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EXECUTIVE COMMITTEE OF
THE MULTILATERAL FUND FOR THE
IMPLEMENTATION OF THE MONTREAL PROTOCOL
Thirty-eighth Meeting
Rome, 20-22 November 2002

PROJECT PROPOSALS: INDIA

This document consists of the comments and recommendations of the Fund Secretariat on the following project proposals:

Aerosol

- Terminal umbrella project aerosol sector — UNDP

Process Agent

- Conversion of carbon tetrachloride (CTC) as process agent to water at Kedia Organic Chemicals, Vapi. — UNIDO
- Sector plan for phasing out of CTC consumption in the chlorinated rubber sub-sector — World Bank

Refrigeration

- Complete phase-out of ODS (CFC-12) technology to non-ODS technology (HFC-134a) for manufacturing of mobile air-conditioners (MACs) at Subros Limited (Phase II) — World Bank
- Plan for phase-out of CFCs in the refrigeration (manufacturing) sector — UNDP/UNIDO

Solvent

- Conversion of carbon tetrachloride (CTC) as cleaning solvent to trichloroethylene at Navdeep Engineering, Palghar — UNIDO

PROJECT EVALUATION SHEET
INDIA

SECTOR: Aerosol ODS use in sector (2001): 132.5 ODP tonnes

Sub-sector cost-effectiveness thresholds: US $4.40/kg

Project Title:

(a) Terminal umbrella project aerosol sector

Project Data	**Contract filler**
	Terminal
Enterprise consumption (ODP tonnes)	132.50
Project impact (ODP tonnes)	132.50
Project duration (months)	24
Initial amount requested (US $)	667,309
Final project cost (US $):	
Incremental capital cost (a)	530,000
Contingency cost (b)	53,000
Incremental operating cost (c)	
Total project cost (a+b+c)	583,000
Local ownership (%)	100%
Export component (%)	0%
Amount requested (US $)	583,000
Cost effectiveness (US $/kg.)	4.40
Counterpart funding confirmed?	
National coordinating agency	Ozone Cell, MOEF
Implementing agency	UNDP

Secretariat's Recommendations	
Amount recommended (US $)	583,000
Project impact (ODP tonnes)	132.50
Cost effectiveness (US $/kg)	4.40
Implementing agency support cost (US $)	74,130
Total cost to Multilateral Fund (US $)	657,130

PROJECT DESCRIPTION

Terminal umbrella project aerosol sector

1. The project proposal is to phase out 132.5 ODP tonnes of ODSs (103.2 ODP tonnes of CFCs and 29.3 ODP tonnes of CTC) used as propellants in the manufacturing of aerosol products, excluding MDI applications. This is the last project in the aerosol sector (excluding MDI applications) for which the Government of India will seek assistance from the Multilateral Fund.

2. Since 1993, the Executive Committee has approved 23 investment projects and one technical assistance programme (for safe use of hydrocarbons at 50 SME aerosol fillers), to phase out a total of 865.5 tonnes of ODSs. The technical assistance programme covered over 70 aerosol fillers and resulted in the conversion of several of the SMEs to non-ODS technologies with their own resources, with an estimated phase out of 125 tonnes. Almost all insecticide products and several other personal care products have now converted to LPG propellant. Currently, only some pharmaceutical and industrial products and some perfumes and cosmetics are still using ODS propellants.

3. The Government of India, has enacted regulations banning CFCs used as an aerosol propellant as of 1 January 2003. The aerosol fillers still using ODS are established in places where LPG cannot be used as a propellant for safety reasons. Many of them will either have to go out of business or use the services of a contract filler.

4. In 2000, the Government of India mandated that all CFC users register under the Small Scale Industries Department (the period for registration expired on 19 July 2002). Through the registration process, a total of 19 aerosol fillers were identified as eligible for conversion. All these enterprises participated in the technical assistance programme, and were visited by UNDP's consultants whereby their baseline conditions and financial viability were checked; furthermore, all enterprises agreed to re-locate using their own resources to another location where hydrocarbon can be safely use. The Government of India stated that if other aerosol fillers are identified, they would be converted with the funding approved under the project (i.e., funds will be pro-rated among the companies).

5. The total capital cost associated with the conversion has been estimated at US $569,000, which includes basic equipment needed for the safe use of hydrocarbons (to be provided on the basis of the equipment baseline at each plant), quality control and training. In addition, US $98,400 has been requested for a follow-up management plan by the Ozone Cell, which includes supervisory, supporting, technical assistance and monitoring activities.

SECRETARIAT'S COMMENTS AND RECOMMENDATION

COMMENTS

6. The Secretariat informed UNDP that based on the description of baseline equipment provided in the project proposal, the filling operations are very basic using manual crimpers and

manual gassers, which are proposed to be replaced with pneumatic gassers and pneumatic crimpers. However the technological upgrade of the equipment was not considered in the calculation of the project cost. UNDP's consultant stated that "the project does not specify sophisticated high tech equipment, but rather the lowest common denominator. In an effort to reduce costs further, as required by Decision 25/50, local pneumatic equipment was identified and recommended". The Secretariat was also informed that most of the beneficiary aerosol fillers will re-locate their facilities using their own resources and will be unable to provide counterpart funding for the conversion.

7. The Secretariat also pointed out that 5 of the 19 enterprises received a new manual crimper and gasser from the a demonstration project approved at the 19th Meeting of the Executive Committee (demonstration of a new manual propellant filling machine that has yet to be made commercially available on the market). However, it was reported that the "crimper and gasser do not work consistently, they failed the testing process, and production cannot depend on them. They can be sustained only with impractical and uneconomic maintenance". UNDP further indicated that all efforts were made to avoid double-counting when assessing the equipment needs at each filler.

8. The Secretariat sought a clarification on why the cost for quality control and safety training varied between US $3,500 and US $6,500. UNDP indicated that the proposed quality control and safety training were designed according to the needs of each filler and also to reduce project costs. However, the Government requested flexibility on the use of the funds amongst the fillers covered by the project during its implementation.

9. Upon a request by the Secretariat, an official letter with an explanation for the use of HCFC-141b at one enterprise (Industrial Automiser) was submitted.

10. The Secretariat pointed out that the cost-effectiveness of the project was US $5.03/kg when the management component of the project (US $98,400) is taken into consideration. Since this value was above the threshold value of the aerosol sector (US $4.40/kg), UNDP agreed to revise the cost of the project, accordingly.

RECOMMENDATION

11. The Fund Secretariat recommends blanket approval of the project with associated support costs at the funding level shown in the table below, on the understanding that the Government of India will not seek additional assistance from the Multilateral Fund in the aerosol sector, excluding MDI applications:

	Project Title	Project Funding (US$)	Support Cost (US$)	Implementing Agency
(a)	Terminal umbrella project aerosol sector	583,000	74,130	UNDP

PROJECT EVALUATION SHEET
INDIA

SECTOR: Process agent ODS use in sector (2000): 4,067 ODP tonnes

Sub-sector cost effectiveness thresholds: n/a

Project Titles:

(a) Sector plan for phasing out of CTC consumption in the chlorinated rubber sub-sector
(b) Conversion of carbon tetrachloride (CTC) as process agent to water at Kedia Organic Chemicals, Vapi.

Project Data	**Process conversion**	**Process conversion**
		Kedia
Enterprise consumption (ODP tonnes)		187.10
Project impact (ODP tonnes)	382.00	187.10
Project duration (months)	36	24
Initial amount requested (US $)	2,200,000	1,256,731
Final project cost (US $):		
Incremental capital cost (a)		1,061,373
Contingency cost (b)		106,137
Incremental operating cost (c)		89,221
Total project cost (a+b+c)	10,587,627	1,256,731
Local ownership (%)	100%	100%
Export component (%)	30.4%	0%
Amount requested (US $)	2,200,000	1,256,731
Cost effectiveness (US $/kg.)	27.80	6.72
Counterpart funding confirmed?		Yes
National coordinating agency	Ministry of Environment and Forest	
Implementing agency	World Bank	UNIDO

Secretariat's Recommendations		
Amount recommended (US $) Project impact (ODP tonnes) Cost effectiveness (US $/kg) Implementing agency support cost (US $)		
Total cost to Multilateral Fund (US $)		

SECTOR PROFILE

12. The latest figure for use of CTC in the process agent sector reported by the Government of India is 4,067 ODP tonnes in the year 2000. The total CTC phase-out from all projects so far approved for the process agent sector in India is 1,134 ODP tonnes. All of these projects were still under implementation during 2000. Therefore the CTC consumption determined as remaining to be addressed in the process agent sector in India is 2,933 ODP tonnes.

PROJECT DESCRIPTION

Sector plan for phasing out of CTC consumption in the chlorinated rubber sub-sector

Background

13. On behalf of the Government of India, the World Bank submitted to the 37th Meeting a proposed sub-sector plan for completion of the phase out of CTC used as a process agent in the manufacture of chlorinated rubber in India. The World Bank advised that the objective of the sub-sector plan was to completely phase out the remaining CTC consumption of about 382 ODP tonnes, and avoid 2,878 ODP tonnes of projected CTC consumption.

14. The plan proposed process conversions at two plants, Rishiroop Rubber International Limited (RRIL) and Rishiroop Polymers Limited (RPL) and closure of two smaller plants. Total incremental costs for conversion and closure of US$19,942,183 were proposed at a cost effectiveness of US $52.20 per kg. Phase out of 249 ODP tonnes of CTC at the fifth chlorinated rubber plant in India, Rishiroop Organics Limited (ROL), has already been addressed through a project approved at the 34th Meeting.

15. A description of the project proposal together with the full project document and the Secretariat's comments on it was circulated to the Executive Committee at its 37th Meeting in document UNEP/OzL.Pro/ExCom/37/39.

16. In its comments the Secretariat concluded that it could support an approach to the Executive Committee for approval of funding on the basis of the cost effectiveness of the chlorinated rubber project for Rishiroop Organics Limited (ROL) approved at the 34th Meeting, after adjustment for technology transfer costs, which had already been paid via the ROL project. The adjusted cost effectiveness was US $7.38 per kg. This cost effectiveness could be applied to the average total CTC consumption level for the last three years of all the remaining chlorinated rubber plants in India, after accounting for the phase out approved for ROL. This consumption figure is 275.2 ODP tonnes. The resulting level of incremental costs would be US $2,030,976. The Secretariat pointed out that this methodology would provide funding for those enterprises still producing and which are proposed for closure, at the same cost effectiveness as if they were to be converted, thus providing maximum flexibility to individual enterprises to decide whether to close or to convert.

17. In its response the World Bank said that this methodology did not capture eligible costs related to plant closure and reflected only a fraction of the total incremental costs to be incurred

by the industry in India. In addition, it did not reflect the required production capacity for meeting the future demand of CTC-free chlorinated rubber. The World Bank wished to explore the issue further with the Secretariat in order to ensure that the funding level under the sector plan would allow the Indian industry to balance its production capacity with future demand.

18. In Decision 37/56 the Executive Committee decided to defer consideration of the project, pending the resolution of outstanding issues.

Current situation

19. On 12 October 2002 the Secretariat received from the Word Bank a Note on Phasing Out CTC Consumption in the Chlorinated Rubber Sector in India, which is attached to this document. The note presents a new proposal for phase-out, involving the following elements:

(a) Conversion of the RRIL plant at a production capacity of 3000 tonnes per year (previously costs requested for conversion at a capacity of 4,500 tonnes per year);

(b) Dismantling costs for the non-operating RPL plant (previously costs requested for conversion);

(c) Conversion of the Tarak plant (previously costs requested for closure);

(d) Closure costs for the Pauraj plant (the same as in the original proposal).

20. The overall proposed cost of this new proposal is US $10,575,627, compared to a total cost of US $18,066,845 requested in the original proposal.

21. On the basis of the total CTC phase-out indicated in the original proposal (380.6 ODP tonnes), the cost effectiveness of the new proposal is US $27.8/kg compared to US $47.5/kg in the original proposal.

SECRETARIAT'S COMMENTS AND RECOMMENDATION

COMMENTS

22. As discussed in the submission to the 37th Meeting, the total, nominal production capacity for the manufacture of chlorinated rubber (CR) in India is 6,050 tonnes. The average production over the last three years was 971 tonnes. The highest level of production achieved since the nominal production capacity was installed in 1993-94 was 1392 tonnes of CR in 1996-97, that is, less than one quarter of the nominal capacity. The proposal submitted to the 37th Meeting would have funded conversion of a total nominal capacity of 5,600 tonnes of CR. The new proposal would fund a total, nominal production capacity in India of 3,850 tonnes annually, including the project for Rishiroop Organics Limited which has already been funded at its full capacity of 550 tonnes. This total still represents about four times the current level of production and about 2.8 times the highest production output achieved in the sector.

23. The circumstances and information regarding incremental costs for closure and for conversion remain the same as those reported in the Secretariat's comments to the 37th Meeting. Considering the rules and policies of the Multilateral Fund, the Secretariat can only support the same approach to phase-out as previously indicated, namely funding on the basis of the cost effectiveness of the ROL project, after adjustment for technology transfer costs, which had already been paid via the ROL project. The adjusted cost effectiveness is US $7.38 per kg. This cost effectiveness could be applied to the average total CTC consumption level for the last three years of all the remaining chlorinated rubber plants in India, after accounting for the phase out approved for ROL. This consumption figure is 275.2 ODP tonnes. The resulting level of incremental costs would be US $2,030,976. This methodology is still able to provide funding for those enterprises still producing and which are proposed for closure, at the same cost effectiveness as if they were to be converted, thus providing maximum flexibility to individual enterprises to decide whether to close or to convert.

RECOMMENDATION

24. Pending.

SUB-SECTOR PROFILE

25. It is reported in the project document that Kedia is the only manufacturer in India of chlorinated paraffin having a chlorine content of 70 percent or more (CP-70). The manufacture of CP with a lower chlorine content does not require the use of CTC in the manufacturing process.

PROJECT DESCRIPTION

Conversion of carbon tetrachloride (CTC) as process agent to water at Kedia Organic Chemicals, Vapi.

26. The project will phase out the use of 187.1 ODP-tonnes of CTC at Kedia Organic Chemicals Pvt. Ltd, Vapi (Kedia). The CTC is used as a process agent in the manufacture of CP-70, a flame retardant additive used in such products as coatings, inks, plastics, foams, adhesives, paint, paper and fabrics. The existing plant commenced production in 1979 with an installed capacity of 900 tonnes of CP-70 per year. The average level of production of CP-70 for the last three years is 582 tonnes, with a corresponding consumption of CTC of 187 ODP tonnes.

27. The phase out of CTC will be accomplished by converting production of CP-70 to a new process using water instead of CTC developed at the enterprise. It is stated that extensive laboratory experiments and pilot plant trials have been conducted to develop the new process. The project document addresses briefly the option of emissions control and indicates that it requires considerable investment and skilled personnel. It concludes that process change is the preferred option.

28. The capacity of the enterprise after conversion will be about 600 metric tonnes of CP-70 per year. Because of the requirements of the new process it is indicated that most of the existing plant will need to be replaced. The major capital cost items requested in the project are the items of process equipment required in a chemical plant, namely, reactors and storage tanks, a nitrogen generator, a vacuum system, a dryer, condensers, a waste water neutralization system, safety equipment, an incinerator, a process control system. The total cost of this process equipment is US $850,000. Additional capital costs for auxiliary equipment assembly installation and technical assistance total some US $200,000. Overall capital costs as requested are US $1,061,373. Incremental operating costs of US $89,221 arising mainly from increased chemical use and increased maintenance costs offset by the absence of costs for CTC are requested for a period of one year. The cost effectiveness is US $6.70/kg.

SECRETARIAT'S COMMENTS AND RECOMMENDATION

COMMENTS

29. Funding of US $79,100 was approved for UNIDO and US $146,900 for the World Bank at the 33rd Meeting of the Executive Committee for preparation of a sector phase-out plan for process agents in India. UNIDO would cover the pharmaceuticals sector and the World Bank the

chlorinated rubber and agrochemicals sectors. The Secretariat requested clarification on when the sector phase-out plan was expected to be submitted to the Executive Committee and how this project is related to it.

30. UNIDO indicated it had received advice from the Government of India that the World Bank is preparing a process agent sub-sector strategy, that includes chlorinated rubber, chlorinated paraffin (CP-70) and other uses of CTC as process agent. UNIDO has also been preparing the pharmaceutical component. The Government of India advised that "The sub-sector strategy report is likely to be completed by March 2003. In view of this, in order to meet the 85 percent reduction target, the proposal of Kedia Chemicals has been endorsed for submitting at the next ExCom for consideration. This project would definitely form a part of the process agent sector strategy."

31. In regard to UNIDO's project preparation funding, UNIDO advised that from the approved preparatory assistance funds of US $79,100, a survey on pharmaceuticals veterinary products and certain other chemicals has been conducted. For the respective companies, non-ODS solutions had been developed and processes designed. Laboratory or miniplant scale trials and analyses of waste streams had been conducted in independent laboratories and various certificates from attorneys acquired. Additionally, verification missions to confirm the status of ODS consumers had been undertaken and case studies prepared for new uses. Up to the present time, approximately US $38,000 had been spent. The remaining funds would be returned to the Fund after finalization of these activities.

32. Noting that Kedia is stated to be the only manufacturer of CP-70 in India, UNIDO was requested to provide confirmation that the Government of India would not seek further funding for the conversion of CP-70 manufacture. UNIDO subsequently provided a copy of correspondence from the Government of India dated 17 October 2002 indicating that since the World Bank was conducting a survey as part of the process agent sector strategy preparation, "it would be premature for the Government of India to confirm that this is the last project". The framework guidelines for process agent projects require that in conjunction with their first project countries must provide a thorough sector overview containing all the enterprises and indicating those enterprises for which the country intends to seek compensation from the Multilateral Fund (Decision 27/78). On this basis, the project submission is not consistent with the guidelines.

33. The Secretariat noted that the baseline CTC process appears to vent the entire quantity of CTC used per batch to the atmosphere with no attempt at recovery. Information was requested on existing environmental or other industrial regulations applicable in the jurisdiction in which the enterprise is operating governing the emission of gases or liquids from plants, to determine whether the operation of the plant met the relevant regulation rules. Interventions needed to bring an enterprise into compliance with existing regulations in its own jurisdiction may not be eligible as incremental costs.

34. UNIDO provided documentation indicating that the enterprise has the appropriate license to discharge effluent from its manufacturing process, subject to certain limitations on effluent content. The license does not address emissions to the atmosphere. This issue is being clarified with UNIDO.

35. To date, all projects approved in the process agent sector have used process change as the means of achieving phase-out. The framework guidelines required that projects contain an assessment of the costs of emission controls. The assessment in this project is very brief. However the baseline process in this project does not have provision for any CTC recovery as mentioned above. The proposed new process has little in common with the original process and most items in the original plant have to be replaced. Additionally, the "water process" is complex and expensive in both capital and operating costs. It therefore appears necessary to consider what emissions control options are available. For example, a simple CTC recovery unit may recover up to 90 percent of the current CTC consumption at a relatively low cost. The Secretariat advised UNIDO that such an option would need to be presented to the Executive Committee for its consideration.

36. UNIDO indicated qualitatively that the costs of adding emission controls to the existing process to reduce emissions to accepted standards would be very high and would require skilled management to be successful. UNIDO indicated it has not considered the cost of more basic controls to recover lesser amounts of CTC such as 90 percent, because the remaining emissions (10 percent) would not meet Montreal Protocol or other accepted standards.

37. It appears that the replacement technology has been developed in house by the enterprise and the project consultant. UNIDO was requested to indicate the history of the technology development that has taken place including the tests that have been undertaken to validate the basic data governing the proposed reaction conditions, and any laboratory or small scale trials that have been undertaken. It needs to be demonstrated that there would be a high level of confidence in the plant design being successful.

38. UNIDO indicated that the technology had been developed cooperatively by UNIDO and the enterprise. It was oriented on the patented technology used by the world's biggest manufacturer of CP-70, Dover Chemical Corporation (USA). The design of the new plant incorporates the results of discussions with the inventors of the technology and has been the subject of intensive laboratory and small-scale trials. UNIDO provided documentation from a patent attorney in India that following a patent search, the proposed process does not violate any existing Indian patents. The project document indicates that Kedia does not export to non-Article-5 countries and this is not expected to change.

39. The incremental operating costs of the project are high and amount to US $153/tonne of CP-70 produced. UNIDO was requested to indicate the current market price of CP-70 (both local and imported) and to provide an assessment of the economic viability of the new plant and new process. UNIDO provided calculations to show that the current price for CP-70 was still viable with the increased production costs from the new process. UNIDO also indicated that since the new product would not contain residual CTC, it may realize a higher selling price.

40. A major part of the high operating cost arises from the need to neutralize very large quantities of hydrochloric acid produced in the process. The Secretariat sought specialist assistance and was advised that there may be scope to amend the process to avoid the production of such large quantities of un-needed acid and thus avoid the operating costs for neutralizing it. UNIDO provided additional technical details indicating that the potentially more efficient process could not be realized in practice.

41. The Secretariat also advised UNIDO that the wastewater treatment system design appeared not to be based on data, but on general principles and assumptions of what will be present. The Secretariat has been advised that these principles are sound and the assumptions are not unreasonable, however the approach results in a very conservative and excessively costly plant. The Secretariat notes that the incremental costs for all approved ibuprufen projects were based mainly on neutralization as the principal treatment. UNIDO advised that the waste stream was different from that found in the ibuprofen process, more difficult to treat and could only be treated using the process proposed.

42. In the determination of incremental costs, account needs to be taken of technological upgrade and new-for-old replacement, in the event that the proposal for process change was accepted. UNIDO was requested to provide an assessment of each factor and its effect on incremental costs. The Secretariat notes that, given the differences in technology and environmental controls between the baseline plant and the new process the technological upgrade will be significant. UNIDO provided a brief outline of some of the differences between the old and new processes but did not include an assessment of technological upgrade and new-for-old replacement.

43. The Secretariat noted that maintenance costs have not been included in any other solvent or process agent projects approved by the Executive Committee and requested UNIDO to delete them from the incremental cost calculation.

44. Because the Government of India has not been able to confirm that the project represents the completion of this sub-sector (that is, CTC use for the production of CP-70), the project may not be able to be approved at this stage since it does not conform to the framework guidelines for process agent projects. However the Secretariat will continue to review technical and cost aspects, for consideration at the appropriate time, and will advise the Sub-Committee on Project Review of additional progress.

RECOMMENDATION

45. Pending.

PROJECT EVALUATION SHEET
INDIA

SECTOR: Refrigeration ODS use in sector (2000): 2,297 ODP tonnes

Sub-sector cost-effectiveness thresholds: Commercial US $15.21/kg
Domestic US $13.76/kg

Project Titles:

(a) Complete phase-out of ODS (CFC-12) technology to non-ODS technology (HFC-134a) for manufacturing of mobile air-conditioners (MACs) at Subros Limited (Phase II)
(b) Plan for phase-out of CFCs in the refrigeration (manufacturing) sector
(c) Plan for phase-out of CFCs in the refrigeration (manufacturing) sector

Project Data	**MAC**	**Multiple-subsectors**	**Multiple-subsectors**
	Subros		
Enterprise consumption (ODP tonnes)			
Project impact (ODP tonnes)	0.00	0.00	0.00
Project duration (months)	12	48	48
Initial amount requested (US $)	2,861,610	2,000,000	1,000,000
Final project cost (US $):			
Incremental capital cost (a)	4,868,384	5,299,000	1,224,000
Contingency cost (b)	287,671	472,400	122,400
Incremental operating cost (c)		1,126,290	177,673
Total project cost (a+b+c)	5,156,055	6,897,690	1,524,073
Local ownership (%)	7400%	100%	100%
Export component (%)	0%	0%	0%
Amount requested (US $)	2,861,610	2,000,000	1,000,000
Cost effectiveness (US $/kg.)			
Counterpart funding confirmed?	Yes		
National coordinating agency	Ministry of Environment and Forests		
Implementing agency	World Bank	UNDP	UNIDO

Secretariat's Recommendations			
Amount recommended (US $)			
Project impact (ODP tonnes)			
Cost effectiveness (US $/kg)			
Implementing agency support cost (US $)			
Total cost to Multilateral Fund (US $)			

PROJECT DESCRIPTION

Sector background

CFC (Annex A Group I) Consumption and Phase-out Profile

According to Decision 35/37 India has selected Option 2 as Starting Point amounting to:	**2,317.2 ODP tonnes**
- Remaining consumption of CFCs eligible for funding as at 38th Meeting (per Decision 35/57, proviso B)	1,530.4 ODP tonnes
- Impact of ALL CFC projects submitted for funding at the 38th Meeting	667.52 ODP tonnes
- Maximum remaining consumption of CFCs eligible for funding following approval of projects submitted to 38th Meeting	862.88 ODP tonnes

Refrigeration Sector Profile

- Consumption of CFCs reported for the refrigeration sector in 2000*	2,297.0 ODP tonnes
- Amount of CFCs to be phased out in on-going refrigeration projects	1,490.2 ODP tonnes
- Impact of refrigeration projects submitted for funding at the 38th Meeting on remaining CFC consumption	535.0 ODP tonnes

* Based on data reported to the Fund Secretariat

Complete phase-out of ODS (CFC-12) technology to non-ODS technology (HFC-134a) for manufacturing of mobile air-conditioners (MACs) at Subros Limited (Phase II)

46. The Government of India is submitting a project proposal for the complete phase out of CFC-12 in the manufacturing of MAC units at Subros. The project is to convert the production of CFC-12-based MAC compressors and condensers to HFC-134a technology.

