ANNEX E
SUB-PROJECT COVER SHEETS

ANNEX E4: Subproject 2.3.: SAGA - Phase-out of CFC-11 & CFC-12 in the manufacture of Commercial Refrigeration Equipment

PROJECT TITLE:	SAGA – PHASE-OUT OF CFC 11 & CFC 12 BY CONVERSION TO CO_2 & HFC 134A AND R 404A IN THE MANUFACTURE OF COMMERCIAL REFRIGERATION EQUIPMENT
IN CURRENT BUSINESS PLAN:	YES
SECTOR:	COMMERCIAL REFRIGERATION
SUB-SECTOR:	COMMERCIAL REFRIGERATION
ODS USE IN SECTOR (2001):	6,500 *ODP KG*
ODS USE AT ENTERPRISE (2001):	6,500 ODP KG CFC 11AND 12
PROJECT IMPACT:	6,500 ODP KG CFC 11AND 12
PROJECT DURATION:	36 MONTHS
TOTAL PROJECT COST:	
INCREMENTAL CAPITAL COST:	US$ 143,700
CONTINGENCY:	US$ 14,370
INCREMENTAL OPERATING SAVINGS:	US$ 82,384 (NOT REQUESTED, IN-KIND PARTICIPATION)
TOTAL PROJECT COST:	US$ 158,070
LOCAL OWNERSHIP:	100%
EXPORT COMPONENT:	0%
REQUESTED GRANT:	**US$ 158,070**
AGENCY SUPPORT COST:	**US$ 12,646**
TOTAL COST TO GEF :	**US$ 170,716**
COST-EFFECTIVENESS:	24.32 US$/Kg (Sector threshold of US$ 15.21/Kg/year), but Low Volume ODS Consuming Country
STATUS COUNTERPART FUNDING:	ENTERPRISE COMMITMENT RECEIVED
MONITORING MILESTONES:	INCLUDED IN PROJECT DOCUMENT
NATIONAL CO-ORDINATING AGENCY:	MINISTRY OF NATURE PROTECTION

PROJECT SUMMARY

SAGA is a 100% Armenian-owned company that manufactures a range of unitary commercial refrigeration equipment. Currently CFC 11 is used as the blowing agent in the production of the rigid PU insulation foam for the equipment cabinets and doors, while CFC 12 is used as refrigerant. Based on the year 2001 consumption figures, this project will eliminate the use of 6.5 ODP tons/year of CFC 11 and CFC 12 by conversion to the use of Water-blown PU-foam and HFC 134a respectively. Funds requested will be used to change the existing production lines, and for technology transfer, technical assistance, re-design, testing, pre-production trials, and training. Incremental Operating Costs resulting from the conversion to the new technology are calculated are not requested

Prepared: **Risto Ojala, in collaboration with the Ministry of Nature Protection, February 2002**

Reviewed by:

PROJECT COVER SHEET

COUNTRY: ARMENIA	**IMPLEMENTING AGENCY:** UNDP
PROJECT TITLE:	SAGA – PHASE-OUT OF CFC 11 & CFC 12 BY CONVERSION TO CO_2 & HFC 134a and R 404A IN THE MANUFACTURE OF COMMERCIAL REFRIGERATION EQUIPMENT
IN CURRENT BUSINESS PLAN:	Yes
SECTOR:	Commercial refrigeration
SUB-SECTOR:	Commercial refrigeration
ODS USE IN SECTOR (2001):	6,500 *ODP kg*
ODS USE AT ENTERPRISE (2001):	6,500 ODP kg CFC 11and 12
PROJECT IMPACT:	6,500 ODP kg CFC 11and 12
PROJECT DURATION:	36 Months
TOTAL PROJECT COST:	
Incremental Capital Cost:	US$ 143,700
Contingency:	US$ 14,370
Incremental Operating Savings:	US$ 82,384 (not requested, in-kind participation)
Total Project Cost:	US$ 158,070
LOCAL OWNERSHIP:	100%
EXPORT COMPONENT:	0%
REQUESTED GRANT:	**US$ 158,070**
AGENCY SUPPORT COST:	**US$ 12,646**
TOTAL COST TO GEF :	**US$ 170,716**
COST-EFFECTIVENESS:	24.32 US$/Kg (Sector threshold of US$ 15.21/Kg/year), but Low Volume ODS Consuming Country
STATUS COUNTERPART FUNDING:	Enterprise Commitment Received
MONITORING MILESTONES:	Included in Project Document
NATIONAL CO-ORDINATING AGENCY:	Ministry of Nature Protection

