07	UNEP	FIN	TRA	HAL	Training programme/workshop	Support to a sub-regional workshop on halon and halon bank management	Workshop on halon and halon bank management targeted at senior fire service officers from industry and Government and senior insurance officers. Expertise and recycling equipment provided from the project approved at the 6th ExCom Meeting.		0.0	0.0	0.0	0.0	Mar-93	Mar-94		Jan-94	80,000	80,000	80,000			X
Malaysia	MAL/HAL/18/INV/72	UNDP	FIN	INV	HAL	Extinguisher	Conversion of production of portable fire extinguishers at Eversafe	Installation of a ABC powder filling equipment with unload equipment and storage tank, filling line and leak detection system, a CO2 filling line with a recovery unit for halon 1211 for refilling of existing fire extinguishers, trials, technical assistance and training. This project represents the phaseout of the halon fire extinguisher sub-sector in the country.		574.0	574.0	0.0	0.0	Nov-95	Nov-96		Oct-96	179,586	175,372	175,372		0.31	X
Venezuela	VEN/HAL/09/TAS/12	UNDP	FIN	TAS	HAL	Technical assistance/support	Workshops for the recycling and banking of halons	Four workshops directed to enterprises and users of fire protection systems, aimed at introducing halon recycling practices, establishment of halon banks and elimination of halons in both portable equipment and fixed new installations.		0.0	0.0	0.0	0.0	Mar-93	Mar-94		Jun-94	26,800	23,100	23,100			X

*According to the 2002 Progress Reports
Source: Inventory and Progress Reports

**Annex IV
Details of Halon Projects in Article 5 Countries Visited**

Country	Code	Agency	Status *	Type	Sector	Subsector	Project Title	Project Description	ExCom Provision	Consumption ODP To Be Phased Out	Consumption ODP Phased Out*	Production ODP To Be Phased Out	Production ODP Phased Out*	Date Approved	Approved Date of Completion	Revised Approved Date of Completion for Implementation Delays*	Date Completed *	Planned Date of Completion for Ongoing Projects*	Original Approved Funds	Total Funds Approved including Adjustments	Funds Disbursed*	Approved Cost-Effectiveness	PCR Received
Venezuela	VEN/HAL/11/TAS/18	Canada	FIN	TAS	HAL	Technical assistance/support	Technical assistance in halon sector	Assessment of halon 1301 needs, halon management programme development, halon 1301 recycling equipment, halon sector study tour, and a workshop (\$109,500 used for other bilateral cooperation).		0.0				Nov-93	Nov-97	Jan-00	May-96		414,000	304,500	304,500		X
Venezuela	VEN/HAL/13/DEM/27	USA	FIN	DEM	HAL	Technical assistance/support	Technical assistance in halon-1211 management	Assistance in the development of a halon 1211 management programme, including halon assessment, halon recycling and baking, and delivery of one UNDP-procured halon 1211 recovery and recharge unit.		2.0				Jul-94	Jul-95		Jul-95		31,000	34,000	34,000	15.5	X
Venezuela	VEN/HAL/19/TAS/47	Canada	FIN	TAS	HAL	Technical assistance/support	Halon recycling and bank management (Phase II)	Continue to support the establishment of a halon bank clearinghouse, provision of halon 1301 and halon 1211 recycling and reclamation equipment and laboratory analysis equipment, and follow-up technology transfer and monitor. Fondoin intends to have the recycling and reclamation facility and clearinghouse financially self-supporting, by charging a recycling fee to cover operating costs (revenue would be used to offset operating costs), and will also make the services provided by the recycling facility available to users in other countries in the region, on a commercial basis.		0.0				May-96	May-98	Jun-97	May-98		352,220	283,356	283,356	0	X