47. Subros manufactures complete MAC systems comprising of compressors, condensers, evaporators, filter dryers, hoses, tubes and other accessories. In 1985, the annual production capacity was 50,000 MAC units. Due to the increasing demand of MAC systems in the early 1990s, the capacity was expanded to 200,000 units of which, 50,000 units were based on HFC-134a refrigerant for the export market. The total capacity of 200,000 units was installed prior to 25 July 1995.

48. At the time of the expansion (1992 to 1994), Subros received financial assistance from the Multilateral Fund (11th Meeting of the Executive Committee) to convert part of its production capacity to non-CFC alternatives (15,000 MAC systems). However, additional resources were

provided by Subros and the project resulted in conversion of a total capacity of 50,000 MAC systems to HFC-134a technology. Subsequently, this capacity was increased again during 1999-2001 by Subros by 50,000 units per year.

49. The project submitted to the 38th Meeting is to convert the remaining CFC-12 MAC production line to HFC-134a technology for the domestic market at Subros. Conversion processes entail plant and equipment modifications for the production of compressors, heat exchangers, receiver dryers, tubes and other accessories. Technical assistance will be provided by its parent company Denso Corporation in Japan.

50. The requested funding level excludes costs related to capacity expansion (from 150,000 units to 200,000 units per year).

Plan for phase-out of CFCs in the refrigeration (manufacturing) sector

51. In the refrigeration sector, the year 2000 ODS consumption data reported to the Fund Secretariat by the Government of India was 2,297 ODP tonnes of CFC-12, comprising 690 ODP tonnes of CFC-12 used for manufacturing new equipment and 1,607 ODP tonnes of CFC-12 used for servicing. No consumption of CFC-11 was reported in the refrigeration sector.

52. Originally, two proposals were submitted for consideration at the 38th Executive Committee Meeting i.e. from UNDP addressing the residual manufacturing in the commercial refrigeration sub-sector (535 ODP tonnes) and from Germany dealing with the servicing refrigeration sector in India (1,233 ODP tonnes). The residual CFC consumption in India eligible for funding was reported to the 37th Meeting of the Executive Committee at the level of 1,530.4 ODP (as per UNEP/Ozl.Pro/ExCom/37/66/Corr.1/Rev1 and in accordance with Decision 37/66). Cumulatively, the impact of these two proposals exceeds the maximum residual fundable consumption in India as calculated in the above document. Subsequently, the Secretariat received an information copy of an e-mail from the NOU in India on 9 October 2002 indicating that the proposal from GTZ Germany would be withdrawn from consideration at the 38th Meeting and would be resubmitted at a later meeting.

53. In the domestic refrigeration sub-sector all seven manufacturers have been assisted under the Multilateral Fund, phasing out 1,742 ODP tonnes. US $11.2 million was allocated by the Executive Committee for this sub-sector.

54. The commercial refrigeration sub-sector is comprised of a large number of predominantly small and medium-sized enterprises. These enterprises are typically characterized by very low levels of investments in plant and machinery which result in labour-intensive operations. Many enterprises opt for locally assembled and/or custom-built foam dispensers, in order to minimize investments and many also engage in hand-mixing/pouring operations. The refrigerant charging and evacuation operations are predominantly carried out by semi-automatic equipment or by manual kits. The transport refrigeration sub-sector is comprised of manufacturers of refrigerated bodies for trucks and trailers and refrigerated containers.

55. The Executive Committee has approved 33 projects in the commercial refrigeration sub-sector covering a total of 60 enterprises at US $7.3 million to phase out 602 ODP tonnes.

All the enterprises in the commercial refrigeration sector were predominantly small and medium-sized, most of them with CFC consumption of less than 20 ODP tonnes/year.

56. The remaining CFC consumption in the refrigeration sector is being addressed by the Government of India through submission of two sector-wide phase-out plans as follows: Sector Phase-out Plan for Refrigeration Manufacturing, Sector Phase-out Plan for Refrigeration Servicing.

57. To address CFC phase-out in the refrigeration manufacturing sub-sector a survey was initiated by UNDP with assistance from local experts and the Government of India. A total of 240 remaining enterprises have been identified and their baseline information obtained. Out of these, 199 enterprises met the Multilateral Fund eligibility criteria for funding, i.e. their CFC-based capacities were established prior to 25 July 1995. Medium-sized enterprises mostly use locally-made foam machines. Small-sized enterprises predominantly use manual mixing of chemicals. About 80% of the enterprises in all, use polyurethane foam in some manner; the remaining either use other insulation or are not involved in insulation. Among the small-sized enterprises, 117 enterprises with a CFC consumption of less than 2.5 ODP tonnes/year have foaming operations, which can be considered negligible in terms of value addition to the product or in terms of sustainability. Medium-sized enterprises typically have semi-automatic charging units, vacuum pumps and leak detectors suited for CFC-12. Small-sized enterprises mostly have assorted charging kits and vacuum pumps, suited for CFC-12.

58. The objective of the Plan is to assist the Government of India to meet its 2007 compliance target for Annex A Group 1 substances. A total of 535 CFC tonnes consumed at 199 enterprises will be phased out by January 2007.

Choice of technology

59. All the enterprises involved will convert to CFC-free systems for their rigid polyurethane foam operations. Until the commercial introduction of mature small-scale zero ODP foam systems, HCFC-141b based systems will need to be used as an interim technology to maintain product standards and acceptability. CFC-12 and R-502 refrigerants will be replaced with HFC-134a and R-404a, respectively.

Components of the Plan and Requested costs

60. The investment component of the plan provides production equipment to all enterprises, including foaming machines and refrigerant charging units at a cost of US $6,542,800, including contingency calculated at 10%. The technical support component includes the establishment of product and quality standards, technology assistance through technical workshops and meetings, and training and certification programme at a cost of US $175,000. The policy and management support component provides local support for the implementation of the project at a cost of US $400,000.

61. Incremental operating costs (IOC) for two years are claimed for the higher cost of foam chemicals and refrigerant, incremental operating costs were calculated at US $1,303,963.

62. The cost-effectiveness of the proposal is US $15.73/kg ODP, which exceeds the threshold established in the commercial refrigeration sub-sector.

63. The overall management of the Plan will be carried out by Government of India with the assistance of UNDP. The CFC phase-out activities for the 18 enterprises in the transport refrigeration sub-sector would be implemented by UNIDO. The CFC phase-out activities in all remaining eligible enterprises would be implemented by UNDP.

64. The Ozone Cell, Ministry of Environment & Forests, will be responsible for monitoring the implementation of the Phase-out Plan, and the promulgation and enforcement of policies/legislation and assist UNDP with the preparation of annual implementation plans and progress report to the Executive Committee. UNDP will annually conduct an independent audit for verifying CFC consumption levels including spot checks and random visits and supervise implementation activities.

Performance and Disbursement Schedule

Year (as of 31 Dec)	ODS phase-out target (ODP tonnes)			Remaining ODS Consumption in Ref (Mfg) Sector (ODP tonnes)	Disbursement (US$)		
	From approved ongoing projects	From Phase-out Plan	Total		UNIDO	UNDP	Total
2002	0	0	0	1,373	1,000,000	2,000,000	3,000,000
2003	200	0	200	1,173	524,073	2,000,000	2,524,073
2004	200	181	381	792	0	1,250,000	1,500,000
2005	200	180	380	412	0	1,250,000	1,000,000
2006	209	203	412	0	0	397,690	397,690
TOTAL	**809**	**564**	**1,373**		**1,524,073**	**6,897,690**	**8,421,763**

Funding Arrangements

65. The Government of India, through UNDP, requests the Executive Committee to approve funding in advance for 2002 and 2003, and that disbursement of the 2004 funding will be requested no later than the last Meeting of the Executive Committee in 2003, against the satisfactory reporting of activities carried out in 2003. The funds for 2005 and 2006 will be requested at the first meeting of the Executive Committee in these years, for the amounts listed in the table above, upon approval of the annual implementation plan and upon confirmation by UNDP, that the agreed reduction targets and relevant performance milestones of the respective preceding years have been achieved.

Justification for the use of HCFC-141b

66. Justification for the use of HCFC-141b based on technological and economic analysis of each enterprise's operations is provided in the project document. UNDP indicated that the choice of HCFC-141b as interim technology was made by the enterprises following a discussion

with them on available alternatives and relevant decisions of the Executive Committee regarding the use of HCFC-141b as interim substitute foam blowing agent.

67. In accordance with relevant decisions of the Executive Committee on the use of HCFCs, a letter of transmittal from the Government of Indonesia endorsing the use of HCF-141b by the companies has been submitted and is attached.

SECRETARIAT'S COMMENTS AND RECOMMENDATIONS

COMMENTS

Complete phase-out of ODS (CFC-12) technology to non-ODS technology (HFC-134a) for manufacturing of mobile air-conditioners (MACs) at Subros Limited (Phase II)

68. The Secretariat has reviewed the project proposal in light of the earlier project to convert the MAC production line for export at Subros that was approved at the 11th Meeting of the Executive Committee, the Evaluation report on MAC projects in India (follow-up to Decision 37/5 (c)) prepared by the Fund Secretariat for consideration by the Executive Committee at its 38th Meeting (UNEP/OzL.Pro/ExCom/38/6), and similar investment projects so far approved in other Article 5 countries.

69. In the context of the evaluation of MAC investment projects, the Government of India organised a visit for the two staff members of the Secretariat accompanied by an international expert on MAC manufacture, to the MAC manufacturing enterprises that have received assistance from the Multilateral Fund, namely Sanden Vikas, Pranav Vikas and Subros. The Secretariat expresses its appreciation to the Government of India and the managers of the manufacturing plants for facilitating these visits.

Date of installation of new production capacity

70. In the document on the Evaluation report on MAC projects (UNEP/OzL.Pro/ExCom/38/6), the Secretariat raised the issue of the date of installation of the production capacity proposed for conversion.

71. Installed and licensed capacity for the production of CFC-12 based MAC systems was until March 1995, 50,000 units per year, as confirmed in Subros Annual Report 1994-1995. The following Annual Report covering the period from April 1995 to March 1996 indicates an increase of capacity to 150,000 units per year, resulting from an expansion programme funded by Subros. It is not fully clear whether all of the added capacity was in place before 25 July 1995, as a result of an expansion in 1992-1994, as Subros claims. The 1994/95 Annual Report said that "capital equipment orders have been placed and major machinery received"; the following year's report confirms completion of the capacity expansion to 200,000 MAC Systems per year. While the production of CFC-12 MAC systems increased in 1995/1996 to 100,006 units (compared to 65,319 units the year before), the 35,000 units in addition to the previous year's production could have been produced also if the commissioning of the new capacities would have taken place after July 1995, and not in March 1995 as now claimed by Subros. The larger part of the additions to

plant and machinery, including investments for doubling the capacity of motor fan production, have been reported for the years 1995/96 and 1996/97 (see Table 1) and, as mentioned above, the capacity increase for CFC-12 MAC systems was reported only in the 1995/96 annual report (see Table 2).

Table 1 Additions to plant and machinery at Subros

Year	Value in Million Rupees	Rate(1 Rupee = US$)	Value (Millions US $)
4/94-3/95	31.2	0.0318	1.0
4/95-3/96	113.8	0.0284	3.2
4/96-3/97	174.8	0.0278	4.9
Totals	**319.8**		**9.1**

Source: Subros Annual Reports

Table 2. Capacity and production of MAC at Subros

Year	Installed Capacity		Actual Production	
	CFC-MAC	HFC-MAC	CFC-MAC	HFC-MAC
April/93-March/94	50,000[1]		43,300	
April/94-March/95			65,319	3,620
April/95-March/96	150,000[2]		100,006	13,544
April/96-March/97			109,263	19,352
April/97-March/98			124,280	25,560
April/98-March/99		50,000[3]	131,555	13,508
April/99-March/00			165,906	15,340
April/00-March/01		100,000[4]	136,334	48,865
April/01-March/02			126,313	61,122

[1] Capacity in place since the middle of the 1990's.
[2] Capacity expansion funded by Subros, reported in Annual Report 1995-1996.
[3] Conversion project funded by the Multilateral Fund, implementation started in 1995 and completed in November 1998.
[4] Capacity expansion funded by Subros during 1999 to 2001.
Source: Subros Annual Reports and project completion report.

72. The conversion project to HFC-134a based MAC units was approved in November 1993, the grant agreement was signed in June 1995 when also the contracts were awarded. Completion according to the PCR occurred in November 1998, three years after the originally planned completion date. The project established a new line for HFC-134a based MAC systems running in parallel to the old line producing CFC-12 based MAC units. In this sense, no conversion took place but the company was enabled to satisfy a national car manufacturer's (Maruti) demand for HFC-134a based MAC systems for exported cars. In parallel, the production of CFC-12 based MAC systems doubled between 1994/1995 and 1997/1998 and continued on that level in the following years with a peak in 1999/2000 (see Table 2).

73. The Secretariat noted that neither the project proposal nor the project completion report provided clear figures concerning the production capacity. It was expected that in 1994-1995 Maruti would require 12,000 HFC-134a based MAC systems for exported cars, and that an

additional 11,000 HFC-134a-based compressors would be exported to the various subsidiaries of Nippondenso. However, the indirect ODS phase out was calculated at 84 ODP tonnes, assuming an original charge of 1.0 kg of refrigerant per MAC unit, and an additional 0.35 kg per year for servicing, resulting in a total production of 50,000 MAC units. In the project completion report, only 23 ODP tonnes were reported as actual phase out, relating to the 23,000 HFC-134a units planned for exports but without calculating service charges nor considering actual production of HFC-134a based MAC units which in 1998-1999, the year of project completion, was 13,508 units.

74. In this regard, the World Bank reported that the annual capacity of the production line for the export market of HFC-134a MACs was expanded as follows:

(a) From 15,000 units to 50,000 units from 1994 to 1998. Part of the total conversion costs was provided by the Multilateral Fund (Phase I of the Subros project);

(b) From 50,000 units to 100,000 units from 1999 to 2001, with no funding provided by the Multilateral Fund (and no request for funding will be sought by the company).

75. With regard to the production line for the domestic market of CFC-12 MAC systems, the capacity was increased from 35,000 units to 150,000 units during the fiscal years 1993–1994 and 1994–1995 (a fiscal year covers the period April 1994 to March 1995). Trial runs and production started in April 1995. The company has planned a further expansion to 200,000 units during 2002. Subros is requesting funding for conversion of the 150,000 units/year capacity, that was installed and commissioned in March 1995.

76. The World Bank also indicated that the Annual Report for the fiscal year 1995-1996 reported a production of 114,250 MAC units. Based on the 150,000 units/year capacity, it would require 8 months to actually produce the 114,250 units. Since the fiscal year 1995–1996 ended in March, the production must have started in July 1995 or before. The new plant was registered on February 14, 1995. In addition, the letter of offer produced by Subros on 27 March 1995 (and authenticated by IDBI), to raise additional capital from the Indian financial market to support the expansion process, indicated that the installation of equipment and commissioning of the CFC-12 production line was completed in March 1995. Also, as presented in the project proposal for Subros, all baseline equipment items were procured prior to July 1995.

77. The World Bank confirmed that no counterpart funds were included in the project completion report; however, Subros can provide an audit report showing that the actual costs of equipment was about US $6.5 million. The statement “infrastructure in the facilities has been created as planned under Phase II” reflects the fact that additional floor space to ensure a safe and good working environment has already been set aside (costs related to these items will not be requested by the company). While it is true that additional investment has been put in by Subros; however, the objective is to convert the current CFC MAC production capacity to HFC-134a based technology.

78. The World Bank also reported that the shortfall in the production capacity was met by imported components until the capacity of 50,000 units per year was fully installed. The baseline

equipment covered by the project approved at the 11th Meeting, was usable at the time it was scrapped in July 1997. Moreover, the enterprise could not find any use of this baseline equipment since the expansion of its CFC-12 based MAC system capacity was completed before July 1995, more than two years prior to completion of the Phase I project.

79. The World Bank also indicated that from 1999 to 2001, Subros expanded the production capacity of the export line to 100,000 HFC-134a based MAC systems, that was initially (and partially) financed by the Multilateral Fund and no additional funding will be requested from the Multilateral Fund.

Compressor production line

80. The project is proposing the conversion of a compressor known as "type 10P" to a "type 10S". The Secretariat pointed out that that the 10S compressor is a new upgrade of the 10P type compressor (i.e., smaller, lighter and with more cooling capacity than the 10P type compressor) and is not related to change of refrigerant. Furthermore, the 10P type compressor is still being sold for HFC-134a applications in the United States. Therefore, the equipment requested for the compressor line was not incremental.

81. The World Bank indicated that the company had advised that the 10P type compressors currently produced are only suitable for CFC-12. The company should either modify the design of the 10P models or replace them with the 10S models. Subros and its technology collaborator reviewed the two options and concluded that for smaller 10P compressors and the climatic conditions in India, the performance drop will be significant. The World Bank also confirmed that the 10S type compressors are smaller and lighter, suggested that the smaller size of new 10S compressors should not be misconstrued as technology upgrade. It is, in fact, a measure to optimise the production costs of the new compressors in order to maintain its product competitiveness.

82. Since receiving the World Bank's response, the Secretariat has received additional advice confirming that the type 10P compressors were sold for, and used in CFC-12 MAC systems not only in the United States, but also in Kuwait and Saudi Arabia.

Evaporator production line

83. The Secretariat also indicated that the enterprise decided to install multi-storage evaporators which provide higher performance, compactness and lightweight against the existing serpentine ones. While the enterprise was not seeking assistance from the Multilateral Fund for the conversion of the evaporator assembly line (which is not an incremental cost); it was requesting funding for a tube bender and a spinning machine (US $340,000) and moulding dies (US $735,000) which are directly related to the changes to the evaporator core design and/or due to vehicle manufacturer requirements. Therefore, the request for these equipment is ineligible. The World Bank reported that the changeover from a serpentine evaporator to multi-storage evaporator is required in order to maintain the performance of the new HFC-134a MAC systems; for a HFC-134a evaporator, the connection has to be changed to improve fitting of oil rings in order to reduce the leakage rate using the proposed equipment.

Cost-related issues

84. The Secretariat pointed out that funding for a number of equipment items were requested retroactively. As decided by the Executive Committee, the level of administrative support costs for retroactive projects should be 6 per cent (Decision 29/72). Subsequently, the World Bank adjusted the agency fees, accordingly.

85. The Secretariat and the World Bank are finalising the discussions on the cost of the project. The results of the discussions will be communicated to the Sub-Committee on Project Review.

Plan for phase-out of CFCs in the refrigeration (manufacturing) sector

CFC consumption in the sector

86. The Secretariat discussed with UNDP several issues identified in the course of reviewing the proposal. The proposed phase-out is 535.4 ODP tonnes: 364.9 ODP of CFC-11 and 170.5 ODP tonnes of CFC-12 in foaming and refrigerant operations respectively. The Secretariat referred to Decision 36/17 that "where requests to prepare multiple sectoral phase-out projects were submitted, the submission of the first sector phase-out project had to be accompanied by a clear implementation plan, covering the coordination among the various implementing agencies involved and detailing how the ODS tonnes remaining to be phased out were distributed over the various sectors and how the reduction in national aggregate consumption would be verified". The requested information had not yet been made available as at the time of preparation of this document.

87. In reviewing the remaining eligible CFC consumption the Secretariat has analysed the CFC-11 consumption reported by the Government of India in the year 2000, namely 3,002 ODP tonnes, of which 2,898 ODP tonnes was in the foam sector. In this context the Secretariat notes that India has never reported consumption of CFC-11 separately in the refrigeration manufacturing sub-sector but has always included it in the foam sector consumption. Accordingly, the Secretariat has considered all CFC-11 consumption used for manufacturing foam whether in the foam or refrigeration sectors. After deducting CFC-11 consumption in the projects under implementation at the end of 2000 (as in the 2000 progress report), making allowance for the amendment to India's starting point agreed at the 37th Meeting and deducting CFC-11 foam consumption in projects approved at the 33rd to 37th Meetings (including the foam sector phase-out plan) it appears that the total funded CFC-11 phase-out exceeds the reported 2000 consumption by over 300 ODP tonnes.

88. The consumption of CFC-11 in the project is indicated as 364.9 ODP tonnes. This consumption appears to be ineligible for funding on the basis that there is no reported CFC-11 consumption remaining to be addressed in India. Subsequently, capital and operating costs associated with foaming operations amounting to about US $3.45 million appear to be ineligible for funding.

89. The Secretariat has also identified minor cost and eligibility issues associated with the calculation of capital and operating costs for the phase-out of CFC-12 in the refrigerant part of the project.

90. The Secretariat is still discussing all the outstanding issues with UNDP. The Sub-Committee on Project Review will be informed of the outcome of these discussions.

RECOMMENDATIONS

Complete phase-out of ODS (CFC-12) technology to non-ODS technology (HFC-134a) for manufacturing of mobile air-conditioners (MACs) at Subros Limited (Phase II)

91. Pending.

Plan for phase-out of CFCs in the refrigeration (manufacturing) sector

92. Pending.

PROJECT EVALUATION SHEET
INDIA

SECTOR: Solvent ODS use in sector (2000): 8,080.6 ODP tonnes

Sub-sector cost-effectiveness thresholds: n/a

Project Title:

(a) Conversion of carbon tetrachloride (CTC) as cleaning solvent to trichloroethylene at Navdeep Engineering, Palghar

Project Data	**CTC**
	Navdeep
Enterprise consumption (ODP tonnes)	53.90
Project impact (ODP tonnes)	53.90
Project duration (months)	24
Initial amount requested (US $)	836,177
Final project cost (US $):	
Incremental capital cost (a)	567,300
Contingency cost (b)	56,730
Incremental operating cost (c)	37,812
Total project cost (a+b+c)	661,842
Local ownership (%)	100%
Export component (%)	0%
Amount requested (US $)	661,842
Cost effectiveness (US $/kg.)	12.28
Counterpart funding confirmed?	Yes
National coordinating agency	Ministry of Environment and Forest
Implementing agency	UNIDO

Secretariat's Recommendations	
Amount recommended (US $)	
Project impact (ODP tonnes)	
Cost effectiveness (US $/kg)	
Implementing agency support cost (US $)	
Total cost to Multilateral Fund (US $)	

SECTOR BACKGROUND

93. The latest consumption data for CTC use in the solvent sector reported by India is 8,080.6 ODP tonnes for the year 2000.

94. At that time, three CTC solvent projects with a total consumption of 11 ODP tonnes were under implementation. Subsequently three CTC solvent projects with a total phase out of 57.5 ODP tonnes have been approved, leaving a reported 8,012.1 ODP tonnes of CTC in the solvent sector in India yet to be addressed.

95. In December 2001, US $169,000 plus support costs was provided to UNEP to assist the Government of India, in co-operation with national level industry associations, in developing an action plan for integrated training and related non-investment activities to support phase-out in the solvent sector. It would include co-operation with UNIDO and the World Bank.