PROJECT SUMMARY

SAGA is a 100% Armenian-owned company that manufactures a range of unitary commercial refrigeration equipment. Currently CFC 11 is used as the blowing agent in the production of the rigid PU insulation foam for the equipment cabinets and doors, while CFC 12 is used as refrigerant. Based on the year 2001 consumption figures, this project will eliminate the use of 6.5 ODP tons/year of CFC 11 and CFC 12 by conversion to the use of Water-blown PU-foam and HFC 134a respectively. Funds requested will be used to change the existing production lines, and for technology transfer, technical assistance, re-design, testing, pre-production trials, and training. Incremental Operating Costs resulting from the conversion to the new technology are calculated are not requested

Prepared: **Risto Ojala, in collaboration with the Ministry of Nature Protection, February 2002**

Reviewed by:

PROJECT OF THE GOVERNMENT OF THE REPUBLIC OF ARMENIA

SAGA – PHASE-OUT OF CFC 11 & CFC 12 BY CONVERSION TO CO_2 & HFC 134a and R 404A IN THE MANUFACTURE OF COMMERCIAL REFRIGERATION EQUIPMENT

1. PROJECT OBJECTIVE

The objective of this project is to phase-out the use of CFCs 11 and 12 at the enterprise SAGA in the manufacture of unitary commercial refrigeration equipment including display cases, bottle coolers, chest freezers, vertical freezers, and visicoolers.

2. & 3. SECTOR BACKGROUD & ENTERPRISE BASELINE DATA

SAGA is only enterprise in the commercial refrigerator sector in the Republic of Armenia and it is a 100% nationally owned company which was founded in April 1992. SAGA's current product range includes display cases, chest freezers and - coolers, bottle coolers, and visicoolers. The production of 6,000 units of such equipment consumed 2.0 tonnes of CFC 11 and 4.5 tonnes of CFC 12 during the year 2001.

75% of SAGA's production during the year 2001 was sold in The Republic of Armenia and the remainder 25% to CIS countries. Equipment is marketed under the "SAGA" brand name.

SAGA presently operates their rigid polyurethane foaming in manual stationary foaming unit. The chemicals are mixed in the small mixing vessel, from which PU-chemical mixture is poured in the chest freezer body cavity. Remainder of manufactured products are insulated by means of expanded polystyrene sheets.

The total CFC consumption during the year 2001 100% of the total CFC consumption in the commercial refrigeration manufacturing sector in the same time period.

A UNDP consultant visited the enterprise in February 2002, found that the plant was in full operation and that the company is financially sound.

The enterprise employs 79 persons.

More detailed baseline data on SAGA is provided in **ANNEX 1**.

4. PROJECT DESCRIPTION

SAGA uses CFC 11 as the blowing agent for the production of the rigid PU insulation foams needed for the chest freezer, visicooler cabinets and doors. Remainder of products are insulated by means of expanded polystyrene sheets. CFC 12 is the major refrigerant. R-502 use is circa 300 kg. The total consumption in 2001, and the ODP tons that will be eliminated by this project are shown in the following table:

Enterprise	CFC 11 (tons)	ODP tons eliminated (see Note*)	CFC 12 (tons)	R-502 (tons)	ODP (tons)	Total ODP Tons eliminated
SAGA	2.0	2.0	4.5	0.3	0.084	6.58

4.1. REPLACEMENT OF CFC 11 WITH CO_2 (Water blown PU foam)

SAGA will phase-out the use of CFC 11 in it's PU foaming operations by replacement with water blown PU-foam.

The enterprise currently has a stationary mixer for PU-chemicals. This equipment is used by the enterprise for both chest freezer cabinet and door foaming duties. A polyol/CFC 11 pre-mix is purchased and the foam equipment does not include a pre-mixer, or a chiller.

The project includes the replacement of the existing stationary mixer with a high-pressure dispenser of the required capacity (80 Kg/min) for chest freezer cabinet and door foaming applications at a cost of US$ 80,000 (due to deficit in baseline equipment, enterprise participation is 30%, US$ 24,000).The foam mixer will be destroyed/disabled following project completion. Funds are also requested for "the upgrade of electrical supply to enable the use of high pressure dispenser" (US$ 15,000), "Training" (US$ 5,000), "Test Trials" related to formulation optimisation (US$ 3,000), and "Technology Transfer/Technical Assistance" (US$ 10,000), all associated with the new foam technology.

The replacement high-pressure foam dispenser is necessary for the chest freezer cabinet and door foaming operations to provide greater formulation flexibility and the required foam quality, and to be able to process the higher viscosities and mixing requirements of both water-blown, and eventually the established, or developing, zero-ODP systems. It is noted that modifications to the replacement high pressure machine, and a polyol/auxiliary blowing agent pre-mixer plus associated equipment will be necessary to enable it to safely handle a flammable blowing agent such as cyclo-pentane.

Nett Incremental Operating Costs of US$ 2,622 associated with the technology change from CFC 11 to water-blown are shown for a period of TWO YEARS only for the illustrative purposes, but are not requested.

Formulation changes will be needed to optimise the insulation value, structural stability, and density of the PU foam produced with water-blown foam. 20% increase in foam density is envisaged, but the better yield of foaming will compensate the density increase.

4.2. REPLACEMENT OF CFC 12 WITH HFC 134a

HFC 134a is universally accepted as a zero-ODP replacement for CFC 12 in the manufacture of small hermetic compressor based commercial refrigeration equipment designed for operation in the mid-temperature range. The technology is mature, and this is the CFC 12 replacement technology selected by

SAGA

The baseline equipment related to the use of CFC 12 refrigerant includes an evacuation and CFC 12 charging station of in-house design, compressor pumps acting as vacuum pumps. Leaks are tested by means of nitrogen pressure.

The existing CFC 12 charging system will be replaced to facilitate the use of HFC 134a at a cost of US$ 18,000. It should be noted that whilst the total annual production volume of commercial refrigeration equipment at SAGA is only 6,000 units, this cannot be converted to a daily average rate of around 26 units as usually large orders are received for urgent delivery. This is taken into account in the requested funding for the replacement charging station. Other costs associated with CFC 12 replacement include two new vacuum pumps (US$ 5,000), one vacuum gauge (US$ 500), two halogen leak detectors (US$ 1,400), one 4-way manifold group & electronic charging scale (US$ 1,000), and funding for training (US$ 5,000), re-design, prototyping, testing, pilot scale production, and reliability test trials (US$ 25,000), and technology transfer/technical assistance (US$ 10,000) related to the new HFC 134a R-404A refrigerant technology.

The requested funding of US$ 25,000 for the tasks of re-design, prototyping, testing, pilot scale production, and reliability test trials reflects the fact that some 11 different models of commercial refrigeration equipment are involved. The unit materials costs for the different models ranges from US$ 250 to US$ 600, and prototyping costs alone are expected to amount to almost US$ 8,000. Pilot scale production of 25 units for reliability test trials to "prove" the SAGA process is expected to cost at least another US$ 12,000. With the additional eligible costs associated with re-design and testing, the requested funding of US$ 25,000 is realistic.

The new CFC replacement technology will be developed in-house with assistance from the enterprise's compressor, refrigerant, equipment, and chemicals suppliers. Additional support will be provided by the relevant UNDP consultants.

Incremental Operating Costs (US$ 79,767) associated with the technology change from CFC 12 to HFC 134a are shown for a period of TWO YEARS only for the illustrative purposes, but are not requested.

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HFC 134a, like CFC 12, is non-flammable. HFC 134a has also been the subject of extensive toxicological testing and is considered safe for use in industrial applications provided the suppliers recommended occupational exposure levels are not exceeded. At the present time, this means ensuring that exposure levels do not exceed 1,000 parts per million on an 8-hour time-weighted average basis. This is the same as the Occupational Exposure Limit (OEL)/Threshold Limit Value (TLV) for CFC 12 and thus no changes from current practices are required.

A reduction of approximately 10% in the mass charge of HFC 134a compared with CFC 12 for a refrigeration system of the same capacity may be anticipated, although this depends on the capacity of the selected replacement compressor. This is taken into account in the calculation of the incremental operational costs.

The chemical stability of HFC 134a/POE based synthetic lubricant systems in unitary commercial refrigeration systems, and hence the long-term performance of the equipment, is sensitive to moisture content and certain chlorinated impurities. This requires that CFC 12 and HFC 134a handling equipment be carefully segregated, and it also calls for better evacuation of the system to an ultimate vacuum level of <250 microns prior to refrigerant charging. Two-sided (high and low pressure) pre-evacuation of the refrigerator system, and measurement of the achieved vacuum level prior to charging with HFC 134a is

recommended.

As system cleanliness and low residual moisture content are vital to the successful manufacture of HFC 134a based refrigeration systems. SAGA will need to re-assess production procedures and re-train production personnel as appropriate.