PROJECT DESCRIPTION

Conversion of carbon tetrachloride (CTC) as cleaning solvent to trichloroethylene at Navdeep Engineering, Palghar

96. Navdeep Engineering consumes 53.9 ODP tonnes of CTC annually in metal cleaning associated with the manufacture of parts and sub-assemblies for refrigerators. The enterprises were established and the relevant equipment installed prior to July 1995. The enterprise uses a variety of cleaning systems ranging from tanks to vapour degreasing machines to clean the interior and exterior of copper tubes and cooling coils in two separate workshops.

97. UNIDO proposes to phase out the consumption of CTC by replacing it with trichloroethylene (TCE). Existing large cleaning tanks will be replaced with similar tanks having lids and ventilation systems to reduce emissions solvent exposure levels. The incremental cost will be based on retrofit costs since the existing tanks are at their end-of-life. Additionally, a total of five low-emission vapour degreasers are proposed to substitute for four existing degreasing machines and two sets of dip-tanks. Two other existing cleaning systems will be retrofitted. A solvent recovery unit will be supplied to reduce solvent consumption. Other incremental capital costs for transport, installation and technical assistance total US $51,300.

98. Four-year incremental operating costs of US $88,947 are sought arising from increased electricity costs for new equipment offset by reduced costs from a 60 percent reduction in solvent use.

SECRETARIAT'S COMMENTS AND RECOMMENDATION

COMMENTS

99. The Secretariat notes that the phase-out of 53.9 ODP tonnes in this project represents only a small contribution to phase-out in the sector overall (remaining reported consumption 8,012 ODP tonnes). UNEP received US $169,000 for project preparation assistance in the

solvent sector in India in December 2001, but no information has yet been provided on the overall approach to phase out in the solvent sector or how India will meet its 2005 control obligations for CTC.

100. The Secretariat discussed with UNIDO the capacity of the new equipment to be provided. UNIDO provided information to indicate that it is consistent with the current level of production in the enterprise.

101. The Secretariat also discussed the overall cost effectiveness of the project and the counterpart contributions to equipment costs for environmental and technological upgrade. For the three new machines that replace dip-tanks (total: US $400,000), the enterprise will contribute 50 percent of the equipment costs as a contribution for environmental costs and for technological upgrade. For the two new machines that replace existing degreasers (total: US $320,000), the enterprises will contribute the cost of environmental filters and the replacement cost of the existing, old equipment that is nearing the end of its useful life (total: US $59,000).

102. The cost effectiveness of the project on this basis is US $12.28/kg compared to US $15.51 as originally submitted. The cost-effectiveness is dependent in part on the original consumption of the enterprise. The consumption of this enterprise appears to be lower than other enterprises of comparable size, possibly because of less wastage and because they have a number of vapour degreasers in the baseline as well as open tanks. For the same reason the reductions in solvent use after conversion (about 60 percent) are less than the maximum of around 85 percent that has been seen in other projects.

RECOMMENDATION

103. The project is referred for individual consideration on account of:

(a) The small contribution to the overall CTC phase-out requirement in the solvent sector in India;

(b) The absence of information on an overall plan or strategy for the sector;

(c) The cost-effectiveness (US $12.28/kg).

Usha Chandrasekhar
Director (O)

भारत सरकार
पर्यावरण एवं वन मन्त्रालय
ओज़ोन सैल
Government of India
Ministry of Environment and Forests
Ozone Cell

D.O.No.:
24th October, 2002

OFFICE MEMORANDUM

Subject: Submission of commitment letters of enterprises to the Multilateral Fund for consideration of Aerosol Sector Plan at the 34th Executive Committee in November, 2002

In continuation to our OM No.5/1/2002-OC dated 25th September, 2002, a copy of the commitment letter received from Industrial Atomizer is enclosed for necessary action.

With reference to the use of HCFC in this industry we would like to confirm the following:-

- The specific situation involved with this enterprise have been reviewed in light of the Executive Committee Decision 27/13 and the HCFC commitments under Article 2-F and it has been determined that the use of HCFC technology is required in these projects for an interim period.
- The enterprise has been fully briefed about the various technologies that are available to phase out CFCs. It is understood that HCFCs constitute an interim solution and we aware that additional funding may not be available to them for future conversion to fully Ozone Depleting Substances-free technology.

We confirm that to the best of our knowledge the enterprise in projects mentioned above, are financially viable.

With regards,

Yours sincerely

(Usha Chandrasekhar)

Ms.Suely Carvello
Principal Technical Adviser and Chief
Montreal Protocol Unit, EAP/SEED
UNDP, New York, USA

INDUSTRIAL ATOMIZER CO.

D-112, Ghatkopar Industrial Estate, L.B.Shastri Marg,
Ghatkopar (West), Mumbai - 400 086. • Phone : 500 7275 • Fax : 91-22-5969022

Date : 12.10.2002

ENTERPRISE COMMITMENT

INDUSTRIAL ATOMIZER Co,represented by Mr.Harish A.Vadodaria (Proprietor) having agreed to the preparation of a project for the consideration of the Executive Committee of the Multilateral Fund for the implementation of the Montreal Protocol to phase out the use of ODS at the enterprise,has received sufficient information on all alternative technologies from the implementaing agency,in consideration of which it has selected HCFC 141b, HCFC 22,Carbon dioxide as the most appropriate substances to be used to replace the CFCs presently in use.It further agrees :

a) That it will use HCFC 141b,HCFC 22 for an interim period allowed by current legal international agreements or any future modifications thereof,to which India is a party,or in accordance with any local regulation pertaining to the same,if applicable.

b) To bear by itself the cost of subsequent conversion to non HCFC substances.

FOR INDUSTRIAL ATOMIZER Co.

Harish Vadodaria(Proprietor)

Usha Chandrasekhar
Director, Ozone Cell
Ministry of Environment & Forests
Government of India
New Delhi

THE WORLD BANK GROUP
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FACSIMILE COVER SHEET AND MESSAGE

DATE: October 12, 2002 **NO. OF PAGES:** #Pgs (including cover sheet) **MESSAGE NO.:** Msg. #

TO: Tony Heterington **FAX NO.:** +1 514 282 0068
Title: Deputy Chief Officer
Officer-in-charge
Organization: Multilateral Fund Secretariat
City/Country: Montreal, Canada

FROM: Erik Pedersen **FAX NO.:** +1 202 522 3258
Title: Technical Advisor Telephone: +1 202 473 5877
Dept/Div: ENVGM, MP unit Dept./Div. No.: ENVGM

SUBJECT: **Indian Chlorinated Rubber Sector**

MESSAGE:

Dear Mr. Hetherington

Attached the note on incremental costs calculation for the chlorinated rubber sector in China. The note has been send by email as well. We look forward to continue the discussions.

Best regards

Erik Pedersen

Attachment

Transmission authorized by: Authorization

If you experience any problem in receiving this transmission, inform the sender at the telephone or fax no. listed above.

August 2002

Note on:
Phasing out CTC consumption in the chlorinated rubber sector in India.

1. Introduction.

A sector plan for chlorinated rubber in India was submitted for consideration at the 37th meeting of the ExCom. The project was deferred as the negotiation on incremental costs associated with the phaseout was not resolved before the deadline for the 37th meeting. During the discussions on the project, the Secretariat, based on the guidelines for the process agent sector, (Decision 27/78), did not considered compensation for closure of production as an eligible incremental costs and funding should be based on either emission control or conversion. However, the PA guidelines calls for consideration of industrial rationalization, which is understood as transferring production from one producer to another producer. It seems to the Bank that closure therefore would be an option under the guidelines as transfer of production would result in closure of one of the participating two parties.

In order to move forward, the Bank has analyzed the CTC phaseout costs based on the conversion approach suggested by the Secretariat. The outcome is shown in the table below and it compared with the closure costs as calculated in the original proposal as submitted to ExCom.

The Bank has also reviewed the issue of fundable capacity for RRIL. In accordance with ExCom guidelines as referred to in the decision on process agents, conversion of the existing capacity is consistent with existing ExCom rules and guidelines. Due to the specific decision taken on RRIL, 550 tons of capacity should be deducted as called for in the Decision. However, after discussing the issue, RRIL has agreed to convert only 3,000 tons of capacity. The rational behind the 3,000 tons capacity is that it is technically possible without creating additional cost implications and that CR market projection carried out by the company shows that 3,000 tons will be needed within the coming 8 years.

The Secretariat has also pointed out that RPL would not be eligible for funding as it has been idle for more than 5 years and has not resumed production. The Bank has reviewed the issue with India. India has agreed to request dismantling costs for full closure and clean up of the site only.

Name of enterprise	**ODP consumption**	**Total closure costs**	**Total conversion costs**	**Least costs option**	**CE conversion**
Tarak	68	4,149,427	**1,538,757**	1,538,757	22.62
Parauj	40	**929,618**	1,023,245	929,618	23.24
RPL	0	**350,000**	350,00	350,000	NA
RIIL	384	30,344,878	**8,053,100**	12,989,370	20.97
	492	35,573,923	10,765,102	**15,807,745**	21.68
RRIL	Adjustment	Export	(30..28%-10%)	**2,634,244**	
		Technical Upgrade	20%	**2,597,874**	
Tarak		Technical Upgrade	0%	**0**	
			Adjustment	**5,232,118**	

TOTAL INCREMENATL ELIGIBLE COSTS	**10,575,627**	

Rishiroop Rubber International

Rishiroop Rubber (International) Ltd. (RRIL) started in 1993. The company is owned by about 20,000 shareholders, and its shares are listed in the Bombay Stock Exchange. It was anticipated that production capacity would be fully utilized by 2000. The company currently has about 120 employees. The average production level of chlorinated rubber for the last three years was 507 MT of which, 283 MT was exported to non-Article 5 countries. The export to non-Article 5 countries constitutes 56% of the total production.

Tarak

Tarak is 100% owned Indian enterprise with an installed annual production capacity of 300 MT of chlorinated rubber. The company started its operation in October 1998. The average chlorinated rubber production for the last three years was 140 MT. About 8.57% of the total production was for exporting to non-Article 5 countries. Currently, Tarak has about 40 employees working at its production facility.

Pauraj

Pauraj Chemicals set up its chlorinated rubber production facility at Tarapur in the State of Maharashtra in 1980. This chlorinated rubber plant has a production capacity of 150 MT per annum. The company is 100% owned by Indians and its current facility employs about 30 workers. The average level of production of chlorinated rubber for the last three year was 78 MT. The total production was for the domestic market.

Rishiroop Polymer Limited

RPL is a 100% Indian owned private limited company, and was incorporated in 1971, with a production facility at Nasik (Maharashtra state), mainly for the manufacture of CR, and also for a small quantity of aromatic resin. The production facility started commercial production in 1973, with an initial installed production capacity for CR of 150 MT per annum; the plant was debottlenecked and expanded in 1988 to increase the installed production capacity to the current level of 550 MT per annum calculated on a three shift basis (continuous production), to meet growing market demand. The maximum production of CR attained by RPL was 532 MT in the fiscal year 1990-91. RPL is a pioneer in developing the indigenous technology for manufacture of CR in India, and have received a national Government award in 1978 for import substitution for developing the process for CR indigenously.

Production at RPL was suspended in September 1995 because of a labor dispute, which was referred to an Industrial Court. It was resolved in October 1999, and RPL has serviced its plant and kept it ready to restart production at short notice.

RPL uses CTC as an inert solvent in the manufacture of CR. The conventional process for production of CR involves using CTC as a solvent medium for chlorination of the rubber. The dry rubber is first dissolved in CTC, and this rubber solution is reacted with chlorine gas to produce chlorinated rubber which stays dissolved in CTC. The solvent CTC is then recovered from this CR solution by flashing it in hot water and recycling it. Because CTC is required to be used as a process solvent and is handled in large quantities, the process causes emissive losses during storage, handling, and reaction, and there is also some presence of CTC as an impurity in the finished product; these factors cause CTC 'consumption'. The various stages of the manufacturing process include feedstock preparation, chlorination, recovery of solvent, filtration, drying, blending and packing. They require media resistant equipment (glass-lined reactors, lead bonded carbon steel reactors, etc.) The facility has utility sections, comprising boilers for steam generation, refrigeration systems, diesel-based generating power sets for standby power generation, air compressors, cooling towers, etc. Finally, the facility also has primary and secondary effluent treatment systems for waste water treatment and solid waste disposal.

The details of CR production and CTC consumption for RPL for the last three years of production are as follows:

Table I: Average Production and CTC Consumption

RPL		
Year*	CTC consumed (MT)	CR Produced (MT)
92-93	222.	376.
93-94	219.	365.
94-95	235.	372
Average	**225**	**371.**

*****: The production and consumption data for RPL are for 3 years prior to Sept. 95 when the industrial lock-out began.

The total average consumption of CTC for RPL, based on their average consumption for the last three years of operation as mentioned above, is 225 MT per annum.

ANNEX A
RISHIROOP RUBBER INTERNATIONAL Ltd.

INCREMENTAL CAPITAL COST SUMMARY FOR 3000 TPA CR PLANT AT RRIL, ANKLESHWAR

Sr.No.	Item	Unit Cost (USD)	Nos	Total (USD)
A	**PROCESS FACILITY**			
1	FRP Storage tanks (50KL)	16500	4	66,000
2	Air operated PTFE - Lined Diaphragm pump	10670	6	64,020
3	Stainless Steel Storage Tank 40 KL	35200	1	35,200
4	Air operated PTFE - Lined Diaphrgram pump	10670	15	160,050
5	Stainless Steel Blending Reactor 1 KL	11000	6	66,000
6	Air operated PTFE - Lined Diaphrgram pump	10670	2	21,340
7	Agitator modifications to the existing Glass lined Carbon Steel Reactor	44000	6	264,000
8	Glasslined Carbon Steel Reactors	98000	12	1,176,000
9	PVDF Lined Carbon Steel Housing for photo chemical systems	3300	24	79,200
10	Photochemical Lamp Systems	25300	24	607,200
10A	Spares for photchemical system Lump sum	49500	1	49,500
11	Cooling System for photo chemical systems			
11.1	Stainless Steel Heat Exchanger	770	24	18,480
11.2	Stainless Steel Centrifugal Pump	770	24	18,480
12	Static Mixer	4400	12	52,800
13	Graphite Heat Exchanger(10 m^2)	15400	12	184,800
14	Air operated PVDF lined diaphragm pump	13200	24	316,800
15	Glasslined stirred tanks	66000	6	396,000
16	FRP Belt filter (250 kg/hr)	357500	2	715,000
16.a	S.S.Slurry hold tanks(10Kl)	41500	4	166,000
17	Paste Conveying system	60500	2	121,000
18	Stainless Steel 316Feed Bins (30KL)	40000	2	80,000
19	Two stage PTFE-Lined SS316 fluidised bed dryer system	385000	2	770,000
20	PVDF lined magnetic pump 2m^3/hr, 20MH (heads in meters	4400	4	17,600
21	Piping - PVDF, SS, FRP, PP Pipes, valves and fittings	385000	1	385,000
22	Pneumatic conveying system	330000	1	330,000
23	Stainless Steel 316 feed bins (25 kl)	25000	2	50,000
24	UPS system for photo chemical systems	15400	24	369,600
25	Stainless Steel Blender (5 kl)	27500	2	55,000
26	FRP Fume Extraction system with alkali scrubber	110000	1	110,000
	Sub-total group A			**6,745,070**

B	**EFFLUENT TREATMENT FACILITY**			**200,000**
C	**PROCESS UTILITY & PIPINGS**			
	Utility			
1	Air dryers 25m^3/min	30000	2	60,000
2	Air Compressors 8m^3/min	60500	2	121,000
3	Cooling Tower 800 MT	22000	1	22,000
4	Underground Water Storage	22000	1	22,000
5	OverheadTank	11000	1	11,000
6	Chilling plant 150TR	110000	2	220,000
7	Diesel Generators 17000 KVA	220000	2	440,000
8	Water softners	16500	2	33,000
9	Air Receiver	16500	1	16,500
10	steel pipes valves & fittings for above	88000	1	88,000
	sub-total			**1,033,500**
D	**ELECTRICALS**			
1	Transformer	33000	1	33,000
2	Powerline cost	33000	1	33,000
3	Power Control Centre	55000	1	55,000
4	Capacitors	22000	1	22,000
5	Electricals Cables,switches starters etc.	88000	1	88,000
	sub-total group			**231,000**
E	**INSTRUMENTATION** Control Panels, instruments (including rotameters, pressures gauges, temperature gauges, control valves) misc items and labor charges		250000	**250,000**
F	**ERECTION & DISMANTLING**		120000	**120,000**
G	**INSULATION & PAINTING**		100000	**100,000**
H	**SAFETY EQUIPMENTS** Continous chlorine monitoring system, ETC.		80000	**80,000**
I	**CIVIL WORKS**		200000	**200,000**
	. Equipment foundations, tank farms, acid-proof tile lining and civil costs of power control center process control room and modification of warehouse, architect's fee, etc.			
J	**STRUCTURAL WORK**		300000	**300,000**
	TECHNICAL KNOW HOW FEE		344000	**344,000**

K	**Consultants fees for detailed engineering**	220000	**220,000**
L	**Pre operative Cost**		
	Insurance	75000	
	Travelling	50000	
	Training	25000	
	Salaries of project team	100000	
	Communication expenses	25000	
	sub-total group		**275,000**
M	**Changeover costs**		**0**
	Fixed Overheads for twelve months	0	
N	**Startup & Commissioning**		**300,000**
	TOTAL		**11,663,070**
	Contingencies @10%		**1,166,300**
	TOTAL INCREMENTAL CAPITAL COSTS		**12,829,370**
	IOC		**160,000**
	TOTAL INCREMENTAL COSTS		**12,989,370**
	ODP		**384**
	CE		**20.97**

ANNEX B

Tarak Chemicals

A category	Unit costs	Existing Baseline	Standard layout for 550 tons	Prorating factor for 300 tons facility: 0.654231	Start of operation: 1996
PRF Storage tank	3,500		4	300	300
HCl pumps PVDF kined manetic pumps	3,000		6	2	7000
SS Latex Storage vessel	15500		1	2	6000
Air Operated pump for latex	6000		5	0.65	10075
S.S Primary Latex Blending rective	7200		1	2	12000
AOD Chlorinated latex feed air operted ptfe	6000		2	0.65	4680
Pre-conditioning vessel G.L Reactor	60000		1	0.65	3900
Chlorinated glass lined G.L Reactor	98000		2	0.65	39000
PVDF Lined GRP housing	3000		4	0.65	63700
Photochemical sytem	23000		4	2	6000
Photochemical Spares	15000		1	2	46000
Spare pumps, 1 year				0.65	9750
Cooling System					
S.S Heat exchangers	700		4		
SS Pumps	700		4	2	1400
GRP Static mixer	4000		2	2	1400
Graphic Chlorinated cooler HE	14000		2	0.65	2600
PVDF lined Mag pump	5700		7	0.65	9100
G.L. Stirr tank	60000		2	2	11400
FRP Belt filter	185000		1	0.65	39000
Pask Conveyor System	29000		1	0.65	120250
SS Feed Bins	8000		2		0
Two Stage Fluid bed dryer	167000		1	0.65	5200
				0.65	108550
PVDF FRF tank	21000		2		
HCl PVDF map pumps	2000		2	0.65	13650
Piping, PVDF, FRP, valves and fitting	60,000		1	0.65	1300
Pneumatic conveying ssyete	68000		1	0.65	39000
SS Feed Bins	8000		2	0.65	44200
UPS	14000		4	0.65	5200
Blender	15000		1	2	28000
Stack	4800		1	0.65	9750
FRP Fume syetem	31000		1	0.65	3120
Process equip.				0.65	20150

B: Effluent Treatment Facility				
Neutralizer	6000	2		
Settling tank	3000	2	0.65	3900
Aerotator	8000	1	0.65	1950
Sludge pumps	300	10	0.65	5200
Sludge drying bed	2000	2	4	1200
Storage	4000	1	0.65	1300
Eff tank	6000	2	0.65	2600
Flowcalculator	3000	1	0.65	3900
Consultant fee	2000	2	0.65	1950
ETP			0.65	1300
C: Process utilities				
Air Dryers 8m3/min	10000	2		
Air compressors 8m3/min	20000	2	0.65	6500
Underground water storage	8000	1	0.65	13000
Overhead Water Tank	5000	1	0.65	5200
Chilling Plant	20000	2	0.65	3250
Diesel generator	90000	1	0.65	13000
Water softners	10,000	2	0.65	58500
Air service	7000	1	0.65	6500
Mild Steel Pipes & Piping	15000	1	0.65	4550
Utilities			0.65	9750
D Electricals				
Transformer	8000	1		
power line costs	8000	1	0.65	5200
PCC	15000	1	0.65	5200
Capacity	4000	1	0.65	9750
Electrical	20,000	1	0.65	2600
Electricals			0.65	13000
Total costs: A+B+C+D				
Instrumentation	80,000	1		
Erection/dismantling	20000	1	0.65	52000
Insulation/painting	20000	1	0.65	13000
Safety	20000	1	0.65	13000
Civil work		1	0.65	13000
Structural work	20,000	1	0	0
Total costs			0.65	13000
Technology transfer costs				
Know how	238000	1	0.65	154700
Engineering company	85000	1	0.65	55250
Pre-operative costs	133000	1	0.65	86450
Change over	71500	1	0.65	46475

Trial and Start up costs	71500	1		0.65	46475
			ICC		1344325
			Cont.		134432.5
			IOC		60000
TOTAL INCREMENTAL COSTS					**1,538,758**
ODS					**65**
CE					**23.67**

ANNEX C

Pauraj Chemicals Pvt. Ltd.

Pauraj Chemicals set up its chlorinated rubber production facility at Tarapur in the State of Maharashtra in 1980. This chlorinated rubber plant has a production capacity of 150 MT per annum.