The technology change from CFC 12 to HFC 134a will involve pilot scale production and reliability test trials to "prove" the enterprise's process before full-scale production with HFC 134a. SAGA will then be manufacturing both CFC 12 and HFC 134a based equipment during the implementation phase of this project. This requires new system evacuation and refrigerant charging equipment.

Leak detection of the refrigeration system is an integral part of the manufacturing process and the use of HFC 134a requires that new leak detection equipment be employed.

5. TECHNOLOGY

5.1 REPALCEMENT OF CFC11

5.1.1 OVERVIEW

The presently preferred ODS phase-out technologies for rigid polyurethane insulating foams are:

CLASSIFICATION	LIQUID TECHNOLOGY	GAS TECHNOLOGY
LOW ODS TECHNOLOGIES ("INTERIM")	HCFC-141b	HCFC-22, -142b HCFC-22/142b
ODS-FREE TECHNOLOGIES ("PERMANENT")	(CYCLO)PENTANE ALL WATER BLOWN HFC-356, HFC-245 ISOMERS	HFC-134a

The selection of an alternative technology is governed by the following considerations:

- Proven and reasonable mature;
- Cost effective;
- Locally available, preferably in blends;
- Acceptable physical properties;
- Meeting established (Government, Company, UNDP) standards on environment and safety.

HFC-245 isomers and HFC-356 do not meet the requirements on maturity and availability. HFC-134a is difficult and expensive, compared to the other technologies. Pentane meets the selection criteria, and is a preferred solution where feasible from a safety standpoint. In cases where pentane is not feasible due to safety concerns, water blown is an acceptable permanent technology. Since there are permanent technologies available, it is not necessary to consider interim solutions.

Pentane technology is the best choice based on economical and environmental considerations. However, there are concerns that the pentane technology could not be safely incorporated into the existing workplace environment. Therefore, SAGA has chosen an all water blown solution, employing only carbon dioxide, generated from the water-isocyanate reaction, as the blowing agent. In accepting the water-blown PU-foaming

technology, SAGA understands that this technology is not the most cost-effective, but as it being a permanent solution, it is preferable for their application.

5.2. IMPACT ON THE PRODUCTION PROCESS

In water blown foams, increased polyol viscosity poses a mixing problem with the current equipment. High pressure dispensing equipment will be required to accommodate this change. High pressure equipment will also result in smaller cell structure, thus helping maintain the insulating properties of the products. Ratios between material components (polyol blend and isocyanate) will change, necessitating a change in fixed gear ratios or, preferably, a switch to variable rate dispensing equipment. Changes in reactivity and system viscosity will alter the pouring behaviour, and will require extensive trials to ensure proper processing and finished insulations of adequate quality.

5.1.3. SELECTION

SAGA has decided to adopt a zero-ODP solution employing only carbon dioxide generated from the water/isocyanate reaction.

5.2.1. REPLACEMENT OF CFC 12 and R-502

5.2.2. OVERVIEW

At the present time the commercially developed options for CFC 12 replacement as the working fluid in the manufacture of domestic and commercial refrigerators and freezers are limited to the choice between:

- HFC 134a (or HFC blends for low temperature applications).
- Hydrocarbons - iso-butane, or propane/butane blends.

HFC 134a is universally accepted as a replacement for CFC 12 in the manufacture of both domestic and commercial refrigerators and freezers. HFC 134a is widely available, the technology is mature and in use in most of the Developed Countries, as well as many Developing Countries. Replacement of CFC 12 by HFC 134a requires relatively modest changes to existing production facilities.

Both Iso-butane, and propane/butane mixtures, have been the choice of some enterprises, particularly in European countries for domestic refrigerators and some commercial refrigeration applications with small refrigerant charge sizes. Whilst there is increasing interest in the use of this technology, it has found only limited acceptance in the USA because of safety concerns relating to the flammability of hydrocarbon refrigerants. The use of hydrocarbon refrigerants always requires extensive changes to existing CFC refrigerator manufacturing facilities to ensure safe operation.

For UNDP, the transfer of hydrocarbon refrigerant technology to enterprises in Developing Countries is conditional on the support of a technology partner experienced in the production of comparable refrigerators and freezers on a commercial scale who must provide assurances on all safety issues. Hydrocarbon refrigerant technology may not then be a practical or cost effective option at many smaller scale enterprises due to the technology assistance and safety-related modifications required. Transfer of this technology also requires the availability of both compressors and hydrocarbon refrigerant of the required quality.