A category	Unit costs	Baseline costs	Standard layout for 550 tons	Prorating factor for 150 tons: 0.403	Start of operation : 1982
PRF Storage tank	3,500		4	150	150
HCl pumps PVDF lined magnetic pumps	3,000		6	2	7000
SS Latex Storage vessel	15500		1	4	12000
Air Operated pump for latex	6000		5	0.4	6200
S.S Primary Latex Blending reactor	7200		1	3	18000
AOD Chlorinated latex feed air operated ptfe	6000		2	0.4	2880
Pre-conditioning vessel G.L Reactor	60000		1	0.4	2400
Chlorinated glass lined G.L Reactor	98000		2	0.4	24000
PVDF Lined GRP housing	3000		4	0.4	39200
Photochemical system	23000		4	2	6000
Photochemical Spares	15000		1	2	46000
Spare pumps, 1 year				0.4	6000
Cooling System					
S.S Heat exchangers	700		4		
SS Pumps	700		4	2	1400
GRP Static mixer	4000		2	2	1400
Graphic Chlorinated cooler HE	14000		2	0.4	1600
PVDF lined Mag pump	5700		7	0.4	5600
G.L. Stirr tank	60000		2	4	22800
FRP Belt filter	185000		1	0.4	24000
Paste Conveyor System	29000		1	0.4	74000
SS Feed Bins	8000		2		0
Two Stage Fluid bed dryer	167000		1	0.4	3200
				0.4	66800
PVDF FRF tank	21000		2		
HCl PVDF map pumps	2000		2	0.4	8400
Piping, PVDF, FRP, valves and fitting	60,000		1	0.4	800
Pneumatic conveying system	68000		1	0.4	24000
SS Feed Bins	8000		2	0.4	27200
UPS	14000		4	0.4	3200
Blender	15000		1	2	28000
Stack	4800		1	0.4	6000

FRP Fume system	31000	1	0.4	1920
Process equip.			0.4	12400
B: Effluent Treatment Facility				
Neutralizer	6000	2		
Settling tank	3000	2	1	6000
Aerator	8000	1	1	3000
Sludge pumps	300	10	0.4	3200
Sludge drying bed	2000	2	6	1800
Storage	4000	1	0.4	800
Eff tank	6000	2	0.4	1600
Flocculator	3000	1	0.4	2400
Consultant fee	2000	2	0.4	1200
ETP			0.4	800
C: Process utilities				
Air Dryers 8m3/min	10000	2		
Air compressors 8m3/min	20000	2	0.4	4000
Underground water storage	8000	1	0.4	8000
Overhead Water Tank	5000	1	0.4	3200
Chilling Plant	20000	2	0.4	2000
Diesel generator	90000	1	0.4	8000
Water softeners	10,000	2	0.4	36000
Air service	7000	1	0.4	4000
Mild Steel Pipes & Piping	15000	1	0.4	2800
Utilities			0.4	6000
D Electricals				
Transformer	8000	1		
power line costs	8000	1	0.4	3200
PCC	15000	1	0.4	3200
Capacity	4000	1	0.4	6000
Electrical	20,000	1	0.4	1600
Electricals			0.4	8000
Total costs: A+B+C+D				
Instrumentation	80,000	1		
Erection/dismantling	20000	1	0.4	32000
Insulation/painting	20000	1	0.4	8000
Safety	20000	1	0.4	8000
Civil work		1	0.4	8000
Structural work	20,000	1	0	0
Total costs			0.4	8000
Technology transfer costs				
Know how	238000	1	0.4	95200

Engineering company	85000	1		0.4	34000
Pre-operative costs	133000	1		0.4	53200
Change over	71500	1		0.4	28600
Trial and Start up costs	71500	1		0.4	28600
			ICC		902950
			Cont.		90295
			IOC		30000
TOTAL INCREMENTAL COSTS					**1,023,245**
ODS					**26**
CE					**39.36**

MULTILATERAL FUND FOR THE IMPLEMENTATION OF THE MONTREAL PROTOCOL ON SUBSTANCES THAT DEPLETE THE OZONE LAYER

PROJECT COVER SHEET

COUNTRY	INDIA	**IMPLEMENTING AGENCY**	UNDP, UNIDO
PROJECT TITLE	Plan for Phase-out of CFCs in the Refrigeration (Manufacturing) Sector in India		
PROJECT IN CURRENT BUSINESS PLAN		Yes	
SECTOR		Refrigeration (Manufacturing)	
SUBSECTOR		All sub-sectors (excl. Servicing &MAC)	

ODS USE IN SECTOR	Baseline (Average of 1995-97)	2,770	MT ODP
	Current (2001)	1,373	MT ODP
	From approved ongoing projects	809	MT ODP
	From remaining non-eligible enterprises	29	MT ODP
	From remaining eligible enterprises	535	MT ODP
	Net remaining	564	MT ODP
PROJECT IMPACT	Reflecting the net ODP value	535	MT ODP
	Including approved ongoing projects	1,344	MT ODP

PROJECT DURATION 4 years

PROJECT COSTS

		UNDP portion	UNIDO portion	Total
Incremental Capital Costs	US$	5,299,000	1,224,000	6,523,000
Contingencies	US$	472,400	122,400	594,800
Incremental Operating Costs	US$	1,126,290	177,673	1,303,963
Total Project Costs	US$	6,897,690	1,524,073	8,421,763

LOCAL OWNERSHIP		100%
EXPORT COMPONENT		0%
REQUESTED GRANT	US$	**8,421,763**
COST EFFECTIVENESS	US$/kg/y	N/A
IMPLEMENTING AGENCY SUPPORT COSTS	US$	TBD
TOTAL COST OF PROJECT TO MULTILATERAL FUND	US$	TBD

STATUS OF COUNTERPART FUNDING	N/A
PROJECT MONITORING MILESTONES	Included
NATIONAL COORDINATING BODY	Ministry of Environment & Forests

PROJECT SUMMARY

This Phase-out Plan will eliminate all the remaining eligible CFC consumption in the Refrigeration (Manufacturing) Sector in India upon completion. The Phase-out Plan will be implemented through four annual implementation programmes and together with the implementation of the approved ongoing projects, will result in the complete phase-out of CFCs in the Refrigeration (Manufacturing) Sector in India in four years. The Phase-out Plan will cover the technology conversions in the remaining eligible enterprises in the Refrigeration (Manufacturing) Sector, excluding the MAC sector, and ensure timely, sustainable and cost-effective phase-out through a combination of investment, technical support and policy/management support components. The Refrigeration (Servicing) sector is being addressed through a separate phase-out plan being submitted to the 38th EC Meeting. The total eligible incremental costs and the requested grant for the Plan for phase-out of CFCs in the Refrigeration (Manufacturing) Sector in India are US$ 8,421,763.

IMPACT OF THE PROJECT ON THE COUNTRY'S MONTREAL PROTOCOL OBLIGATIONS

The approval of this project will help India in meeting its Montreal Protocol obligations, such as the phased reductions in ODS consumption as per the agreed schedules.

PREPARED BY	UNDP (in consultation with MOEF and UNIDO)	**DATE**	July 2002
REVIEWED BY	Dr. Hubert Creyf (Foams), Dr. Lambert Kuijpers (Refrigeration)	**DATE**	August 2002

PROJECT OF THE GOVERNMENT OF INDIA
Plan for phase-out of CFCs in the Refrigeration (Manufacturing) Sector in India

1. PROJECT OBJECTIVES

The objectives of this project are:

a) To achieve complete phase-out of CFCs in the Refrigeration (Manufacturing) Sector in India within four years.
b) To enable India to meet its obligations of phased ODS reductions in accordance with the control schedule of the Montreal Protocol.
c) To ensure timely, sustainable and cost-effective CFC phase-out in the Refrigeration (Manufacturing) Sector, through development and implementation of a combination of investment, technical support and policy/management support components.

2. INSTITUTIONAL FRAMEWORK

India ratified the Vienna Convention in March 1991 and the Montreal Protocol in June 1992. In 1993, India prepared a detailed Country Programme to phase out ODS in accordance with its national industrial development strategy and in line with the Montreal Protocol control schedule. The Country Programme was aimed at ensuring that the phase out will be effected without undue economic burden to both consumers and industry and provided India with the opportunity to access the Montreal Protocol Financial Mechanism. The guiding principles of the Country Programme are, to minimize economic dislocation as a result of ODS phase-out, minimize industrial obsolescence, maximize indigenous production, promote one-step phase-out and to emphasize decentralized management.

The Government of India has entrusted the work relating to ozone layer protection and implementation of the Montreal Protocol, to the Ministry of Environment and Forests (MOEF), which is the coordinating Ministry in India for all matters concerning the Montreal Protocol. The MOEF has set up an Ozone Cell, as the national unit to manage and coordinate India's country programme for ODS phase-out.

The MOEF has established an empowered Steering Committee, which comprises of high-level representation from other line ministries and is primarily responsible for formulating and implementing policies and procedures pertaining to India's compliance with the Montreal Protocol. The Steering Committee is supported by three Standing Committees, namely the Technology and Finance Standing Committee (which reviews and endorses ODS phase-out proposals and activities), Standing Committee for Small Scale Industry (which is entrusted with advising on ODS phase-out and compliance by the crucial small industries sector) and Standing Committee for Monitoring and Evaluation (which advises and monitors implementation).

Recognizing the importance of establishing an effective policy framework for the successful implementation of the Country Programme, MOEF has initiated an aggressive action plan to create such a framework to reinforce the various ODS phase out measures:

2.1 Regulatory Measures

a) The Steering Committee, since its inception, has instituted an elaborate legal procedure for review and endorsement of project proposals, for submission to the Multilateral Fund for funding. Each enterprise seeking assistance is required to make a formal application to MOEF in a prescribed format along with legally binding documentation and certifications for establishing its eligibility, CFC consumption and financial viability. Each proposal is reviewed by the Technology and Finance Standing Committee for technical and policy issues and if acceptable, recommended for acceptance and formal endorsement.

b) Trade in controlled substances with countries not party to the Montreal Protocol has been prohibited.

c) Export of Annex A and Annex B substances to Non-Article 5 Parties has been prohibited.

d) The import and export of all Annex A and Annex B substances are subject to licensing.

2.2 Fiscal Measures

a) Full exemption from payment of Customs and Excise tariffs on capital goods required to implement ODS phase out projects funded by the Multilateral Fund. The exemption from Customs and Excise tariffs has been extended to ODS phase-out projects, which were eligible for funding under the Multilateral Fund, whether or not such enterprises actually sought assistance from the fund. This will also cover projects submitted for retroactive financing. The benefit was available subject to the condition that enterprises should give a clear legal commitment to stop using ODS in all future manufacturing operations after the projects were implemented.

b) The duty exemptions were also extended to items of recurring use, including non-ODS alternatives for a duration for which, incremental operating costs were committed by the Multilateral Fund in approved projects.

c) The duty exemptions were also extended to capital goods required for establishing new capacity with non-ODS technology.

d) Indian financial institutions have been advised not to finance/refinance new ODS producing/consuming enterprises.

e) The Tariff Advisory Committee (a statutory body under the Insurance Act, 1938) has decided to grant suitable discounts on fire insurance premiums if alternative agents are used to replace halons.

2.3 Legislation

In exercise of the powers conferred under sections 6, 8 and 29 of the Environment Protection Act of 1986, Government of India formulated the draft Ozone legislation called the Ozone Depleting Substances Rules, which were published in the Gazette of India in 1998 for public comments and also circulated in the industry for advance intimation and comments. These have since been officially notified and have formally come in to effect from January 2000. The provisions of this comprehensive legislation are summarized as below:

ODS Production

- Mandatory registration with MOEF
- Restriction on production levels as per "base level" and specified time-bound reductions.
- Prohibition on creating new capacity or expansion of capacity
- Export restricted to countries who are signatory to the Montreal Protocol

ODS Consumption

- Ban on new capacity or expansion of capacity for production of ODS based equipment.
- Mandatory registration with designated authorities
- Declaration requirement in prescribed format, to the seller, at the time of procurement of ODS

ODS Trade

- Mandatory registration for Exporters & Importers with designated authorities

- No sales without license to persons/organizations which have not intimated the Government of India about use of ODS based equipment (including compressors).

General

- Mandatory registration for reclamation and destruction of ODS. All registrations will be valid for specified periods, after which, they are required to be renewed.
- Every person who produces, uses, imports, sells, stocks, reclaims or destroys ODS has to maintain records and file reports as specified.
- Every entity, which has received technical and/or financial assistance from any international agency or financial assistance from Government of India including duty exemptions, is required to maintain records and file reports as specified.

3. SECTOR BACKGROUND

3.1 Background of the Refrigeration Sector

The range of products manufactured in the sector includes, household refrigerating appliances such as domestic refrigerators and freezers, commercial refrigeration equipment such as display cabinets, bottle coolers, chest freezers, hot and cold water dispensers, visi-coolers, ice-candy machines, water coolers, reach-in refrigerators, walk-in coolers and freezers, industrial refrigeration equipment such as cold storage, process chilling and transport refrigeration units, and commercial air conditioning applications such as central air conditioning systems and mobile air conditioning units. The sector has experienced substantial growth in the past decade, due to the trade liberalization and tariff reduction policies, increased rural electrification, increased emphasis on agriculture-based food processing industries, consistent growth in the per capita income, indigenous availability of chemicals, all round growth and diversification in the various industrial sectors and applications, particularly in sectors such as automotive, transportation, construction, etc., growing predominance of the service industry, the relatively low market penetration of domestic, commercial and industrial appliances and expansion due to the replacement market. The sector, with the exception of domestic refrigerators and to some extent central air conditioning plants, comprises of a large number of small/medium sized enterprises and tiny/unorganized enterprises, which could pose a challenge to be reached, educated and addressed in respect of the ODS phase-out. CFCs are consumed as blowing agents (CFC-11) and refrigerants (CFC-12, R-502, etc) in the manufacture of refrigeration and air-conditioning products.

India will need to make tremendous efforts to comply with the next control step of the Montreal Protocol, i.e. 50% reduction by 2004/2005. The Indian industry will also need to comply with the new legislations. The sector phase-out approach would contribute to such compliance in a timely and cost-effective manner.

3.2 Structure of the Refrigeration Sector

There exist capacities in India for manufacturing the chemicals and components required by the Refrigeration (Manufacturing) Sector.

3.2.1 Supply Industry

Compressors

There are a few manufacturers, both indigenous and multinational, of hermetic and semi-hermetic refrigeration compressors in India; the domestic demand of compressors is met through these manufacturers and complemented with imports from North America, Europe, Japan and Southeast Asia. Three indigenous manufacturers have been assisted by MLF for conversions and for facilitating CFC phase-out in the downstream users.

Chemicals

Refrigerants and blowing agents required in manufacturing refrigeration appliances, equipment and systems, are manufactured in India and the domestic requirements are met mainly through indigenous sources. The other refrigeration system components are partly produced indigenously and partly imported.

Equipment and tooling

There are a few indigenous manufacturers in India, of the processing equipment and tooling required for this sector. These manufacturers are engaged in fabricating and assembling low-pressure polyurethane foam dispensers, refrigerant charging and evacuation equipment and other tooling. Most of the major multinational equipment manufacturers are represented in India, however, given the size and geography of the country, the level of technical support and after-sales service available from them is quite inadequate. The presence of indigenous manufacturers is directly related to the relatively high investment costs of imported equipment, to the unsatisfactory quality and level of support available and to the high cost of spare parts and consumables.

On the whole, considering the geography and size of the country, the availability of upstream supplies in general is satisfactory, however the quality and level of customer service and technical support is quite limited, mainly due to inadequate infrastructure and due to insufficient availability of trained and qualified staff.

3.2.2 User Industry

In the domestic refrigeration sub-sector, there are a few large manufacturers of household refrigerators and freezers, who either have license or joint venture agreements multinational corporations or have wholly owned subsidiaries. There are also a few indigenous manufacturers of domestic refrigeration equipment. Seven manufacturers have been assisted under the MLF.

The commercial refrigeration sub-sector comprises of a large number of predominantly small and medium-sized enterprises, which are geographically scattered and with relatively little access to sophisticated technology and practices. These enterprises are typically characterized by very low levels of investments in plant and machinery and resulting labor-intensive operation. Many enterprises opt for locally assembled and/or custom-built foam dispensers, typically single-ratio and low-pressure type, to minimize investments. Many also engage in hand-mixing/pouring operations. The refrigerant charging and evacuation operations are predominantly carried out by semi-automatic equipment or by manual kits.

The transport refrigeration sub-sector comprises of manufacturers of refrigerated bodies for trucks and trailers and refrigerated containers. As a critical element in the cold chain, this sub-sector serves an important function.

Although general awareness about quality assurance, training, environment and safety-related issues exists, it does not receive much emphasis in practice, due to low levels of operating capital, because of the low scale of operation and the pressures on profitability exerted by the very competitive domestic market as well as relatively cheap imports. In general, the knowledge of the latest chemicals and technologies is limited in these enterprises.

There is a significant existing population of domestic and commercial refrigeration appliances and equipment and also of mobile air conditioning units. Due to the rapid economic growth in the past two decades, there is a significant number of office buildings and complexes served by central air conditioning centrifugal chillers, which require servicing. As a result, there is a large and fast growing servicing sector comprising of a large number of servicing establishments.

3.3 History of ODS Phase-out

The baseline ODS consumption for all sectors in India, as reported by the Government of India is as tabulated below:

Table-1
India: Baseline ODS Consumption (1995-97)

SECTOR	1995 (MT)	1996 (MT)	1997 (MT)	Average (ODS MT)	Average (ODP MT)
Aerosols	1,626	1,788	983	1,466	1,466
Foams	6,203	6,384	6,812	6,466	6,466
Refrigeration	2,521	2,818	2,973	2,770	2,770
Solvents	154	26	12	64	53
Halons	295	234	221	250	1,245
TOTAL	**10,799**	**11,250**	**11,001**	**11,016**	**12,000**

The Refrigeration and Air Conditioning Sector in India accounts for about 25% of India's baseline CFC consumption. Since 1994, until December 2001, a total of 40 investment projects in the Refrigeration (manufacturing) Sector have been funded under the Montreal Protocol mechanism, implemented by UNDP, UNIDO or the World Bank. The detailed list of investment projects approved in this sector until end-2001 is attached in Annex-1. The summary of approved investment projects is as below:

Table-2
India Refrigeration Sector - Historical investment project approvals as of December 2001

Refrigeration Sub-Sector	Category of enterprises	Number of approved Projects	CFC Phase-out Target (ODP MT)	Approved Funding (US$)	Overall CE (US$/kg)
Domestic	Large	7	1,742	11,209,134	6.44
Commercial/other	Medium or small	33	602	7,318,068	12.16

The seven enterprises in the domestic refrigeration are large manufacturers and constitute the entire indigenous domestic refrigeration sub-sector in India. The 33 approvals in the commercial refrigeration sub-sector (and other sub-sectors) covered a total of 60 enterprises. All of the enterprises in the commercial refrigeration (and other sub-sectors) were predominantly small and medium-sized, most of them with a CFC consumption of less than 20 MT/y. Only 2 out of the 60 enterprises had a baseline CFC consumption of more than 20 MT/y. Of the total 60 enterprise covered, 44 enterprises had a baseline CFC consumption of less than 10 MT/y. The distribution of the approved investment projects based on enterprise size is tabulated below:

Table-3
India – Commercial Refrigeration (and other) Sub-sectors
Distribution of investment project approvals as of December 2001 by enterprise size

Baseline CFC Consumption range (MT/y)	Number of enterprises	Distribution (% of total CFC consumption)
0 to 5	37	33.2
5 to 10	8	12.3
10 to 20	13	47.1
Above 20	2	7.4
Total	60	100.0

Thus, 45 out of 60 (75%) of the enterprises covered, had a CFC consumption of less than 10 MT/y. This is consistent with the observations in section 3.2.2), particularly with those related to the modest levels of investments, training, technical assistance, knowledge base and awareness available to these enterprises.

The Montreal Protocol programme in India has addressed primarily the domestic refrigeration sub-sector and to some extent the commercial refrigeration sub-sector. In addition to achieving the ODS phase-out targets, it has created a degree of awareness among the industry, of the need for incorporating environmental objectives in their investment and operational decisions. The technical assistance and training inputs received through the projects have also enhanced to some extent, the capacity at the enterprise level to address technical and environmental issues. However, the source of the remaining consumption in the Refrigeration (Manufacturing) sub-sector is from predominantly small and medium-sized enterprises characterized as described in the user industry structure (section 3.2.2) by modest levels of investments, training, technical assistance, knowledge base and awareness available to these enterprises. Moreover, since the enterprises are scattered and difficult to access, the progress of the programme in this sector on the whole, has been modest.

3.3.1 Historical Phase-out Approach

Of the total of 60 enterprises covered by the investment project approvals in the commercial refrigeration sub-sector (and other sub-sectors), 40 enterprises were part of five group projects. All enterprises covered were essentially small or medium-sized with individual baseline CFC consumption levels less than 10 MT/y, most of them with less than 5 MT/y. This represents 66% of the total number of enterprises, 45.5% of the total funded baseline CFC consumption in the sub-sector and about 51.2% of the total approved funding. Thus, the group approach seems to be effective in terms of coverage and CFC phase-out, though it has not necessarily been fully effective in mitigating the infrastructural barriers, such as technology awareness, technical assistance, training, etc. due to the relatively limited amounts of resources approved for these activities, which are considered crucial in sustaining the viability of the enterprises and the CFC phase-out. A sector-wide phase-out approach therefore needs to be selected to address the remaining CFC consumption in this sector, addressing these concerns and considering that:

- That the Refrigeration (Manufacturing) Sector has made relatively modest progress in CFC phase-out
- Only the phase-out of CFCs in new products in all remaining manufacturing enterprises in this sector will primarily limit CFC use in this sector and provide the Government with the control and confidence needed to assure India's compliance with the Montreal Protocol control milestones and assist the enterprises in compliance with the present and forthcoming legislations.

3.3.2 Historical Technology Choices

Five of the seven approved projects in the domestic refrigeration sub-sector selected cyclo-pentane technology for conversion of their foam operations. All remaining approved projects selected HCFC-141b based systems. The choices have been guided primarily by the scale of operations and costs. For the refrigerant operations, enterprises of all (except one) approved projects in the sector have chosen HFC-based technology, being the only cost-effective and viable technology available.

3.3.4 Future CFC phase-out Action Plan

The Government of India plans to address the remaining CFC consumption in the Refrigeration and Air Conditioning Sector through submission of a sector-wide phase-out plans beginning 2002 as below:

- Sector Phase-out Plan for Refrigeration Manufacturing (November 2002)
- Sector Phase-out Plan for Refrigeration Servicing (November 2002)

3.4 Survey of the Refrigeration (Manufacturing) Sector

The approved non-investment project, Strategy and Action Plan for ODS Phase-out in the Foam Sector in India, was approved in July 1994. At this time, the implementation of the Montreal Protocol programme in India had just commenced. The objectives and scope of work envisaged under this project were:

- To collect information on the sector (leading to identification of users, categorization of the users, technology selection, etc.)
- To prepare an ODS phase-out strategy (covering awareness creation and information dissemination, capacity building, etc.)
- To prepare and implement an action plan for ODS phase-out (addressing management, timeframe and estimated costs of phase-out, SMEs and informal sectors, etc.)

The project was initially envisaged to be executed nationally, through the Department of Chemicals, Ministry of Petrochemicals, Government of India. However, until 1997, not much progress was made. The approved project document was not signed until this point. In the intervening period (from July 1994 until 1997) substantial progress was made in the Foam and Refrigeration (Manufacturing) Sectors through preparation, approval and implementation of several projects through the World Bank and UNDP. Thus, the original scope of this project, which presumed that a strategy would be in place before implementation of ODS phase-out activities, needed to be modified to reflect the changed scenario. The Government of India requested UNDP to propose a revised scope of activities for the project, which would enable identification of residual ODS users through direct contact, workshops and publicity, which would lead to formulation of investment projects covering the foam and refrigeration sectors and enable development of the appropriate action plan for ODS phase-out. UNDP developed the revised scope of the activities under this project in collaboration with Government of India, as below:

- Identification all upstream suppliers to the Foam Sector.
- Interaction with and information dissemination to the residual ODS users in the Foam and Refrigeration (Manufacturing) Sectors through newspaper announcements and workshops.
- Identification of all residual ODS users in the Foam and Refrigeration (Manufacturing) Sectors

UNDP/UNOPS in collaboration with MOEF, arranged for newspaper announcements for facilitating information dissemination and to locate residual ODS users in June 1998. The first identification and technical assistance workshop for residual ODS users in January 1999 which resulted in successful identification of a large section of residual ODS users in the Foam and Refrigeration (Manufacturing) sectors, fruitful interaction with them and led to the preparation of several projects. UNDP/UNOPS continued the identification work of ODS users and for maintaining sustainability and ensuring local capacity development, retained the services of a local consulting firm in agreement with MOEF. Through the UNDP international and local experts, the work of surveying and identifying remaining CFC users continued and resulted in a steady submission and approval of investment projects. The second identification and technical assistance workshop for residual ODS users, preceded by field contacts and publicity, was held during November 2000. The workshop resulted in further identification of CFC users in the Foam and Refrigeration (Manufacturing) sectors.

The surveying work of the Foam and Refrigeration (Manufacturing) sectors continued with enterprise contacts and plant visits, based on the information and knowledge base generated through the workshops and through the responses to the various publicity actions, carried out under this project. During the first half of 2002, additional assistance for the survey was provided by AIACRA (All India Air Conditioning & Refrigeration Association) and its affiliated and subsidiary associations and chapters.

The survey and identification work of residual CFC users in the foam sector was completed in April 2002 and for refrigeration (manufacturing) sector was largely completed in June 2002. Most residual CFC users are now identified and their baseline information obtained.

3.4.1 Survey Methodology

The Survey Methodology comprised of the following steps:

- Interaction with upstream suppliers (chemicals and equipment)
- Interaction with enterprises

Interaction with upstream suppliers was carried out through regular interactions, meetings and visits. Through these interactions, lists of manufacturers were obtained. Additional inputs were obtained also through the lists maintained by UNDP/UNOPS local and international experts. MOEF also carried out a publicity campaign through all major national and regional newspapers, encouraging residual ODS users to register with MOEF. In addition, information on small and medium-sized enterprises was sought from the relevant government departments and from the AIACRA. To supplement the sources of information above, two identification and technical assistance workshops were arranged as described above, through which, additional enterprises were identified. Most of the enterprises (over 80%) were physically visited through field trips and plant visits carried out by UNDP/UNOPS national consultants and AIACRA affiliates. For the purpose of obtaining baseline information on the enterprises, a questionnaire developed by UNDP was used. The figures of ODS consumption obtained through the survey, were correlated with the records of domestic ODS sales from distributors and traders and with the information provided by the upstream chemical suppliers, to the extent available.

3.4.2 Survey Results

CFC Consumption, eligibility and classification of enterprises

In the survey, a total of about 240 remaining enterprises in the Refrigeration (Manufacturing) Sector were identified, which have residual CFC consumption. The enterprises were spread out all over India, with a predictable concentration in the in the proximity of major industrial areas such as Mumbai, Delhi, Bangalore, Chennai, Chandigadh, etc. Out of these, 199 enterprises met the MLF eligibility criteria for funding, i.e. their CFC-based capacities were established prior to July 25, 1995. The indicative lists of all eligible and ineligible enterprises are provided in Annex-2. The remaining eligible CFC consumption and enterprises by sub-sector are summarized as below:

Table-4
India Refrigeration (Manufacturing) Sector – Summary of remaining unfunded CFC users/consumption

Sub-sector/Category	Number of Enterprises	CFC Consumption (MT)
Eligible enterprises		
Commercial Refrigeration (medium-sized)	6	66.92
Transport Refrigeration (medium-sized)	18	114.12
Commercial Refrigeration (small-sized with CFCs ≥ 2.5 MT/y)	58	180.32
Commercial Refrigeration (small-sized with CFCs < 2.5 MT/y)	117	173.89
TOTAL	**199**	**535.25**
Ineligible enterprises	**41**	**29.06**
GRAND TOTAL	**240**	**564.31**

The remaining 41 enterprises, with a total of CFC consumption of 29.06 MT/y were established after July 25, 1995, and are not eligible for MLF funding. The reasons for the relatively small number of non-eligible CFC users remaining in the sector are as below:

a) MOEF circulated and publicized the draft Ozone Rules in the industry around 1997. The rules included a provision prohibiting installation of new CFC-based capacity, upon coming into force.

b) The industry was in recession in 1996-98 limiting new investments.
c) Due to the awareness of the Montreal Protocol obligations, most of the new capacities established after 1995 were non-CFC-based. In addition, the Government had also extended tariff exemptions and other benefits for installing new non-ODS based technology.
d) Most enterprises with CFC-based capacities established after 1995, converted on their own to CFC-free technologies, fully or partially, knowing that they would not be eligible for funding.

Products manufactured

The surveyed enterprises in the commercial refrigeration sub-sector typically manufacture equipment such as chest freezers, display cabinets, bottle coolers, visi-coolers, reach-in refrigerators, hot/cold water dispensers, water coolers, ice-candy machines, etc, serving the users in the hospitality and food service industry. Many of these enterprises consume CFC-11 used as blowing agent for the rigid foam insulation and CFC-12 used as the refrigerant.

In the transport refrigeration sub-sector, the enterprises manufacture insulated bodies for refrigerated trucks and trailers and the refrigeration systems. These enterprises consume CFC-11 used as blowing agent for the rigid foam insulation and CFC-12/R-502 as the refrigerant.

Baseline Equipment

Based on the responses to the questionnaires, as well as the inputs received from plant visits, the baseline equipment for the foam and refrigeration operations in the enterprises can be summarized as below:

Foaming: Medium-sized enterprises mostly use locally made (or in some cases imported) foam machines. Small-sized enterprises predominantly use manual mixing of chemicals. About 80% of the enterprises in all, use PU foam in some manner; the remaining either use other insulations or are not involved in insulation.

Refrigeration: Medium-sized enterprises typically have semi-automatic charging units, vacuum pumps and leak detectors suited for CFC-12. Small-sized enterprises mostly have assorted charging kits and vacuum pumps, suited for CFC-12.

Baseline Resources

While the owners/management of the enterprises surveyed, are more or less conversant with the need to eliminate CFCs under the Montreal Protocol, most enterprises do not have the financial or technical resources to undertake and sustain conversions at their own cost. Most of the small-sized enterprises have 2-10 employees. The medium-sized enterprises employ about 10-30 persons. While the technicians have basic skills in refrigeration charging and evacuation, there is a lack of good housekeeping and related practices and lack of adequate knowledge or training on CFC-free technologies or applications. Most of the small-sized enterprises do not have well-equipped factories or workshops and lack organizational and infrastructural facilities.

Summary

The enterprises, for the purpose of this Phase-out Plan, are classified into medium-sized (with a CFC consumption typically above 5 MT/y and small-sized (with a CFC consumption typically below 5 MT/y). Among the small-sized enterprises, 117 enterprises with a CFC consumption of less than 2.5 MT/y have foaming operations, which can be considered negligible in terms of value addition to the product or in terms of sustainability. The remaining 58 enterprises with a total CFC consumption higher than 2.5 MT/y are engaged in foaming on a more regular and sustainable basis and would need assistance to facilitate their conversion and maintain their sustainability.

4. PROJECT DESCRIPTION

The Phase-out Plan for elimination of CFCs in the Refrigeration (Manufacturing) sector in India will be implemented through a combination of Investment, Technical support and Policy & management support components.

4.1 Investment Component

The investment component of the plan will focus on enabling the participant enterprises to physically eliminate CFCs from their production activities and would comprise of the following elements:

- Assessment of the technical requirements of conversion
- Determining the scope of international and local procurement
- Development of technical specifications and terms of reference for procurement
- Prequalification and short-listing of vendors
- International/local competitive bidding
- Techno-commercial evaluation of bids and vendor selection
- Procurement contracts
- Site preparation
- Customs clearance and delivery
- Installation and start-up
- Product and process trials
- Operator training
- Commissioning and phase-in of CFC-free production
- Destruction of baseline equipment

The approach for implementing the investment component in the remaining eligible and unfunded enterprises in the sector is proposed to be through a combination of individual and group sub-projects as below:

To be implemented by UNDP

- Six individual sub-projects covering 6 medium-sized enterprises in the commercial refrigeration sub-sector
- Four group sub-projects covering 58 small-sized enterprises (with significant foaming baseline) in the commercial refrigeration sub-sector
- Six group sub-projects covering 117 small-sized enterprises (without significant foaming baseline) in the commercial refrigeration sub-sector

To be implemented by UNIDO

- One group sub-project covering 18 enterprises in the transport refrigeration sub-sector.

This approach draws on previous implementation experience and has been designed based on the size, level of organization, location and customer base of enterprises concerned and also based on ease and convenience for execution and management. Given the generally small size of the remaining enterprises in the sector, with inadequate in-house technical capabilities, the need for adequate investments for plant and process changes, supported by investments on adequate technical assistance, trials and training, is critical and will involve proportionately larger inputs. It is foreseen that the durations for the sub-projects would be set in such a way as to ensure that the verifiable annual performance targets as may be required for the Phase-out Plan, would be quantifiable and achievable. CFC phase-out in ineligible enterprises will not be funded under the sector phase-out plan and is expected to take place through the control, which the Government will have through policy and regulatory actions. Any unaccounted or unidentified eligible enterprises will be identified and accommodated within the resources approved for this sector phase-out plan.

4.1.1 Plant and process investments

Foam Operations

a) New chemicals suitable for the selected alternative technology will be required. These will be available from existing chemical suppliers. No specific investments are foreseen for handling of raw chemicals. However, activities under 4.1.2 will assist enterprises for safe handling of the chemicals.

b) The use of new formulations will lead to a marginal change in mixing ratios and increased viscosity leading to reduced flowability of the chemical mixture. HCFC-141b based foam will have an increased thermal conductivity in relation to that produced with CFC-11, which is being replaced. The existing manual mixing process or low-pressure foam dispensers will not be able to handle the new formulations without adversely affecting the cell structure and thereby the thermal conductivity of the foam. Hand mixing is also not recommended from occupational health and safety standpoints. New high or medium-pressure foam dispensers as applicable, of equivalent effective capacity, which will provide a finer cell structure and help minimize the deterioration of thermal conductivity of the foam, and also minimize the occupational health and safety risks, will therefore be needed to be introduced, to replace the existing dispensers/hand-mixing process.

c) The HCFC-141b based foam will have an increased molded density with respect to the CFC-11 based foam, resulting in increased requirement of chemicals. This increase will be partially offset by the savings resulting from more efficient handling of chemicals due to the new foam dispensers.

Refrigerant Operation

a) Compressors suitable and optimized for HFC-134a/R-404a will be required. These will be available from existing suppliers.

b) The chemical stability of HFC-134a/R-404a and of the synthetic lubricants compatible with HFC-134a/R-404a is highly sensitive to moisture and impurities in the system, as compared to that with CFC-12. The evacuation/charging process for HFC-134a/R-404a and polyolester lubricant will need to ensure the required level of cleanliness and dryness in the system. To ensure this the following is proposed:

- The vacuum pumps will need to be suitable for use with HFC134a/R-404a. Retrofitting of vacuum pumps has not proven cost-effective or logistically feasible in the past, especially for enterprises of this size and considering non-availability of the required parts and services; therefore appropriate quantities of new vacuum pumps suitable for the conversion, consistent with the baseline capacities, will need to be provided.
- The existing refrigerant charging units/kits are not suitable for use with HFC-134a/R-404a and cannot be retrofitted, and will therefore be replaced with automatic or portable semi-automatic charging units suitable for HFC-134a/R-404a duty.

c) The design/sizing of the refrigeration system will need to be suitably changed, to ensure the viability of the process and to maintain product performance and reliability in manufacturing, such as:

- Upsizing the condensers and reengineering evaporators and condensers, so as to ensure the levels of cleanliness and contamination that can be tolerated with HFC-134a/R-404a (< 5 ppm)
- Lengthening of the capillaries or changing the thermostatic expansion valve models.
- Use of filter-dryers with finer pores, suitable for use with HFC-134a/R-404a.

d) The existing leak detection is unsuitable for detecting HFC-134a/R-404a leakages; therefore suitable hand-held leak detectors will need to be provided.

4.1.2 Technical assistance

Technical assistance will be required to be provided through international experts and, when available, national experts to ensure a smooth transition to the new replacement technology. The experts would need to be process specialists and their functions will include overall technical supervision of conversion projects and technical coordination between equipment/chemical suppliers, recipient enterprises and the implementing and/or executing agency. Their specific responsibilities include:

a) Technical assistance for preparing specifications of equipment to be procured in the sub-project
b) Technical equipment bid evaluation from suppliers during the competitive bidding process
c) Technical guidance to the recipient enterprise during start-up with the new equipment and process
d) Resolving technical issues with the phase-in of the new equipment and processes
e) Technical evaluation of the results of production and product quality trials jointly with the recipient enterprise
f) Technical project commissioning including final technical inspection of equipment and process for establishing completion and compliance with project objectives such as the destruction of the baseline CFC-based equipment where applicable, verification of depletion of CFC stocks, and verifying that the non-CFC production process is in operation
g) Technical evaluation of enterprise reimbursement claims on equipment, raw materials, local works and other items and certification of the same
h) Technical clearance of project completion, so that the project assets can be handed over and the project closed.
i) Technical assistance for completion and other reporting requirements.

4.1.3 Product and Process Trials

Trials will be required to validate the new/retrofitted equipment as well as the production process using the new technology, specifically to establish their performance and suitability for the conversion in accordance with specifications and project objectives. Trials will also be needed to evaluate and establish satisfactory end product properties. Trial costs will cover the cost of chemicals, raw materials, components, consumables and utilities required during site preparation and commissioning.

4.1.4 Application and Process Training

Training will be needed to acquaint the production personnel in the enterprise with the new equipment and processes. Training will also be required to address safety and industrial hygiene issues, such as flammability, ventilation, and health hazards and to institute the required industrial practices as applicable to the replacement technology.

4.2 Technical Support Component

Since the Sector Phase-out Plan will address the entire Refrigeration (Manufacturing) Sector, the industry as a whole will need to be supported through provision of a technical support component for ensuring that their phase-out actions and initiatives are not only technically sound but also sustainable, and consistent with the important priorities of the Government, which are to prevent industrial dislocation and obsolescence. The Technical Support component will assist the Refrigeration (Manufacturing) Sector as a whole, for the following:

a) Establishment of quality and performance standards for the CFC-free products and applications within the sector.
b) Interaction with the user industry for providing technology assistance for sustainability of CFC-free refrigeration applications, through technical workshops and meetings
c) Establishment of a training, certification and licensing program for refrigeration system production operators and technicians, for sustaining the CFC-free technologies.

4.3 Policy & Management Support Component

The implementation of the Phase-out Plan will need to be closely aligned and coordinated with the various policy, regulatory, fiscal, awareness and capacity-building actions the Government of India is taking and will need to take in future, in order to ensure that the implementation of the Phase-out Plan is consistent with the Government priorities, such as promotion of indigenization and decentralized management. Further, in view of the annual performance-based targets needed to be achieved under the terms of the Phase-out Plan, the implementation of the Plan will need to be closely and efficiently managed and will introduce additional coordinating, reporting and monitoring activities.

The Phase-out Plan for the Refrigeration (Manufacturing) Sector will be managed by a dedicated management team, comprising of a coordinator to be designated by the Government and supported by representatives and experts from the implementing/executing agencies and the necessary support infrastructure. The Policy & Management Support component of the Phase-out Plan will include the following activities, for the duration of the Plan:

a) Management and coordination of the Plan implementation with the various Government policy actions pertaining to the Refrigeration Sector
b) Establishment of a policy development and enforcement program, covering various legislative, regulatory, incentive, disincentive and punitive actions to enable the Government to acquire and exercise the required mandates in order to ensure compliance by the industry with the phase-out obligations.
c) Development and implementation of training, awareness and capacity-building activities for key government departments, legislators, decision-makers and other institutional stakeholders, to ensure a high-level commitment to the Plan objectives and obligations.
d) Awareness creation of the Phase-out Plan and the Government initiatives in the Sector among consumers and public, through workshops, media publicity and other information dissemination measures.
e) Preparation of annual implementation plans including determining the sequence of enterprise participation in the planned sub-projects.
f) Verification and certification of CFC phase-out in completed sub-projects within the Plan through plant visits and performance auditing.
g) Establishment and operation of a reporting system of usage of CFCs/substitutes by users
h) Reporting of implementation progress of the Plan for the annual performance-based disbursement.
i) Establishment and operation of a decentralized mechanism for monitoring and evaluation of Plan outputs, in association with provincial regulatory environmental bodies for ensuring sustainability.

5. TECHNOLOGY

The selection of the alternative technology for conversion would be governed by the following:

a) Proven and reasonably mature technology
b) Cost-effective conversion.
c) Availability of the systems at favorable pricing.
d) Critical properties that have to obtained in the end product
e) Compliance with established (local and international) standards on safety and environment.

The technology selected would also need to be easily adaptable at the (generally small-sized) recipient enterprises, which predominantly would be participating in this project. The selection of the technology would also need to be consistent with the priorities of the Government and industry and to ensure sustainability of the technology in the long-term.

5.1 Foam Operation

The presently available/emerging CFC-phase-out technologies, for rigid polyurethane insulating foams are:

CLASSIFICATION	LIQUID TECHNOLOGY	GASEOUS TECHNOLOGY
Low ODP technologies (Interim)	HCFC-141b, HCFC-141b + water	HCFCs (22, 142b, 22 + 142b/141b
Zero ODP technologies (Permanent)	Water, Pentanes (n, iso, cyclo) HFC-245fa, HFC-365mfc, HFC-365/227	HFCs (134a, 152a)

Interim Technologies

HCFC-22 (independently or in combination with HCFC-142b and more recently with HCFC-141b) based systems, due to the low boiling point of HCFC-22, cannot be supplied pre-blended and will require investments in full-fledged in-house blending facilities. HCFC-22 also has residual ODP.

HCFC-141b has a boiling point near ambient temperatures. HCFC-141b based systems are technically mature and commercially available. They also provide relatively the most acceptable insulation value and energy efficiency, and the lowest investment and operating costs vis-à-vis other options. No major changes in the auxiliary equipment/tooling in the production program, such as jig/mold redesign, are needed. However, HCFC-141b has residual ODP and is also an aggressive solvent.

Permanent Technologies

Pentane based (n-, iso-, cyclo) systems require extensive safety related provisions/investments due to their flammability. Due to safety considerations, the use of pre-blended systems is not viable and additional investments for in-house pre-mixing are required. Cyclopentane has miscibility limitations with polyols. The molded densities and insulation values are still inferior to those obtained with HCFC-141b. The advantages are their relatively lower operating costs; they are environmentally relatively safe (no ODP/GWP or health hazards) and constitute a permanent technology. Hydrocarbons are thus, the preferred conversion technology for large and organized users, where safety requirements can be complied with and investments can be economically justified. In the present scenario, since most of the enterprises are small or medium-sized, application of hydrocarbon-based systems is not considered feasible.

Gaseous HFCs have been used successfully but cannot been applied widely at the present time, due to cost and availability factors.

For water-based systems, the insulation values, density and commercial availability are unsatisfactory at present. However, these systems have acceptable processing characteristics and are expected to be mature and commercially viable in the near future, especially for applications where insulation values are not very critical. In addition, they are environmentally safe (zero ODP/GWP, no health or safety hazards) and constitute a permanent technology. Since in the current situation the rigid foam is for insulation applications, applying water-based technology is not considered feasible.

Chemical and systems suppliers and the appliance industry have extensively evaluated liquid HFC-based systems. Preliminary trials with non-optimized formulations indicate lower molded foam densities, insulation values comparable to HCFC-141b and no solvent action. On the whole, liquid HFCs are considered to be the only potential zero-ODP alternatives to hydrocarbons. HFC-245fa is expected to be commercially produced beginning the mid-2002. Another candidate, a non-flammable blend of HFC-365mfc and HFC-227, is also planned for commercial production in the second half of 2002. Provided that the commercial and availability considerations are addressed, these substances can be considered to be viable long-term substitutes.

Based on the above considerations, the enterprises will convert to CFC-free systems in future, for their rigid polyurethane foam operations. Until the commercial introduction of mature CFC-free systems, HCFC-141b based systems will need to be used as an interim technology, to maintain product standards and acceptability.

5.2 Refrigerant Operation

The alternative technologies for replacement of CFC-12 in small capacity hermetic/semi-hermetic refrigeration systems are as below:

HCFCs: HCFC-22, Blends
HFCs: HFC-134a, HFC-152a
Hydrocarbons: HC-290 (Propane), HC-600a (Isobutane), and HC290/600a (1:1mixture of both)

HCFCs are not preferred long-term substitutes, due to their residual ODP.

Hydrocarbon technologies though environmentally safe (no ODP/GWP or health hazards) and technically acceptable, require elaborate safety/monitoring provisions and investments due to their flammability and will not be suitable for cost-effective and financially sustainable transfer to small and medium-sized enterprises.

HFC-152a has higher discharge temperatures/pressures, is flammable and less stable at high temperatures and the technology for the same is not widely available.

HFC-134a technology as a replacement for CFC-12 based refrigeration systems, is universally accepted, especially in small hermetic/semi-hermetic systems. HFC-134a is a zero ODP option. The technology is commercially available. Hermetic compressors optimized for HFC-134a are commercially available. This technology is therefore the preferred conversion technology in this project. For low-temperature applications using R-502, based on similar lines as above, R-404a will be the selected replacement technology.

5.3 Technology Selection

Based on the selection parameters for the technologies for foam and refrigerant operations described earlier, the selection of the CFC replacement technologies in the remaining enterprises can be summarized as below:

Sub-sector	CFC Consumption (MT)	Technology Selected
Foam operation	393.78	HCFC-141b + partial water-based systems
Refrigerant operation	170.53	HFC-134a/R-404a

5.4 Additional Justification for HCFC technology

The implementing agency experts prior to the preparation of this proposal appraised the prospective recipient participating enterprises and had detailed discussions with the technical and managerial personnel of the enterprises, regarding the choice of technology for replacing the existing CFC-based technology, under the project. The enterprises were briefed in detail about the following:

1. An overview of the available interim (low ODP) and permanent (zero ODP) replacement technologies.
2. The techno-economic impact of each technology on the products manufactured, and the processes and practices employed by them.
3. The possible implication of each technology, in terms of its known impact on environment, health and safety, such as ozone depleting potential, global warming potential, occupational health, fire and explosion hazards.
4. It was emphasized to them that HCFC technologies are interim in nature due to their residual ODP and therefore may continue to adversely affect the environment, though at a lower scale than CFCs.
5. It was further explained that HCFCs use may become restricted under present or future international conventions and may also need to be phased out at a future date, and any investments required for their phase-out and for conversion to safer technologies, may have to be borne by them.

The enterprises indicated their preference for selection of HCFC-141b based technology, in their rigid foam operation. The specific justifications offered by them are as below:

Water-based systems were considered, but are unsuitable due to the unsatisfactory insulation values, density and other end-product properties, which will affect their competitiveness. They considered hydrocarbon-based systems unsuitable due to the following factors:

a) The fire, explosion and security hazard and compliance with local safety regulations involved in the storage and handling of hydrocarbons, in view of their flammability. In the present premises of these enterprises such compliance is not possible. At the present time, it would not be cost-effective or viable for them to relocate their manufacturing facilities to ensure such compliance.

b) Since hydrocarbons cannot be pre-mixed in polyols due to the safety hazard they present in transportation, additional investments on in-house premixing equipment will be required. Considering their low volume of production, such investments are not economically viable.

c) In view of safety considerations, additional and continuous monitoring of plant operations by statutory authorities will be needed. The plant operators will need additional retraining for safety practices. The insurance premiums will increase. This will add to the burden of recurring costs.

In view of the above, the enterprises selected HCFC-141b (+ partial water) based systems for their rigid foam operations as the interim conversion technology, which will ensure quick phase-out of most of the ODP, while maintaining products competitive and the properties at acceptable levels.

6. INCREMENTAL COSTS

6.1 Summary of incremental costs

The incremental capital and operating costs for the Phase-out Plan are calculated based on the guidance provided by the various Executive Committee Decisions and precedents and agreements reached with MLF during recently approved similar projects in this Sector. The basis and detailed calculations for the various cost elements are presented in Annex-3 and Annex-4. The total costs worked out are as below:

Incremental Capital Costs:	US$ 6,523,000
Contingencies:	US$ 594,800
Incremental Operating Costs:	US$ 1,303,963
Total:	**US$ 8,421,763**

6.2 Economies

The incremental costs of the Plan are budgeted on the basis that the sector-wide phase-out approach will result in economies through adoption of cost-effective execution strategies and also through dynamics of the market forces, while providing the Government with the flexibility and the resources to align its policy and regulatory actions with the technical actions, for ensuring a timely, systematic and sustainable phase-out. Some of the salient provisions of the economies considered for calculating the incremental costs of the sector-wide approach as compared to the individual project-to-project approach, are as below (more details are provided in Annex-3):

a) In the investment component, budgets for technical assistance, trials and training are reduced to reflect the savings in the group/sector-wide approach, based on prior agreements for similar projects.

b) Only those enterprises with significant or meaningful foaming baselines have been considered for supporting the foaming operations.

c) The proposals for replacing the baseline CFC-based equipment have been based on functionality rather than eligibility alone, resulting in savings in the overall costs of the replacement equipment, in accordance with prior agreements with MLF on similar projects.

d) To account for the impact of market forces in shaping the incremental operating costs, projected price differentials are considered only for foam chemicals and refrigerants (and not for other components).

7. COST EFFECTIVENESS

The Cost Effectiveness (ratio of the total incremental costs to the net ODP phased out per year post-project) of this project works out to US$ 15.73/kg/y. This has been calculated from the net incremental project costs of US$ 8,421,763 and the total CFCs, reflecting the net ODP value after deducting the residual ODS of HCFC-141b amounting to 28.88 MT) 535.43 MT, to be phased out upon completion. Details are provided in Annex-5. As per available guidance from Executive Committee Decisions, sector-wide phase-out plans are not subjected to a cost-effectiveness threshold.

8. FINANCING

The total requested grant funding is **US$ 8,421,763.**

9. IMPLEMENTATION

9.1 Flexibility Clause

As mentioned before, the list of enterprises as annexed is the result of a detailed survey, the accuracy of which was confirmed by MOEF and AIACRA (All India Air Conditioning and Refrigeration Association). However, in the unlikely event that some of the enterprises identified in the plan would become ineligible – for example because some would go out of business between the time of the survey and the time they would be assisted – the plan allows for the following flexibility:

(a) The tonnage corresponding to cancelled enterprises and the associated amount of fund assistance, could be applied to other refrigeration manufacturing enterprises that would be found to be eligible but that were not included in the present annex.

(b) The tonnage corresponding to cancelled enterprises and corresponding amount of funds associated to this, could be applied to any other eligible activities in the refrigeration sector, as determined by MOEF.

This is flexibility has been reflected in paragraph 5 of annex 9.

9.2 Management and execution

The overall management of the Plan will be carried out as described in Section 4.3, by Government of India with the assistance of UNDP.