HFC 152a might be considered as another candidate for CFC 12 replacement in hermetic compressor based domestic and commercial, refrigeration equipment. However, HFC 152a is also flammable, the technology has not been developed commercially, and there are some questions around it's stability in refrigerator systems. Furthermore, compressors for use with HFC 152a are not commercially available.

5.2.2. SELECTION

Based on the results of discussions with compressor suppliers, plus considerations relating to scale of manufacture, refrigerant charge sizes, work-force skills, as well as product availability, the selected CFC 12 replacement technology is HFC 134a.

The new HFC 134a technology will be developed in-house by SAGA with assistance from compressor, and refrigerant suppliers. The relevant UNDP consultants will also provide assistance. Provision for this is made within the project budget and successful project completion can be anticipated.

6. PROJECT COSTS

6.1. INCREMENTAL CAPITAL COSTS

CAPITAL COST FOR CFC 11 PHASE-OUT

HIGH PRESSURE FOAM DISPENSER (80 Kg/min), WITH SINGLE MIXING HEAD, & CHILLER	80,000	
ENTERPRISE PARTICIPATION DUE TO DEFICIT IN BASELINE	-24,000	
ELECTRICAL SUPPLY FOR HP FOAMING UNIT	15,000	
TRAINING	5,000	
PRODUCTION TRIALS & FORMULATION OPTIMISATION		3,000
TECHNOLOGY TRANSFER/TECHNICAL ASSISTANCE	10,000	
Subtotal (US$)	**89,000**	

CAPITAL COST FOR CFC 12 PHASE-OUT

R134a REFRIGERANT CHARGING EQUIPMENT (1 off)	18,000	
ROTARY VANE VACUUM PUMP (2 off)	5,000	
VACUUM GAUGE	500	
HALOGEN LEAK DETECTION EQUIPMENT (2 off)	1,400	
4-WAY MANIFOLD GROUP AND ELECTRONIC CHARGING SCALE		1,000
TRAINING	5,000	
RE-DESIGN, PROTOTYPING, TESTING, PILOT SCALE PRODUCTION & RELIABILITY TEST TRIALS	25,000	
TECHNOLOGY TRANSFER/TECHNICAL ASSISTANCE	10,000	
Subtotal (US$)	**49,700**	

TOTAL INCREMENTAL CAPITAL COST (US$) **138,700**

6.2. INCREMENTAL OPERATING COSTS & BENEFITS

Incremental operating costs are shown for TWO years only for illustrative purposes, but not requested and are based on the production volume of unitary refrigeration equipment for the 12-month period during the year 2001. Details of the calculations are provided in **ANNEX 2.**

PHASE-OUT OF CFC 11 - Annual Costs for Materials:	1,507	
PHASE-OUT OF CFC 12 - Annual Costs for Materials:	45,843	
TOTAL ANNUAL INCREMENTAL OPERATING COST (US$)		**47,350**
TOTAL FOR TWO YEARS AT NPV (47,350 x 1.74)		**82,389**

6.3. TOTAL PROJECT INCREMENTAL COSTS

DESCRIPTION	US$
Capital cost for CFC 11&12 Phase-out	138,700
Evaluation Mission	5,000
Contingencies (10%)	14,370
Subtotal	158,070
Executing Agency Fees	12,646
TOTAL INCREMENTAL CAPITAL COST	170,716

TOTAL COST US$ **170,716**

% Article 5.1 Country Ownership **100%**

Based on the selected water-blown PU foaming technology this project will eliminate a total of 6,500 ODP Kg of ODS. As The Republic of Armenia qualifies as a "Low-volume Consuming Country" (LVC), it is exempt from the cost-effectiveness thresholds applied by the MLF in determining project funding eligibility. The funding requested from the GEF Council is then US$ 158,070

6.4. PROJECT COST EFFECTIVENESS

(a) TOTAL PROJECT COST = US$ 170,716

(b) LESS PROJECT SUPPORT SERVICES = US$ 12,646

(c) TOTAL ODS ELIMINATED = 6,500 ODP Kg

BASED ON THE TOTAL PROJECT COST, THE PROJECT COST-EFFECTIVENESS USING WATER BLOWN PU FOAMING TECHNOLOGY IS 24.32 US$/Kg

7. FINANCING PLAN

SAGA requests funding of US$ 158,070 representing 100% of the Incremental Capital Costs of US$ 158,070, and in line with the GEF eligible country ownership of the enterprise. (With agency support cost the total cost for the fund is US$ 170,716)

8. PROJECT IMPACT

This project will eliminate the use of 6.5 ODP tons per year. This is based on the ODS consumption during the 12 month period, in 2001.