The CFC phase-out activities for the 18 enterprises in the transport refrigeration sub-sector would be implemented by UNIDO. The CFC phase-out activities in all remaining eligible enterprises would be implemented by UNDP.

The Ozone Cell, Ministry of Environment & Forests, will be responsible for monitoring of the implementation of the Phase-out Plan. The Ozone Cell will be responsible for tracking the promulgation and

enforcement of policy/legislations and assist UNDP with the preparation of annual implementation plans and progress report to the Executive Committee. UNDP would conduct an annual independent audit for verifying CFC consumption levels including spot checks and random visits and supervise implementation activities.

9.3 Performance and Disbursement Schedule

Year (as of 31 Dec)	ODS phase-out target (MT)			Remaining ODS Consumption in Ref (Mfg) Sector (MT)	Disbursement (US$)		
	From approved ongoing projects	From Phase-out Plan	Total		UNIDO	UNDP	Total
2002	0	0	0	1,373	1,000,000	2,000,000	3,000,000
2003	200	0	200	1,173	524,073	2,000,000	2,524,073
2004	200	181	381	792	0	1,250,000	1,500,000
2005	200	180	380	412	0	1,250,000	1,000,000
2006	209	203	412	0	0	397,690	397,690
TOTAL	**809**	**564**	**1,373**		**1,524,073**	**6,897,690**	**8,421,763**

9.4 Funding Arrangements

Upon approval by MLF of the Phase-out Plan, the Government of India, through UNDP, requests the Executive Committee to authorize disbursement of funding in advance for 2003, the implementation plan for which, is as below:

a) Establishment of operational mechanism for management and monitoring of the Phase-out Plan.
b) Formulation of detailed terms of reference and work plans for various activities under the Technical Support and Policy & Management Support components
c) Establishment of an operational mechanism for participation in the Phase-out Plan and for obtaining phase-out commitments from enterprises.
d) Initiating CFC phase-out activities for 14 enterprises in the transport refrigeration sub-sector (UNIDO)
e) Initiating CFC phase-out activities for the 6 medium-sized enterprises in the commercial refrigeration sub-sector through individual sub-projects (UNDP)
f) Selection of the enterprises for group projects in the commercial refrigeration sub-sector (UNDP)
g) Two workshops under the Technical Support Component for technology assistance to prospective participant enterprises in the sector.
h) One workshop for public awareness and information dissemination under the Policy and Management Support component.

Since the average duration for completion of a sub-project is expected to be about 18 months, the phase-out activities initiated in 2003 will not be produce results until mid or end-2004, contributing to the reduction of consumption starting 2005. Therefore, the Government of India through UNDP, will request the disbursement of the 2004 funding not later than the last Meeting of the Executive Committee in 2003, against satisfactory reporting of activities carried out in 2003. The funds for 2005 and 2006 will be transferred to UNDP at the first meeting of the Executive Committee in these years, for the amounts listed in the table above, upon approval of the annual implementation plan and upon confirmation by UNDP, that the agreed reduction targets and relevant performance milestones of the respective preceding years have been achieved.

10. RESULTS

This project will completely eliminate the use of CFCs in the Refrigeration (Manufacturing) Sector in India.

ANNEXES

Annex-1: List of Approved Investment Projects in the Refrigeration (Manufacturing) Sector in India
Annex-2: List of remaining enterprises in the Refrigeration (Manufacturing) Sector in India
Annex-3: Incremental Capital Costs
Annex-4: Incremental Operating Costs
Annex-5: Cost-effectiveness
Annex-6: Environmental Assessment
Annex-7: Cover Sheet (UNIDO component)
Annex-8: Cover Sheet (UNDP component)
Annex-9: Draft Agreement
Annex-10: Technical Reviews

ANNEX-1
India – Refrigeration (Manufacturing) Sector: Historical Approvals

MLF Number	Agency	Sub-Sector	Title	Impact	Grant	Approval	CE	Status
Domestic Refrigeration								
IND/REF/20/INV/104	IBRD	Domestic	Godrej-GE Appliances (Foam)	568.0	2,691,570	Oct-1996	4.74	COM
IND/REF/22/INV/125	IBRD	Domestic	Maharaja International	59.80	510,000	May-1997	9.58	ONG
IND/REF/22/INV/126	IBRD	Domestic	Voltas Ltd.	354.00	2,724,378	May-1997	7.73	COM
IND/REF/22/INV/134	IBRD	Domestic	Videocon Appliances Ltd.	351.70	1,835,115	May-1997	6.82	COM
IND/REF/25/INV/183	IBRD	Domestic	BPL Refrigeration Ltd.	136.00	722,906	Jul-1998	7.76	ONG
IND/REF/27/INV/204	IBRD	Domestic	Whirlpool of India Ltd.	200.60	675,165	Mar-1999	4.84	ONG
IND/REF/30/INV/337	IBRD	Domestic	Godrej–GE Appliances (Ref)	71.7	2,050,000	Mar-2000	28.59	ONG
TOTAL (Domestic Refrigeration – 7 projects)				**1,742**	**11,209,134**		**6.44**	
Commercial Refrigeration								
IND/REF/18/INV/61	IBRD	Commercial	Meghdoot Refrigeration	18.00	164,590	Nov-1995	9.14	COM
IND/REF/18/INV/62	IBRD	Commercial	V. Krishna & Co.	14.80	147,020	Nov-1995	9.80	COM
IND/REF/18/INV/63	IBRD	Commercial	V. Krishna Engineers	17.00	202,790	Nov-1995	11.93	COM
IND/REF/18/INV/64	IBRD	Commercial	Friz-Tech P. Ltd.	12.00	132,920	Nov-1995	11.08	COM
IND/REF/19/INV/89	IBRD	Commercial	Rabi-Run Refrigeration	14.00	142,622	May-1996	10.83	COM
IND/REF/19/INV/90	IBRD	Commercial	Seepra Refrigeration	15.00	171,910	May-1996	12.12	COM
IND/REF/19/INV/91	IBRD	Commercial	Shakti Fabricators	13.50	159,230	May-1996	12.43	ONG
IND/REF/19/INV/92	IBRD	Commercial	Chandra Frig Co.	9.40	130,984	May-1996	13.98	ONG
IND/REF/19/INV/93	IBRD	Commercial	Rockwell Industries	18.00	181,004	May-1996	10.60	COM
IND/REF/19/INV/94	IBRD	Commercial	Sethia Appliances	16.00	173,384	May-1996	11.38	COM
IND/REF/20/INV/105	IBRD	Commercial	Supercold Refrigeration	11.00	133,770	Oct-1996	12.16	ONG
IND/REF/20/INV/106	IBRD	Commercial	Murali Refrigeration	9.00	126,485	Oct-1996	14.05	COM
IND/REF/22/INV/110	IBRD	Commercial	Ref. Comp. & Accessories	9.50	125,370	May-1997	13.92	ONG
IND/REF/22/INV/120	IBRD	Commercial	Standard Refrig. Appliances	18.80	170,180	May-1997	9.06	COM
IND/REF/22/INV/122	IBRD	Commercial	Sheetal Engineering	8.70	127,630	May-1997	14.64	COM
IND/REF/22/INV/123	IBRD	Commercial	Hindustan Refrig. Industries	10.10	132,320	May-1997	13.04	ONG
IND/REF/22/INV/124	IBRD	Commercial	Refrig. and Home Appliances	11.30	147,300	May-1997	12.98	ONG
IND/REF/22/INV/131	IBRD	Commercial	Polar Enterprises	10.80	138,190	May-1997	12.75	COM
IND/REF/23/INV/144	IBRD	Commercial	Aarkay Industries	19.80	135,798	Nov-1997	7.62	COM
IND/REF/23/INV/145	IBRD	Commercial	Saikrupa Industries	14.80	125,618	Nov-1997	9.20	COM
IND/REF/23/INV/152	IBRD	Commercial	Sarkar Refrigeration	12.00	117,100	Nov-1997	10.35	COM
IND/REF/23/INV/160	IBRD	Commercial	Sidwal Refrigeration	11.70	169,744	Nov-1997	14.95	COM
IND/REF/25/INV/180	IBRD	Commercial	Sandeep Refrigeration	9.90	107,684	Jul-1998	10.83	COM
IND/REF/25/INV/182	IBRD	Commercial	Prashant Refrigeration	0	0	Jul-1998	0	Canceled
IND/REF/31/INV/257	UNDP	Commercial	Fedders Lloyd Corporation	21.20	257,428	Jul-2000	12.15	COM
IND/REF/32/INV/282	UNDP	Commercial	Sandlas Air-Con Systems	23.30	228,517	Dec-2000	9.80	ONG
IND/REF/32/INV/286	UNDP	Commercial	Group - 9 Enterprises	53.50	789,425	Dec-2000	14.75	ONG
IND/REF/32/INV/290	UNIDO	Commercial	Umbrella - 3 enterprises	27.30	328,894	Dec-2000	12.04	ONG
IND/REF/34/INV/323	UNDP	Commercial	Group - 5 enterprises	22.00	323,627	Jul-2001	14.73	ONG
IND/REF/35/INV	UNDP	Commercial	Ice-Make Refrigeration	12.40	157,305	Dec-01	12.72	ONG
IND/REF/35/INV	UNDP	Commercial	Group - 9 Enterprises	56.50	726,448	Dec-01	12.85	ONG
IND/REF/35/INV	UNDP	Commercial	Konark Refrigeration	13.10	182,684	Dec-01	13.98	ONG
IND/REF/35/INV	UNDP	Commercial	Group - 14 enterprises	68.00	960,097	Dec-01	15.21	ONG
TOTAL (Commercial Refrigeration – 33 projects)				**602**	**7,318,068**		**12.16**	
GRAND TOTAL (40 projects)				**2,344**	**18,527,202**		**7.90**	

ANNEX-2
India – Refrigeration (Manufacturing) Sector: Indicative Lists of Remaining Enterprises

Table 2.1: Medium-sized Enterprises (Commercial Refrigeration)

No	Enterprise name	Location	Products	Baseline equipment	
				Foam	Refrigerant
1	Beeco Aircon	Meerut	CR	1 LPD (local)	2 SACU, 10VP, 3 LD
2	Cheerag Refrigeration	Mysore	CR	1 LPD	2 SACU, 2 VP, 1 LD
3	Hello Mineral Water Industries	Noida	CR	1 LPD	1 SACU, 4 VP, 2 LD
4	Hemair	Hyderabad	CR	1 LPD	1 SACU, 3 VP, 1 LD
5	Mec Air	Vadodara	CR	1 LPD	2 SACU, 3 VP, 1 LD
6	Tristar	Nasik	CR	1 LPD (local)	2 SACU, 4 VP, 2 LD
TOTAL (6 medium-sized enterprises – commercial refrigeration)				**CFC-11: 48.57 MT, CFC-12: 18.35 MT, Total: 66.92 MT**	

Table 2.2: Medium-sized Enterprises (Transport Refrigeration)

No	Enterprise name	Location	Products	Baseline equipment	
				Foam	Refrigerant
1	Anand Body Builders	Delhi	TR	HM	4 MCK, 3 VP, 2 LD
2	Anand Ishwar Body Builders	Delhi	TR	HM	3 MCK, 2 VP, 2 LD
3	Anil Transport	Delhi	TR	HM	2 MCK, 2 VP, 2 LD
4	Asian Perishables	Delhi	TR	HM	3 MCK, 3 VP, 2 LD
5	Bright India	Delhi	TR	HM	4 MCK, 2 VP, 2 LD
6	Evergreen Transport	Mumbai	TR	HM	2 MCK, 1 VP, 1 LD
7	Golden Temple Enterprises	Delhi	TR	HM	4 MCK, 2 VP, 2 LD
8	Harish Body Builders	Delhi	TR	HM	3 MCK 1 VP, 1 LD
9	HS Body Builders	Faridabad	TR	HM	2 MCK, 2 VP, 1 LD
10	Indo Gulf Enterprises	Gurgaon	TR	HM	3 MCK, 1 VP, 1 LD
11	JK Refrigerated Vans	Faridabad	TR	HM	3 MCK, 2 VP, 1 LD
12	Raghubir Body Builders	Delhi	TR	HM	2 MCK, 1 VP, 1 LD
13	RK Body Builders	Delhi	TR	HM	3 MCK, 1 VP, 1 LD
14	Sai Baba Refrigeration	Delhi	TR	HM	5 MCK, 4 VP, 2 LD
15	Shalu Enterprises	Delhi	TR	HM	4 MCK, 1 VP, 1 LD
16	Sheetal Perishable Cargo Carr.	Mumbai	TR	HM	1 SACU, 1 MCK, 2 VP
17	Suashish International	Delhi	TR	HM	2 MCK, 1 VP, 1 LD
18	Trans Gulf	Delhi	TR	HM	5 MCK, 3 VP, 2 LD
TOTAL (18 medium-sized enterprises– transport refrigeration)				**CFC-11: 93.78 MT, CFC-12 20.34 MT, Total: 114.12 MT**	

Table 2.3: Small-sized Enterprises (Commercial Refrigeration) with CFC consumption > 2.5 MT/y

No	Enterprise name	Location	Products	Baseline equipment	
				Foam	Refrigerant
1	Aaco Refrigeration	Amritsar	CR	HM	Assorted MCK, VP, LD
2	Air Control Systems	Lucknow	CR	HM	
3	Amber Enterprises	Rajpura	CR	HM	
4	Avon Enterprises	Delhi	CR	HM	
5	Best Refrigeration	Udaipur	CR	HM	
6	Bharat Refrigeration Mfg. Co.	Delhi	CR	HM	

Table 2.3: Small-sized Enterprises (Commercial Refrigeration) with CFC consumption > 2.5 MT/y (cont'd)

No	Enterprise name	Location	Products	Baseline equipment	
				Foam	Refrigerant
7	Birla Aircon	Delhi	CR	HM	Assorted MCK, VP, LD
8	Biswal Refrigeration Industries	Cuttack	CR	HM	
9	Bristol India	Fazilka	CR	HM	
10	Chandra Refrigeration	Hyderabad	CR	HM	
11	Chirag Refrigeration P. Ltd.	Jaipur	CR	HM	
12	Cool Age	Faridabad	CR	HM	
13	Cool Breeze	Palakkad	CR	HM	
14	Daffoo Engineering	Delhi	CR	HM	
15	Dairy Den	Gandhinagar	CR	HM	
16	DD Refrigeration	Delhi	CR	HM	
17	Delair	Gurgaon	CR	HM	
18	Freezon	Delhi	CR	HM	
19	Glacier Refrigeration	Delhi	CR	HM	
20	GN Cool Systems	Amritsar	CR	HM	
21	GS Enterprises	Delhi	CR	HM	
22	Guru Nanak Enterprises	Delhi	CR	HM	
23	ICE Enterprises	Alwar	CR	HM	
24	Indian Catering Equipment Co	Bhiwadi	CR	HM	
25	Kalyan Cooling Corporation	Kanpur	CR	HM	
26	Kamal Cool	Gurgaon	CR	HM	
27	Kanakdhara Refrigeration	Jaipur	CR	HM	
28	Khanna Engineers	Faridabad	CR	HM	
29	Khatir Refrigeration	Delhi	CR	HM	
30	Kohinoor Industries	Ludhiana	CR	HM	
31	Krishna Refrigeration	Junagarh	CR	HM	
32	Malhotra & Co	Chandigadh	CR	HM	
33	Metro Enterprises	Delhi	CR	HM	
34	Moonstar Refrigeration	Lucknow	CR	HM	
35	Paramount Industries	Delhi	CR	HM	
36	Prakash Cooling	Delhi	CR	HM	
37	Pooma Enterprises	Palakkad	CR	HM	
38	Pury's Refrigeration	Lucknow	CR	HM	
39	Relief Industries	Delhi	CR	HM	
40	Royal Refrigeration Works	Delhi	CR	HM	
41	Sagar Refrigeration	Pathankot	CR	HM	
42	Sant Refrigeration	Delhi	CR	HM	
43	Semko	Ambala	CR	HM	
44	Siddharth Refrigration	Rudrapur	CR	HM	
45	Simran Refrigeration	Faridabad	CR	HM	
46	Super Coolpoint	Agra	CR	HM	
47	Super Refrigeration Industries	Delhi	CR	HM	
48	Taj Cooling Cabinets	Agra	CR	HM	
49	Techcons Refrigeration	Mumbai	CR	HM	

Table 2.3: Small-sized Enterprises (Commercial Refrigeration) with CFC consumption > 2.5 MT/y (cont'd)

No	Enterprise name	Location	Products	Baseline equipment	
				Foam	Refrigerant
50	Thermotech	Jaipur	CR	HM	Assorted MCK, VP, LD
51	Udaya Enterprises	Udipi	CR	HM	
52	Veerm's Engineers	Nagpur	CR	HM	
53	Vijay Refrigeration	Jamnagar	CR	HM	
54	Vijay Udyog	Jaipur	CR	HM	
55	Volga Refrigeration	Kanpur	CR	HM	
56	Western Refrigeration Ind.	Palakkad	CR	HM	
57	Yamuna Telefridge	Yamunanagar	CR	HM	
58	Yog Trading Co.	Kanpur	CR	HM	
TOTAL (58 small-sized enterprises with CFCs > 2.5 MT/y				**CFC-11: 127.90 MT, CFC-12: 52.42 MT, Total: 180.32 MT**	

Table 2.4: Small-sized Enterprises (Commercial Refrigeration) with CFC consumption < 2.5 MT/y

No	Enterprise name	Location	Products	Baseline equipment	
				Foam	Refrigerant
1	Acme Refrigeration	Goa	CR	HM	Assorted MCK, VP, LD
2	Aditi Refrigeration	Delhi	CR	HM	
3	Advance Refrigeration	Delhi	CR	HM	
4	Alaska Industries	Nagpur	CR	HM	
5	Allied Refrigeration	Ghaziabad	CR	HM	
6	Amancio Refrigeration	Vadodara	CR	HM	
7	Anucool Engineers	Kolhapur	CR	HM	
8	AP Industrial Components	Nainital	CR	HM	
9	AR Corporation	Cuttack	CR	HM	
10	Arctic Aircon	Hyderabad	CR	HM	
11	Arctic Freezers	Trichur	CR	HM	
12	Asiatic Refrigeration	Delhi	CR	HM	
13	Associated Engineers	Mumbai	CR	HM	
14	Balaji Refrigeration	Hyderabad	CR	HM	
15	Bcool Refrigeration	Delhi	CR	HM	
16	Benner Enterprises	Pondicherry	CR	HM	
17	Bharat Aircon	Chennai	CR	HM	
18	Bharat Refrigeration Industries	Chennai	CR	HM	
19	Bhargava Refrigeration	Jaipur	CR	HM	
20	Bhaskar Refrigeration	Belgaum	CR	HM	
21	Bombay Refrigeration	Ahmednagar	CR	HM	
22	Canara Refrigeration	Udipi	CR	HM	
23	Carriers Refrigeration	Trivendram	CR	HM	
24	Chefaid Equipments	Delhi	CR	HM	
25	Climate Creators	Bangalore	CR	HM	
26	Comfort Refrigeration	Jaipur	CR	HM	
27	Commercial Refrigeration Ent.	Delhi	CR	HM	
28	Coolpack	Kanpur	CR	HM	

Table 2.4: Small-sized Enterprises (Commercial Refrigeration) with CFC consumption < 2.5 MT/y (cont'd)

No	Enterprise name	Location	Products	Baseline equipment	
				Foam	Refrigerant
29	Cooltech Corporation	Chandigadh	CR	HM	Assorted MCK, VP, LD
30	Cool Tech Ref. Systems	Delhi	CR	HM	
31	Cosmos Aircond. & Ref. Ind.	Cuttack	CR	HM	
32	Craisler Refrigeration	Delhi	CR	HM	
33	Crystal Refrigeration	Calcutta	CR	HM	
34	Data Refrigeration	Delhi	CR	HM	
35	DS Freezing	Kanpur	CR	HM	
36	Durga Refrigeration	Jaipur	CR	HM	
37	Elite Refrigeration	Delhi	CR	HM	
38	Eros Refrigeration	Nagpur	CR	HM	
39	Everest Engineers	Mumbai	CR	HM	
40	Everest Industries	Jalandhar	CR	HM	
41	Excel Rerigeration	Bangalore	CR	HM	
42	Expo Refrigeration	Jammu	CR	HM	
43	Freeze Cool	Nagpur	CR	HM	
44	Freezetech	Hyderabad	CR	HM	
45	Freezeking Enterprises	Bangalore	CR	HM	
46	Gemko Engineers	Ambala	CR	HM	
47	Gilly Enterprises	Aurangabad	CR	HM	
48	Gossons Air	Mohali	CR	HM	
49	GY Cooling	Kanpur	CR	HM	
50	Himalaya Cooling	Calcutta	CR	HM	
51	Imperial Refrigeration	Calcutta	CR	HM	
52	India Refrigeration	Hyderabad	CR	HM	
53	India Refrigeration Enterprises	Yamunanagar	CR	HM	
54	Indo German Refrig.	Amritsar	CR	HM	
55	Indo Tech Engineers	Saharanpur	CR	HM	
56	Industrial Refrigeration	Mumbai	CR	HM	
57	Jai Refrigeration Industries	Jammu	CR	HM	
58	Jamshed Refrigeration	Kanpur	CR	HM	
59	Jashan Refrigeration	Kanpur	CR	HM	
60	JK Industries	Kolhapur	CR	HM	
61	Jolly Refrigeration	Dehra Dun	CR	HM	
62	JVG Enterprises	Delhi	CR	HM	
63	Kadam Engineering	Kolhapur	CR	HM	
64	Kalsi Frost Engineering Co	Jalandhar	CR	HM	
65	KP Cooling Corporation	Kanpur	CR	HM	
66	Ladhar Enterprises	Ludhiana	CR	HM	
67	Lalwani Refrigeration	Sangli	CR	HM	
68	Lexus Engineering	Ludhiana	CR	HM	
69	Mittal International	Delhi	CR	HM	
70	Mohan Refrigeration	Ludhiana	CR	HM	
71	National Refrigeration	Chennai	CR	HM	

Table 2.4: Small-sized Enterprises (Commercial Refrigeration) with CFC consumption < 2.5 MT/y (cont'd)

No	Enterprise name	Location	Products	Baseline equipment	
				Foam	Refrigerant
72	Neptune Refrigeration	Chennai	CR	HM	Assorted MCK, VP, LD
73	New Coolwell Enterprises	Delhi	CR	HM	
74	Newcool India	Kanpur	CR	HM	
75	New India Refrigeration	Delhi	CR	HM	
76	New Saarkar Refrig.	Karnal	CR	HM	
77	Nikhil Enterprises	Kolhapur	CR	HM	
78	Perfect Refrigeration	Hyderabad	CR	HM	
79	Pooja Refrigeration	Jalandhar	CR	HM	
80	Prachi Enterprises	Jaipur	CR	HM	
81	Pritam Refrigeration	Nagpur	CR	HM	
82	Ranjana Frost	Chandigadh	CR	HM	
83	R. E. Airtech Industries	Calcutta	CR	HM	
84	Refair Engineering Works	Delhi	CR	HM	
85	Refrigeration Engg	Calcutta	CR	HM	
86	Refrigeration Eqpt Co	Calcutta	CR	HM	
87	Refrig. Machinery Mart	Calcutta	CR	HM	
88	Remi Instruments	Mumbai	CR	HM	
89	Renu Refrigeration	Delhi	CR	HM	
90	Sanan Refrigeration	Jalandhar	CR	HM	
91	Saturn Industries	Mohali	CR	HM	
92	Satkar Refrigeration	Ambala	CR	HM	
93	S-Cool Systems	Chennai	CR	HM	
94	Shankar Refrigeration	Amravati	CR	HM	
95	Sheetal Aircon	Delhi	CR	HM	
96	Sheetal Refrigeration Industries	Akola	CR	HM	
97	Shiva Frost	Mahadpur	CR	HM	
98	Shivalik Products	Ambala	CR	HM	
99	Shome's Refrigeration	Calcutta	CR	HM	
100	Subhash Chander & Bros.	Delhi	CR	HM	
101	Sunfrost Refrigeration	Ambala	CR	HM	
102	Supra Refrigeration	Hyderabad	CR	HM	
103	Teeyem Freezers	Trivendram	CR	HM	
104	Tempkin	Calcutta	CR	HM	
105	Trikuta Cooling	Delhi	CR	HM	
106	Uniair Enterprises	Chandigadh	CR	HM	
107	United Brothers	Delhi	CR	HM	
108	Unitemp	Ludhiana	CR	HM	
109	Upfront Engineering	Chennai	CR	HM	
110	Vanguard Refrigeration	Hyderabad	CR	HM	
111	Varsha Refrigeration	Kolhapur	CR	HM	
112	Vijay Refrigeration	Ambala	CR	HM	
113	Vishwakarma Refrig	Yamunanagar	CR	HM	
114	Vita Ice Candy	Jaipur	CR	HM	

Table 2.4: Small-sized Enterprises (Commercial Refrigeration) with CFC consumption < 2.5 MT/y (cont'd)

No	Enterprise name	Location	Products	Baseline equipment	
				Foam	Refrigerant
115	Weathermakers	Calcutta	CR	HM	Assorted MCK, VP, LD
116	You-like Refrigeration	Karnal	CR	HM	
117	3-Star Refrigeration	Ludhiana	CR	HM	
TOTAL (117 small-sized enterprises) with CFCs < 2.5 MT/y				**CFC-11: 105.99 MT, CFC-12: 67.90 MT, Total: 173.89 MT**	

Table 2.5: List of ineligible enterprises

No	Enterprise name	Location	Products	Baseline equipment	
				Foam	Refrigerant
1	Abhishek Aircon Appliances	Delhi	CR	HM	Assorted MCK, VP, LD
2	Abohar Aircare	Abohar	CR	HM	
3	Aircare	Delhi	CR	HM	
4	Amigo Dispensing Solutions	Baroda	CR	HM	
5	Ascon Refrigeration	Faridabad	CR	HM	
6	BP Industries	Delhi	CR	HM	
7	Band Box Electric	Ludhiana	CR	HM	
8	Bawa Joginder Singh & Co	Chandigarh	CR	HM	
9	Bhandari Engg & Electricals	Bhatinda	CR	HM	
10	Bliss Engineers	Jalandhar	CR	HM	
11	Climatic Equipments	Delhi	CR	HM	
12	Cool Connection	Delhi	CR	HM	
13	Cool Makers	Tennur	CR	HM	
14	Cool-N-Cool	Faridabad	CR	HM	
15	Cool Palace	Delhi	CR	HM	
16	Cryoscientific Instruments	Chennai	CR	HM	
17	Fauji Refrigeration	Chandigarh	CR	HM	
18	Fridge India	Faridabad	CR	HM	
19	Gulshan Engineers	Delhi	CR	HM	
20	Hemkunt Electricals	Delhi	CR	HM	
21	Jogi Refrigeration	Chandigarh	CR	HM	
22	Khera Instruments	Delhi	CR	HM	
23	Marito Appliances	Mehsana	CR	HM	
24	Marplex Appliances	Ankleshwar	CR	HM	
25	Naarang Scientific Works	Delhi	CR	HM	
26	Noble Refrigeration	Delhi	CR	HM	
27	Osho Home Appliances	Delhi	CR	HM	
28	Paras Enterprises	Parwanoo	CR	HM	
29	Parkaire Engg Co	Delhi	CR	HM	
30	Rakesh Industries	Delhi	CR	HM	
31	Rattan Refrigeration	Delhi	CR	HM	
32	Refco & Wassamat Appliances	Delhi	CR	HM	
33	Saraf Cooling Co	Kanpur	CR	HM	
34	SK Refrigeration Co	Delhi	CR	HM	

Table 2.5: List of ineligible enterprises (Cont'd)

No	Enterprise name	Location	Products	Baseline equipment	
				Foam	Refrigerant
35	Solar Engineering Co.	Bangalore	CR	HM	Assorted MCK, VP, LD
36	Surendra Fabricators	Delhi	CR	HM	
37	Surendra Refrigeration Works	Khanna	CR	HM	
38	Swastik Industries	Delhi	CR	HM	
39	Triveni Refrig & Elect. Ent.	Allahabad	CR	HM	
40	United Refrigeration Works	Kanpur	CR	HM	
41	Unity Aircon Systems	Delhi	CR	HM	
TOTAL (41 ineligible enterprises)				**CFC-11: 17.54 MT, CFC-12: 11.52 MT, Total: 29.06 MT**	

Table 2.6: Summary

Sub-sector	Indicative Number of Enterprises	CFC Consumption (MT/y)		
		CFC-11	CFC-12	Total
Commercial Refrigeration (medium-sized)	6	48.57	18.35	66.92
Transport Refrigeration (medium-sized)	18	93.78	20.34	114.12
Commercial Refrigeration (small-sized with CFCs ≥ 2.5 MT/y)	58	127.90	52.42	180.32
Commercial Refrigeration (small-sized with CFCs < 2.5 MT/y)	117	105.99	67.90	173.89
Ineligible enterprises	41	17.54	11.52	29.06
GRAND TOTAL	**240**	**393.78**	**170.53**	**564.31**

KEYS FOR TABLE:

DR: Domestic Refrigeration
CR: Commercial Refrigeration
TR: Transport Refrigeration
IR: Industrial Refrigeration
CS: Cold storage

HM: Hand-mixing
LPD: Low-pressure foam dispenser
HPD: High-pressure foam dispenser

MCK: Manual charging kits
SACU: Semi-automatic charging units
ACU: Automatic charging units
VP: Vacuum pumps
LD: Leak detectors

ANNEX-3
INCREMENTAL CAPITAL COSTS

A. Investment Component

The following table summarizes the basis and considerations for calculating the incremental capital costs, for the remaining unfunded eligible participant enterprises in the Phase-out Plan:

Medium-sized enterprises (Commercial Refrigeration)

No	Item/Description	Unit	Qty	Cost (US$)
Foam Operation				
1	High-pressure foam dispenser	Nos	1	80,000
2	Trials for establishing the technology, equipment and process	Lot	1	5,000
3	Technical assistance	Lot	1	5,000
4	Training	Lot	1	2,500
Sub-total (Foam operation)				**92,500**
Refrigerant Operation				
1	Automatic charging units	Nos	1	15,000
2	Vacuum pumps	Nos	2	6,000
3	Hand-held leak detectors	Nos	2	2,000
4	Trials and prototype testing	Lot	1	5,000
5	Technical Assistance	Lot	1	5,000
6	Training	Lot	1	2,500
Sub-total (Refrigerant operation)				**35,500**
Total (for each enterprise)				**128,000**
Grand Total (for 6 enterprises)				**768,000**

Medium-sized enterprises (Transport Refrigeration)

No	Item/Description	Unit	Qty	Cost (US$)
Foam Operation				
1	Medium-pressure foam dispenser (60 lit/min)	Nos	1	30,000*
2	Trials for establishing the technology, equipment and process	Lot	1	5,000
3	Technical assistance	Lot	1	5,000
4	Training	Lot	1	2,500
Sub-total (Foam operation)				**42,500**
Refrigerant Operation				
1	Portable charging units	Nos	2	5,000
2	Vacuum pumps	Nos	2	6,000
3	Hand-held leak detectors	Nos	2	2,000
4	Trials and prototype testing	Lot	1	5,000
5	Technical Assistance	Lot	1	5,000
6	Training	Lot	1	2,500
Sub-total (Refrigerant operation)				**25,500**
Total (for each enterprise)				**68,000**
Grand Total (for 18 enterprises)				**1,224,000**

* Reflects 33% enterprise contribution to account for hand-mixing baseline

Small-sized enterprises (Commercial Refrigeration) with significant foaming baseline considered

No	Item/Description	Unit	Qty	Cost (US$)
Foam Operation				
1	Medium-pressure foam dispenser (40 lit/min)	Nos	1	20,000*
2	Trials for establishing the technology, equipment and process	Lot	1	2,500
3	Technical assistance	Lot	1	2,500
4	Training	Lot	1	1,000
Sub-total (Foam operation)				**26,000**
Refrigerant Operation				
1	Portable charging units	Nos	2	5,000
2	Vacuum pumps	Nos	2	6,000
3	Hand-held leak detectors	Nos	2	2,000
4	Trials and prototype testing	Lot	1	2,500
5	Technical Assistance	Lot	1	2,500
6	Training	Lot	1	1,000
Sub-total (Refrigerant operation)				**18,000**
Total (for each enterprise)				**44,000**
Grand Total (for 58 enterprises with significant foaming baseline)				**2,552,000**

* Reflects 33% enterprise contribution to account for hand-mixing baseline

Small-sized enterprises (Commercial Refrigeration) without significant foaming baseline

No	Item/Description	Unit	Qty	Cost (US$)
Foam Operation				**0***
Refrigerant Operation				
1	Portable charging units	Nos	1	2,500
2	Vacuum pumps	Nos	1	3,000
3	Hand-held leak detectors	Nos	1	1,000
4	Trials and prototype testing	Lot	1	2,500
5	Technical Assistance	Lot	1	2,500
6	Training	Lot	1	500
Sub-total (Refrigerant operation)				**12,000**
Total (for each enterprise)				**12,000**
Grand Total (for 117 enterprises without significant foaming baseline)				**1,404,000**

* See note 1 at the end of Annex-2

The total costs for the investment component are summarized as below:

Enterprise Category/Sub-sector	Cost (US$)
Medium-sized enterprises (commercial refrigeration)	768,000
Medium-sized enterprises (transport refrigeration)	1,224,000
Small-sized enterprises with significant foaming baseline	2,552,000
Small-sized enterprises without significant foaming baseline	1,404,000
Sub-total	**5,948,000**
Contingencies (10%)	**594,800**
Total (Investment Component)	**6,542,800**

B. Technical Support Component

Activity	Cost (US$)
Establishment of product and quality standards for various CFC-free refrigeration products and applications (Technical consultancy for 50 man-days @ US$ 500 per man-day)	25,000
User industry interactions for technology assistance for applications through technical workshops and meetings (10 workshops at US$ 10,000/workshop)	100,000
Training, certification and licensing program for refrigeration system manufacturing operators and technicians to be carried out through the industry associations (Legal and technical consultancy for 100 man-days @ US$ 500 per man-day)	50,000
Total	**175,000**

C. Policy & Management Support Component

Activity	Cost (US$)
Management and monitoring (1,000 man-days @US$ 100/man-day)	100,000
Policy development & decentralized enforcement program (500man-days @ US$ 100 per man-day	50,000
Training and capacity-building activities for government stakeholders and decision makers (10 workshops @ US$ 10,000/workshop)	100,000
Public awareness creation and information dissemination activities (5 workshops @ US$ 10,000 per workshop, plus information dissemination	75,000
Verification and certification (500 man-days @ US$ 150/man-day)	75,000
Total	**400,000**

D. Summary

Activity	Cost (US$)
Investment Component (including 10% contingencies)	6,542,800
Technical Support Component	175,000
Policy & Management Support Component	400,000
GRAND TOTAL	**7,117,800**

Notes:

1. For small-sized enterprises consuming CFCs equal or more than 2.5 MT/y, the baseline is considered significant and sustainable enough for supporting foaming operations. Out of a total about 175 small enterprises, there are 58 enterprises with a CFC consumption of equal or more than 2.5 MT/y. Foaming equipment has been proposed for these 58 enterprises only. For the remaining 117 enterprises, only the refrigeration operation is proposed to be supported.

2. The determination of the quantity, budget and type of replacement equipment, is based on previous agreements and precedents for similar projects and guidance provided by relevant Executive Committee decisions.

ANNEX-4
INCREMENTAL OPERATING COSTS

A. Basis and considerations

1. **Incremental operating costs are not claimed for the refrigeration operation in enterprises in the transport refrigeration sub-sector in accordance with the relevant MLF rules.** Only the incremental operating costs on account of their foaming operations are considered.
2. **Incremental operating costs claimed pertain only to the cost differentials between foam chemicals and refrigerants, as it is foreseen that these differentials would exist throughout the duration of the project due to indigenous availability.**
3. **Incremental operating costs are not claimed on account of cost differentials for other components, such as compressors, condensers, evaporators, capillaries or expansion devices, etc., as it is foreseen that these cost differentials may not apply throughout the duration of the project.**
4. The increased costs on account of molded foam density increases in rigid foam with HCFC-141b based systems with respect to CFC-11 based systems as calculated as recommended by OORG and adopted by Executive Committee Decision 31/35. In order to apply the density increases, the distribution of products manufactured by relative CFC consumption, is assumed to be equal among the five product classifications, namely, display cabinets, chest freezers, visi-coolers, vending machines and walk-in-coolers.
5. The net savings on account of more efficient handling of chemicals due to the introduction of a new high-pressure or medium-pressure foam dispensers are calculated at 5%.
6. The calculation of incremental operating costs is based on the following assumptions and chemical costs:

   Rigid foam
   - Cost of baseline CFC-based chemical system: US$ 2.50/kg (Baseline ratio - 100:43:143)
   - Cost of HCFC-141b based chemical system: US$ 2.67/kg (New ratio - 100:26:145)

   Refrigeration
   - Cost differential for refrigerant: US$ 3.00/kg

7. All amounts rounded off to the nearest US$ 1.00
8. The calculations exclude all taxes/duties and growth.
9. All other considerations not specifically clarified above, are based on recent agreements with MLF.

2. Calculations

Foam Operation

Item	Unit	Before Conversion (US$)			After Conversion (US$)			Net Incremental Cost (US$/yr)
		Qty	Rate	Amount	Qty	Rate	Amount	
Foam Chemicals	Kg	2,508,267	2.50	6,270,668	2,633,680	2.67	7,031,926	761,258
Subtotal				6,270,668			7,031,926	761,258
Less savings due to more efficient processing of chemicals (5%)								(351,596)
Incremental operating costs/year for foam operation								**409,662**
Incremental operating costs for foam operation (NPV for 2 years @10% annual discounting)								**712,812**

Refrigerant Operation

Item	Unit	Qty.	Price Differential between pre- and post conversion (US$/unit)	Modifying Factor (if applicable)	Net Incremental Cost (US$/yr)
Refrigerant	Kg	138,670	3.00	0.90	339,742
Incremental operating costs/year for refrigeration operation					**339,742**
Incremental operating costs for ref. operation (NPV for 2 years @10% annual discounting)					**591,151**

3. Summary Of Incremental Operating Costs

The incremental operating costs for the various categories of enterprises/sub-sectors are tabulated below:

Enterprise Category/Sub-sector	Baseline CFCs (MT/y)	Baseline CFCs eligible for IOCs (MT/y)	IOCs (US$)
Medium-sized enterprises (commercial refrigeration)	66.92	66.92	170,245
Medium-sized enterprises (transport refrigeration)	114.12	93.78	177,673
Small-sized enterprises (commercial refrigeration, $\geq$ 2.5 MT/y)	180.32	180.32	465,782
Small-sized enterprises (commercial refrigeration, < 2.5 MT/y)	173.89	173.89	490,263
Ineligible enterprises	29.06	0	0
TOTAL	**564.31**	**514.91**	**1,303,963**

ANNEX-5
COST-EFFECTIVENESS

A. ODP Impact of the Project

SUBSTANCE	ODP	CONSUMPTION (KG)	NET ODP KG
CFC-11	1.00	393,780	393,780
Substitute: HCFC-141b	0.11	262,520	28,877
CFC-12	1.00	170,530	170,530
Substitute: HFC-134a	0.00	153,477	0
Remaining ODP Consumption in the sector			**28,877**

B. Cost-effectiveness Calculation

PARAMETER/COST HEAD	UNIT	TOTAL
Total Project Costs		
A. Incremental Capital Costs	US$	7,117,800
B. Contingencies (10% of A)	US$	Included
C. Incremental Operating Costs	US$	1,303,963
D. Total Project Costs (A + B + C)	US$	8,421,763
Adjustments to Project Costs		
E. Adjustment for non-Article-5 ownership	US$	0
F. Adjustment for export to non-Article-5	US$	0
G. Adjustment for technological upgrade	US$	0
Net Project Costs		
H. Net Project costs (D – [E + F + G])	US$	8,421,763
ODS Phase-out		
I. Total ODS phase-out	Kg	564,310
J. Net ODP phase-out	ODP Kg	535,433
Cost-effectiveness		
K. Cost-effectiveness (H/J)	US$/kg/y	15.73
Eligible MLF Funding	**US$**	**8,421,763**

ANNEX-6
ENVIRONMENTAL ASSESSMENT

HCFC-141b has an ODP of 0.11 and GWP of 630, which are considered acceptable for rigid polyurethane foam application. HCFC-141b is considered non-flammable as a liquid and moderately flammable as a gas (7.6% to 17.7% in air by volume), and is considered safe in applications where the exposure level is less than 500 ppm on a 8-hour time weighted average basis, which is marginally lower than the existing technology. The smog potential of HCFC-141b is about ten times that of CFC-11, although with an emission rate of about 3% during production, this is not an issue. No changes in the current occupational safety practices are envisaged.

HFC-134a has zero ODP and GWP of 1,300. For this application, this is considered acceptable. HFC-134a is non-flammable, and has been extensively tested for toxicity, and is considered safe in applications where the exposure level is less than 1000 ppm on a 8-hour time weighted average basis, which is the same as that for CFC-12, the existing technology. Therefore no changes in the current occupational safety practices are envisaged in this project.

This project thus uses environmentally safe and acceptable technology

The enterprises participating in this project have obtained the necessary statutory environmental clearances for their present operations. Additional clearances if any, for implementing this project, will be obtained as and when required from the relevant competent authorities.

ANNEX-7
Cover Sheet – UNIDO Component

COUNTRY	INDIA		**IMPLEMENTING AGENCY**	UNIDO
PROJECT TITLE	Plan for elimination of CFCs in the transport refrigeration sub-sector in India.			
PROJECT IN CURRENT BUSINESS PLAN			Yes	
SECTOR			Refrigeration (Manufacturing)	
SUBSECTOR			Transport Refrigeration	
ODS USE IN SECTOR	Baseline (Average of 1995-97)		2,770	MT ODP (All sub-sectors)
	Current (2000)		2,297	MT ODP (All sub-sectors)
ODS USE IN ENTERPRISE	Current (2000)		114.12	MT ODP
PROJECT IMPACT			107.24	MT ODP
PROJECT DURATION			2 years	
PROJECT COSTS	Incremental Capital Costs	US$	1,224,000	
	Contingencies	US$	122,400	
	Incremental Operating Costs	US$	177,673	
	Total Project Costs	US$	1,524,073	
LOCAL OWNERSHIP			100%	
EXPORT COMPONENT			0%	
REQUESTED GRANT		US$	**1,524,073**	
COST EFFECTIVENESS		US$/kg/y	N/A	
IMPLEMENTING AGENCY SUPPORT COSTS		US$	TBD	
TOTAL COST OF PROJECT TO MULTILATERAL FUND		US$	TBD	
STATUS OF COUNTERPART FUNDING			N/A	
PROJECT MONITORING MILESTONES			Included	
NATIONAL COORDINATING BODY			Ministry of Environment & Forests	

PROJECT SUMMARY

This project will phase out 93.78 MT of CFC-11 and 20.34 MT of CFC-12 consumption annually, in the production of transport refrigeration equipment at 18 enterprises, by converting foam operations to HCFC-141b as the blowing agent (as the interim technology, with later conversion to ODS-free technology) and to HFC-134a/R-404a as the refrigerant. This conversion constitutes the complete phase-out of CFCs in this sub-sector in India. The enterprises use manual mixing of polyurethane chemicals and CFC-12-based refrigeration charging, evacuation and leak detection equipment in the baseline, which will be replaced/retrofitted. The project will include incremental capital costs for the 18 enterprises, covering (partial) costs of medium-pressure foam dispensers (US$ 540,000), refrigerant charging units (US$ 90,000), vacuum pumps (US$ 108,000), leak detectors (US$ 36,000), re-design, testing, trials (US$ 90,000), technical assistance (US$ 90,000) and training (US$ 45,000). The eligible incremental operating costs amount to US$ 177,673.

IMPACT OF THE PROJECT ON THE COUNTRY'S MONTREAL PROTOCOL OBLIGATIONS

The approval of this project will help India in meeting its Montreal Protocol obligations, such as the phased reductions in ODS consumption as per the agreed schedules and its obligations under the Phase-out Plan for eliminating CFCs in the Refrigeration (Manufacturing) Sector.

PREPARED BY	UNDP (in consultation with MOEF and UNIDO)	**DATE**	August 2002
REVIEWED BY	Dr. Hubert Creyf (Foams), Dr. Lambert Kuijpers (Refrigeration)	**DATE**	August 2002

ANNEX-8
Cover Sheet – UNDP Component

COUNTRY	INDIA		**IMPLEMENTING AGENCY**	UNDP
PROJECT TITLE	Plan for elimination of CFCs in the Refrigeration (Manufacturing) Sector in India (except transport refrigeration)			
PROJECT IN CURRENT BUSINESS PLAN			Yes	
SECTOR			Refrigeration (Manufacturing)	
SUBSECTOR			All (except Transport Refrigeration)	
ODS USE IN SECTOR	Baseline (Average of 1995-97)		2,770	MT ODP
	Current (2000)		2,297	MT ODP
	From remaining enterprises		450.19	MT ODP (except Trans. Ref.)
PROJECT IMPACT			428.19	MT ODP
PROJECT DURATION			4 years	
PROJECT COSTS	Incremental Capital Costs	US$	5,299,000	
	Contingencies	US$	472,400	
	Incremental Operating Costs	US$	1,126,290	
	Total Project Costs	US$	6,897,690	
LOCAL OWNERSHIP			100%	
EXPORT COMPONENT			0%	
REQUESTED GRANT		US$	**6,897,690**	
COST EFFECTIVENESS		US$/kg/y	N/A	
IMPLEMENTING AGENCY SUPPORT COSTS		US$	TBD	
TOTAL COST OF PROJECT TO MULTILATERAL FUND		US$	TBD	
STATUS OF COUNTERPART FUNDING			N/A	
PROJECT MONITORING MILESTONES			Included	
NATIONAL COORDINATING BODY			Ministry of Environment & Forests	

PROJECT SUMMARY

This project will eliminate all the remaining eligible CFC consumption in the Refrigeration (Manufacturing) Sector in India (except Transport Refrigeration) upon completion. The Phase-out Plan will be implemented through four annual implementation programmes and together with the implementation of the approved ongoing projects, will result in the complete phase-out of CFCs in the Refrigeration (Manufacturing) Sector in India in four years. The Phase-out Plan will cover the technology conversions in the remaining eligible enterprises in the Refrigeration (Manufacturing) Sector and ensure timely, sustainable and cost-effective phase-out through a combination of investment, technical support and policy/management support components. The Refrigeration (Servicing) sector is being addressed through a separate phase-out plan being submitted to the 38th EC Meeting. The total eligible incremental costs and the requested grant for the Phase-out Plan for the Refrigeration (Manufacturing) Sector (except Transport Refrigeration) are US$ 6,897,690.

IMPACT OF THE PROJECT ON THE COUNTRY'S MONTREAL PROTOCOL OBLIGATIONS

The approval of this project will help India in meeting its Montreal Protocol obligations, such as the phased reductions in ODS consumption as per the agreed schedules.

PREPARED BY	Nandan Chirmulay, UNDP Expert	**DATE**	July 2002
REVIEWED BY	Dr. Hubert Creyf (Foams), Dr. Lambert Kuijpers (Refrigeration)	**DATE**	August 2002

ANNEX-9
Draft Agreement

1. The Executive Committee approves in principle a total of US$ 8,421,763 in funding for the phased reduction and complete phase-out in of CFCs used in the Refrigeration (Manufacturing) Sector in India. This is the total funding that would be available to India from the Multilateral Fund for the complete elimination of CFC use in the Refrigeration (Manufacturing) Sector in India, by 31 December 2006. The agreed level of funding would be disbursed in installments as indicated in Table-1 and on the basis of the understanding set out in this agreement. By this agreement, India commits that it will eliminate its total CFC consumption in the Refrigeration (Manufacturing) Sector in accordance with the phase-out target and CFC consumption limits as indicated in Table-1 below:

Table-1
Disbursement Schedule and Control Targets for CFC Consumption and Phase-out in the Refrigeration (Manufacturing) Sector in India

Parameter		2002	2003	2004	2005	2006	2007	Total
Annual CFC Consumption limit in the Refrigeration (Mfg) Sector (ODP MT)		1,373	1,373	1,173	792	412	0	N/A
Annual CFC phase-out target in the Refrigeration (Mfg) Sector (ODP MT)		0	200	381	380	412	0	1,373
Annual funding instalment (US$)	UNIDO	1,000,000	524,073	0	0	0	0	1,524,073
	UNDP	2,000,000	2,000,000	1,250,000	1,250,000	397,690	0	6,897,690
	Total	**3,000,000**	**2,524,073**	**1,500,000**	**1,000,000**	**397,690**	**0**	**8,421,763**
Agency support costs (US$)	UNIDO						0	
	UNDP						0	
	Total						**0**	
Total cost to Multilateral Fund (US$)							0	

2. The phase-out of CFCs achieved in the Refrigeration (Manufacturing) Sector in excess of the specified target for a given year will contribute to achievement of the phase-out targets in subsequent years.

3. The Executive Committee also agrees in principle that the funds for the implementation of the annual programme for any given year will be provided at the last meeting of the Executive Committee in the preceding year, in accordance with the disbursement schedule in Table-1, for the exact amount listed for that year and on the basis of the implementation programme for the year, subject to the performance requirements contained in this agreement. The Executive Committee will strive to ensure that funds are provided at its second meeting in the preceding year. The funding installments for 2004, 2005 and 2006 will be released subject to:

a) The confirmation that all agreed phase-out targets and consumption limits for the previous year have been achieved;

b) The verification that the activities planned for the previous year, were undertaken in accordance with the annual implementation programme.

4. The Government of India agrees to ensure accurate monitoring of the phase-out. The Government of India will provide regular reports, as required by its obligations under the Montreal Protocol and this Agreement. The consumption figures provided under this agreement will be consistent with India's reports to the Ozone Secretariat under Article 7 of the Montreal Protocol. The Government of India also agrees to allow independent verification audits as provided for in this agreement, and in addition, external evaluation as may be directed by the Executive Committee, to verify that annual CFC consumption levels correspond to those agreed and that the implementation of the Refrigeration (Manufacturing) Sector Phase-out Plan proceeds as scheduled and agreed in annual implementation programmes.

5. The Executive Committee agrees to provide India with flexibility in using the agreed funds to meet the consumption limits indicated in Table-1. The Executive Committee has the understanding that during implementation, as long as it is consistent with this Agreement, the funds provided to India pursuant to this Agreement may be used in the manner that India considers will achieve the smoothest possible CFC phase-out, consistent with operational procedures as agreed between India and UNDP in the Refrigeration (Manufacturing) Sector Phase-out Plan as revised and as indicated in the annual implementation programmes. In addition, in the unlikely event that some enterprises would become ineligible for funding – for example because they would go out of business between the time of approval and the time they would be assisted – and if no further eligible manufacturing enterprises can be identified for assistance, the tonnage corresponding to these cancelled enterprises and their corresponding level of funds, could be applied to any other eligible activities in the refrigeration sector, as determined by MOEF. In the Executive Committee's acknowledgement of the flexibility available to India in achieving a complete CFC phase-out in the Refrigeration Sector, it is understood that India is committing to provide the necessary level of resources as may be required for the implementation of the plan and for achieving the consumption limits indicated in Table-1 above.

6. The Government of India agrees that the funds being agreed in principle by the Executive Committee at its 37th Meeting for the complete phase-out of CFCs in the Refrigeration (Manufacturing) Sector are the total funding that will be available to India to enable its full compliance with the reduction and phase-out as agreed with the Executive Committee, and that no additional Multilateral Fund resources will be forthcoming for any related activities in the Refrigeration (Manufacturing) Sector. It is also understood that aside from the agency fees referred to in paragraph 8 below, the Government of India, the Multilateral Fund, and its Implementing Agencies, and bilateral donors will neither request nor provide further Multilateral Fund related funding for the accomplishment of the total phase-out of CFCs in the Refrigeration (Manufacturing) Sector in India.

7. The Government of India agrees that if the Executive Committee meets its obligations under this Agreement, but India does not meet the reduction requirements outlined in Table-1 and other requirements outlined in this Agreement, the Implementing Agency and the Multilateral Fund will withhold subsequent tranches of funding outlined in Table-1, until such time as the required reduction has been met. It is clearly understood that the fulfillment of this Agreement depends on the satisfactory performance by both the Government of India and the Executive Committee of their obligations. In addition, India understands that with respect to all calendar year targets beginning with 2004, the Multilateral Fund will reduce the subsequent tranches and therefore the total funding for Annex-A Group-I substances in the amount of US$ _____ per ODP MT of reductions in consumption not achieved in any year, unless the Executive Committee decides otherwise.

8. UNDP is the Implementing Agency for the implementation of this Phase-out Plan, which will be completed by the end of 2006. A fee of a total of ___ % of the value of the investment activities and ___ % of the value of the policy and management support activities has been agreed in accordance with provisions of this Agreement as indicated in Table-1. As the main implementing agency, UNDP would be responsible for the following:

a) Ensuring performance and financial verification in accordance with specific UNDP procedures and requirements as specified in the Refrigeration (Manufacturing) Sector Phase-out Plan;

b) Reporting on the implementation of the annual implementation programmes to be included as part of each annual programme starting with the submission for the 2003 annual implementation programme prepared in 2002;

c) Providing verification to the Executive Committee that the control targets listed Table-1 and the associated activities have been met;

d) Ensuring that technical reviews undertaken by UNDP are undertaken by appropriate independent technical experts;

e) Assisting India in preparation of annual implementation programmes, which will incorporate achievements in previous annual programmes;

f) Carrying out required supervision missions;

g) Ensuring the presence of an operating mechanism to enable effective, transparent implementation of the programme, and accurate data reporting;

h) Verifying to the Executive Committee that CFC consumption phase-out in the Refrigeration (Manufacturing) Sector has been completed based on the schedules listed in Table-1;

i) Ensuring that disbursements are made to India based on agreed performance targets in the project and provisions in this Agreement;

j) Providing assistance for policy, management and technical support for implementation of the Sector Phase-out Plan, as and when required.

9. The Government of India also commits through this Agreement, to permanently sustain the reductions indicated in Table-1.

F. No. 5-1-2001
Government of India
Ministry of Environment and Forests
Ozone Cell

Core IV B, 2nd Floor
India Habitat Centre
Lodhi Road
New Delhi – 110003
Ph. : 4642176 / Fax : 4642175
Dated : 24th August, 2002

OFFICE MEMORANDUM

Sub: Endorsement of Projects for submission to the 38th Meeting of the Executive Committee of the Multilateral Fund for the Implementation of the Montreal Protocol.

The undersigned is directed to enclose herewith government note of transmittal for elimination of CFC-11 and CFC-12 in the Refrigeration (manufacturing) Sector in India (excluding the MAC Sector) to the 38th Executive Committee of the Multilateral Fund for the Implementation of the Montreal Protocol.

(Dr. S. Satapathy)
Joint Director

Mrs. Suely Machado Carvalho
Principal Technical Adviser & Chief
UNDP/BDP/ESDG/MPU
Room FF-9116, 304 East 45th Street
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Copy to : Dr. Tamás Gróf
Deputy Director
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Fax.: +43-1-213464714

ANNEX-8
Cover Sheet - UNDP Component

COUNTRY	INDIA	**IMPLEMENTING AGENCY**	UNDP
PROJECT TITLE	Plan for elimination of CFCs in the Refrigeration (Manufacturing) Sector in India (except transport refrigeration)		
PROJECT IN CURRENT BUSINESS PLAN			Yes
SECTOR			Refrigeration (Manufacturing)
SUBSECTOR			All (except Transport Refrigeration)
ODS USE IN SECTOR	Baseline (Average of 1995-97)		2,770 MT ODP
	Current (2000)		2,297 MT ODP
	From remaining enterprises		450.19 MT ODP (except Trans. Ref.)
PROJECT IMPACT			428.19 MT ODP
PROJECT DURATION			4 years
PROJECT COSTS	Incremental Capital Costs	US$	5,299,000
	Contingencies	US$	472,400
	Incremental Operating Costs	US$	1,126,290
	Total Project Costs	US$	6,897,690
LOCAL OWNERSHIP			100%
EXPORT COMPONENT			0%
REQUESTED GRANT		US$	6,897,690
COST EFFECTIVENESS		US$/kg/y	N/A
IMPLEMENTING AGENCY SUPPORT COSTS		US$	TBD
TOTAL COST OF PROJECT TO MULTILATERAL FUND		US$	TBD
STATUS OF COUNTERPART FUNDING			N/A
PROJECT MONITORING MILESTONES			Included
NATIONAL COORDINATING BODY			Ministry of Environment & Forests

PROJECT SUMMARY

This project will eliminate all the remaining eligible CFC consumption in the Refrigeration (Manufacturing) Sector in India (except Transport Refrigeration) upon completion. The Phase-out Plan will be implemented through four annual implementation programmes and together with the implementation of the approved ongoing projects, will result in the complete phase-out of CFCs in the Refrigeration (Manufacturing) Sector in India in four years. The Phase-out Plan will cover the technology conversions in the remaining eligible enterprises in the Refrigeration (Manufacturing) Sector and ensure timely, sustainable and cost-effective phase-out through a combination of investment, technical support and policy/management support components. The Refrigeration (servicing) sector is being addressed through a separate phase-out plan being submitted to the 38th ExCom Meeting. The total eligible incremental costs and the requested grant for the Phase-out Plan for the Refrigeration (Manufacturing) Sector (except Transport Refrigeration) are US$ 6,897,690.

IMPACT OF THE PROJECT ON THE COUNTRY'S MONTREAL PROTOCOL OBLIGATIONS

The approval of this project will help India in meeting its Montreal Protocol obligations, such as the phased reductions in ODS consumption as per the agreed schedules.

PREPARED BY	Nandan Chirmulay, UNDP Expert	**DATE**	July 2002
REVIEWED BY	Dr. Hubert Creyf (Foams), Dr. Lambert Kuijpers (Refrigeration)	**DATE**	August 2002

ANNEX-7

Cover Sheet – UNIDO Component

COUNTRY	INDIA	**IMPLEMENTING AGENCY**	UNIDO
PROJECT TITLE	Plan for elimination of CFCs in the transport refrigeration sub-sector in India.		
PROJECT IN CURRENT BUSINESS PLAN			Yes
SECTOR			Refrigeration (Manufacturing)
SUBSECTOR			Transport Refrigeration
ODS USE IN SECTOR	Baseline (Average of 1995-97)		2,770 MT ODP (All sub-sectors)
	Current (2000)		2,297 MT ODP (All sub-sectors)
ODS USE IN ENTERPRISE	Current (2000)		114.12 MT ODP
PROJECT IMPACT			107.24 MT ODP
PROJECT DURATION			2 years
PROJECT COSTS	Incremental Capital Costs	US$	1,224,000
	Contingencies	US$	122,400
	Incremental Operating Costs	US$	177,673
	Total Project Costs	US$	1,524,073
LOCAL OWNERSHIP			100%
EXPORT COMPONENT			0%
REQUESTED GRANT		US$	**1,524,073**
COST EFFECTIVENESS		US$/kg/y	N/A
IMPLEMENTING AGENCY SUPPORT COSTS		US$	TBD
TOTAL COST OF PROJECT TO MULTILATERAL FUND		US$	TBD
STATUS OF COUNTERPART FUNDING			N/A
PROJECT MONITORING MILESTONES			Included
NATIONAL COORDINATING BODY			Ministry of Environment & Forests

PROJECT SUMMARY

This project will phase out 93.78 MT of CFC-11 and 20.34 MT of CFC-12 consumption annually, in the production of transport refrigeration equipment at 18 enterprises, by converting foam operations to HCFC-141b as the blowing agent (as the interim technology, with later conversion to ODS-free technology) and to HFC-134a/R-404a as the refrigerant. This conversion constitutes the complete phase-out of CFCs in this sub-sector in India. The enterprises use manual mixing of polyurethane chemicals and CFC-12-based refrigeration charging, evacuation and leak detection equipment in the baseline, which will be replaced/retrofitted. The project will include incremental capital costs for the 18 enterprises, covering (partial) costs of medium-pressure foam dispensers (US$ 540,000), refrigerant charging units (US$ 90,000), vacuum pumps (US$ 108,000), leak detectors (US$ 36,000), re-design, testing, trials (US$ 90,000), technical assistance (US$ 90,000) and training (US$ 45,000). The eligible incremental operating costs amount to US$ 177,673.

IMPACT OF THE PROJECT ON THE COUNTRY'S MONTREAL PROTOCOL OBLIGATIONS

The approval of this project will help India in meeting its Montreal Protocol obligations, such as the phased reductions in ODS consumption as per the agreed schedules and its obligations under the Phase-out Plan for eliminating CFCs in the Refrigeration (Manufacturing) Sector.

PREPARED BY	UNDP (in consultation with MOEF and UNIDO)	**DATE**	August 2002
REVIEWED BY	Dr. Hubert Creyf (Foams), Dr. Lambert Kuijpers (Refrigeration)	**DATE**	August 2002

c. UNIDO

Subject: RE: URGENT: IND-Refrigeration Manuf
Date: Tue, 27 Aug 2002 13:38:37 +0200
From: T.Grof@unido.org (Tamas GROF)
To: jacques.van.engel@undp.org
CC: ozone@del3.vsnl.net.in, S.Yalcindag@unido.org (Seniz YALCINDAG)

Dear Jacques,

Thanks for the Project Document. In line with our telephone discussion we agree to its submission to the Secretariat. In case of any assistance required, please contact us.

Kind regards,

Tamás

Country: **INDIA**
Firm: **Various**
Type: **Refrigeration (Manufacturing) Sector Plan**
Date: **August 2002**

RTU-UN/Pav-LK-20233-dl

Scope
The plan under review covers the conversion in India of the remaining CFC consumption in the manufacturing of all domestic, commercial and transport refrigeration units (excluding the servicing sector).

1. Project Objectives and Institutional Framework
No comments regarding this description. The legislation is adequately described.

2. Description of the Refrigeration Sector
The description of the background and the structure of the refrigerator sector are clear. 3.2.2 "User industry" gives a good overview. The ODP tonnes (and CE values) given in the tables 1-3 are clear. It is useful information to learn that the net refrigeration consumption for 2001 is 1373 ODP tonnes (excluding servicing), of which 809 tonnes are already addressed in approved projects. This leads to the conclusion (from the figures given) that a "net" consumption of 535 ODP tonnes still needs to be addressed via projects (or a sectoral plan for manufacturing). Table 2 gives an adequate description of the historic project information, where the commercial sector had a funding level of US$12.16/ODP kg.

The description of the historical approach (and technology choices) in phasing out as given in sections 3.3.1 and 3.3.2 does not raise questions (where is section 3.3.3?).

Chapter 3.4, sections 3.4.1, survey methodology, and 3.4.2, survey results, do not raise comments. Table 4 gives a brief description of the companies concerned, which is supported by sections on "products manufactured", "baseline equipment", baseline resources" etc. It would have been interesting if a description would have been given of the number of units made per year by representative companies together with the refrigerant charge applied, in this way making it possible to check operating costs for the refrigerant consumed (is all the refrigerant reported consumed in the manufacturing process and is it necessary?) *(additional information provided gives insight in the production and refrigerant use for some representative companies).*

3. Project Description
The plant and process investments material given here is identical to the material given in separate projects before. However, a brief explanation could be given why vacuum pumps cannot be retrofitted (age?) and why existing refrigerant charging kits are not suitable for HFCs. Under "refrigerant operation" part c it is mentioned "upsizing the condensers and reengineering evaporators and condensers, so as to ensure the levels of cleanliness....". The first is engineering for product performance, the second has to do with the manufacturing process, and this needs to be corrected.

The technical assistance is the important issue. One can assist companies via national consultants and experts, but it should be emphasised that one needs to make provisions that the companies do not keep using CFCs (if they are cheap and available); in fact the small companies are comparable to small servicing companies where the same issue plays an important role. This implies destruction of old equipment, national monitoring, and some kind of certification of the manufacturing people and the products. This is explicitly mentioned under "technical support component" point c. The important issue is the question "how can training and certification guarantee that the non-CFC operations become "sustainable". This is pertinent and is also addressed in section 4.2.

No comments to the management component description. This management could indeed be part of the system that guarantees that operations are CFC free, and one should attribute to this management component a clear reporting requirement on all kind of phenomena.

4. Technology

The summary of the selection of the alternative technology for conversion is brief and adequate. The proposal gives a short overview of the refrigerant candidates for domestic/commercial refrigerators, i.e. HCF-134a, HFC-152a, propane, isobutane and mixtures. In fact, only, HFC-134a (R-404A) and isobutane are globally valid options for new equipment; it is acceptable if the proposal mentions that flammables are not suited for SME operations. The choice for HFC-134a (R-404A) is acceptable.

5. Environmental impact

The refrigerant HFC-134a (R-404A) proposed has no ODP and acceptable other environmental characteristics.

6. Project costs

The following to the project costs:
Incremental investment and operating costs etc. amount to US$8.4 million, with a CE of 15.73/kg ODP. If this is compared to the cost effectiveness of historical approvals for medium or small commercial firms, being about US$12 (see earlier table in the proposal), one can observe that the CE in this proposal is 15% higher (mainly due to costs for foaming equipment).

No comments to Annex 1 and Annex 2.

Costs given per company for medium sized enterprises (refrigerant operation) are acceptable. The same applies to the small sized operations. Costs for technical support are acceptable (should it be US$500 per day?); the same applies to the policy component (should it be US$150 per day?).

The calculation of operational costs on the basis of the chemical only is acceptable. The Table nr 3 giving the summary is in order. No comments to the cost effectiveness calculation.

7. Implementation time frame (disbursement schedule)

No comments.

8. Recommendation

The conversion project **is supported** where it concerns the entire project concept and the various elements.
It would be useful in addition,

- To give some more information on number of units produced in certain companies and the charges applied, than just for a representative number;
- To describe why new vacuum pumps and charging machines need to be installed at all companies; and
- To correct for inconsistencies in the description of the re-engineering for HFC-134a.

Eindhoven, 02 08 21
Kuijpers, LJM

---------- Original Message ----------
Date: Wed, 21 Aug 2002 09:19:54 -0400
To: Lambert Kuijpers <lambermp@wxs.nl>
From: Nandan Chirmulay <nandan@erols.com>
Subject: Re: 38th EC: India - Refrigeration (Mfg) Sector Phase-out Plan
Cc: Jacques Van Engel <jacques.van.engel@undp.org>

Dear Lambert:

Thank you for the review. My comments are as below:

a) Individual enterprise production levels:

There is a significant variation in the ranges, sizes, models, capacities, etc. of products manufactured by different enterprises - and this makes it an enormously difficult task to arrive at anything, which could be called "representative". A similar exercise done for the Indonesia Refrigeration (Mfg) Sector Plan submitted and approved at the 37th EC Meeting did not prove very fruitful in enhancing the understanding of the consumption patterns. Further, this is a Sector Phase-out Plan with a provision to address the individual enterprise consumption in a flexible manner, provided the overall Plan commitments are met. Therefore, individual enterprise-level calculations may not have a bearing on the incremental costs finally agreed upon or needed. Moreover, the overall IOC calculations provided in Annex-4 can be used to estimate the overall production level in the Sector and at the enterprise level as well (by dividing it over the number of eligible enterprises and obtaining a kind of "per enterprise average").

b) Your other two points relating to the vacuum pump retrofit and changes in the refrigeration system design are now addressed in the final version of the document.

If you find the above explanations acceptable, please have a signed version of the review faxed to Jacques/UNDP at your earliest convenience.

Best regards
Nandan

TECHNICAL REVIEW.

1.Country:

India.

2.Project Title:

Plan for phase-out of CFCs in the refrigeration (manufacturing) sector in **India.**

3.(Sub)Sector:

Refrigeration.

This review covers only the foam part.

4.CP-Relationship:

India ratified the Vienna Convention in March 1991, and the Montreal Protocol in June 1992. A detailed country programme was prepared in 1993. It aimed to phase-out all ODS in accordance with its national industrial development strategy, and the Montreal control schedule.

The Ministry of Environment and Forest (MOEF) is leading the efforts in the phaseout of CFCs in close cooperation with the consuming and supplying industry. The MOEF has set up an Ozone Cell as the national unit to manage and coordinate India's country programme for ODS phase-out.

5.Technology:

The government of India wants to achieve a complete phase-out of CFCs in the refrigeration manufacturing sector within four years, and proposes therefore, together with UNDP and UNIDO a phase-out project.

This project is based upon development and implementation of measures in the field of investments, technical support and management procedures.

The reviewer fully agrees with the proposed project text. Some additional suggestions are:

-under 4.1 or 4.2, it could be added that measures must be foreseento update the industry on further developments concerning the use of new zero ODS technologies. This could eg be done by publications from

UNDP or UNIDO, or via the raw material suppliers. In this way, smaller enterprises will be able to learn when technically and economically acceptable solutions are available.

-under 4.3, a new legislation could be added which forbids imports of CFCs, or so called "recycled" CFCs.

6.Environmental Impact:

HCFC 141b has an ODP and a GWP of 0.1 (vs 1.0 for CFC 11). The smog potential is about ten times the one of CFC 11. The emission legislation of India must be consulted, and the workplace concentration must be monitored and kept below the legal value.

7.Project Costs:

Both ICC and IOC can be accepted as presented. It should be checked whether all mentioned companies are 100% Indian.

8.Implementation:

Can be accepted as presented.

9.Recommendation:

It is recommended to accept the project.

Prepared by Dr. Hubert Creyf, UNDP Foam Sector Reviewer.

Date:082602

GOVERNMENT NOTE OF TRANSMITTAL OF INVESTMENT PROJECTS TO THE EXECUTIVE COMMITTEE OF THE MULTILATERAL FUND FOR THE IMPLEMENTATION OF THE MONTREAL PROTOCOL

PROJECT OF THE GOVERNMENT OF INDIA

The Government of India requests UNDP and UNIDO to submit the Sectoral Phaseout Plan for CFCs in the Refrigeration (manufacturing) Sector in India (excluding the MAC Sector) Sector in India to the Executive Committee of the Multilateral Fund for the Implementation of the Montreal Protocol for consideration at its 38th Meeting. (project copy is enclosed)

Section I: ODS Consumption Data

1. The ODS consumption figure of the project has been validated by the National Ozone Unit (NOU).

2. The consumption data have been retained in the records of the NOU for reference and/or future verification.

3. The Government has been advised by the NOU that the agreement to the project indicates a commitment to ensure that the validated phase-out figure was realized and yielded a sustained reduction from the 2000 consumption of 2898 (CFC-11) ODS metric tonnes and 690.33 (CFC-12) MT for the RAC sector.

Table 1: Project Submitted to the 38th Meeting of the Executive Committee

No.	Name of Recipient Enterprise	Sector/Sub-Sector	ODS phaseout (ODP-MT)	Grant Requested (US$)	Implementing Agency
1.	Sectoral Phaseout Plan for CFCs in the Refrigeration (manufacturing) Sector in India (excluding the MAC Sector)	Refrigeration Sector (excluding Mobile Air-Conditioning)	428.19 MT 107.24 MT	6,897,690 1,524,073	UNDP UNIDO

Section II: Other Relevant Actions Arising from Decision 33/2

4. It is understood that, in accordance with the relevant guidelines, the funding received for a project would be partly or fully returned to the Multilateral Fund in cases where technology was changed during implementation of the project without informing the Fund Secretariat and without approval by the Executive Committee;

5. The National Ozone Unit undertakes to monitor closely, in cooperation with customs authorities and the environmental protection authorities, the importation and use of CFC and to combine this monitoring with occasional unscheduled visits to importers and recipient manufacturing companies to check invoices and storage areas for unauthorized use of CFC.

6. The National Ozone Unit will cooperate with the relevant implementing agencies to conduct safety inspections where applicable and keep reports on incidences of fires resulting from conversion projects.

Section III : Projects Requiring the Use of HCFCs for Conversion *(To be included where applicable)*

7. In line with Decision 27/13 of the Executive Committee and in recognition of Article 2 F of the Montreal Protocol, the Government

(a) has reviewed the specific situations involved with the project(s) (insert names of enterprises) as well as its HCFC commitments under Article 2F; and

(b) has nonetheless determined that, at the present time, the projects needed to use HCFCs for an interim period with the understanding that no funding would be available for the future conversion from HCFCs for the company/companies involved.

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Designation: Director (Ozone Cell)
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E-mail: ozone@del3.vsnl.net.in

Date: 21 August, 2002