9. PROJECT IMPLEMENTATION

9.1 MANAGEMENT

UNDP will oversee the successful implementation of this project, and will provide technical assistance during project execution.

9.2 PROJECT SCHEDULE

TASK												
	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12
PROJECT PREPARATION • MLF Approval	X											
• Preparation/Agreement of Equipment Specs. etc.		X										
• Vendor Selection & Equipment Purchase			X									
• Refrigerator System Redesign Prototyping & Testing			X	X	X							
• Component Procurement & Assembly Process Review			X	X								
• Finalise Redesign of Models for Pilot Scale Production			X	X								
• Procurement of Components for Pilot Scale production			X	X	X							
REFRIGERATION EQUIPMENT • Arrival of Refrigeration Equipment					X							
• Equipment Installation, Commissioning & Training					X	X						
• R134a Pilot Scale Production						X						
• Reliability Test Trials							X					
• Test Trial Results Evaluation								X	X			
• Mass Production with R134a									X	X		
FOAM EQUIPMENT • Arrival of Foam Equipment					X							
• Equipment Installation, Commissioning, & Training						X	X	X				
• Foam System Trials & Formulation Optimisation								X				
• Mass Production with CFC-free PU Foam								X	X			
PROJECT COMPLETION • Verification/Certification of Project Completion											X	X
PROJECT COMPLETION REPORT												X

10. MILESTONES FOR PROJECT MONITORING

MILESTONE	TARGET MONTHS	ACHIEVED	NOT ACHIEVED	DELAY IN MONTHS	REMARKS
Approved Project submitted to both Government & Beneficiary Enterprise	1				
Signature of Contract Documents	4				
Agreement of Replacement Equipment Specifications	6				
Bid Analysis, Vendor Selection, & Purchase Orders issued	12				
Delivery of Refrigeration Equipment	15				
Delivery of Foam Equipment	15				
Commissioning of Refrigeration Equipment & Pilot Scale Production with R134a	18				
Commissioning of Foam Equipment & Optimisation of WATER-BLOWN PU-Formulation	24				
Mass Production CFC-free Foam	27				
Completion of R134a Reliability Test Trials	21				
Mass Production with R134a	30				
Certification of Project Completion & Destruction/Disablement of Replaced Baseline Equipment	36				

11. ANNEXES

ANNEX 1: SAGA - Baseline Data

ANNEX 2: Incremental Operational Cost Calculations.

ANNEX 3: SAGA - "Letter of Commitment".

ANNEX 4: List of Equipment to be Retrofitted, Destroyed, or Rendered Unusable, During Project Implementation, or Following Successful Project Completion.

ANNEX 5: Project Technical Reviews.

ANNEX 1

ENTERPRISE BASELINE DATA

FULL NAME:	SAGA
ADDRESS:	8. Kievian, Yerevan, The Republic of Armenia
CONTACT PERSON:	Tigran Khachatryan - Director
TEL / FAX:	Tel:+374-1-575759 Fax: +374-1-573316 cellular: +374-9-499112, 403048
E-.mail:	saga@arminco.com, http://www.saga.am
TOTAL CAPITAL:	US$ 40,000

BASELINE EQUIPMENT:

EQUIPMENT	MAKE/MODEL	SERIAL No.	CAPACITY	YEAR	PROPOSED ACTION	DISPOSAL PLAN
1 x Sationary foam mixer	Indigenous make	Nt available	80 kg/min	Not known	Replace with 80 Kg/min HP Dispenser	Destroy & Disposal as Scrap
1 x R12 Charging Station	Enterprise Own Model	n/a	n/a	Not known	Replace for Charging R134a for Unitary Equipment	Destroy & Disposal as Scrap

BASELINE ODS CONSUMPTION DATA:

YEAR	ACTIVITY	CFC 11 CONSUMPTION (tonnes)	CFC 12 CONSUMPTION (tonnes)
1999	Unitary Refrigeration Equipment	1.4	3.0
2000	Unitary Refrigeration Equipment	1.5	4.0
2001	Unitary Refrigeration Equipment	2.0	4.5
TOTALS		4.9	11.5
Average		1.63	3.83

PRODUCTION & ODS CONSUMPTION DATA year 2001

UNITARY COMMERCIAL REFRIGERATION EQUIPMENT

Capacities 200 to 2,500 litres
Production volume 6,000 pcs
Average R12 Charge: 750 g
R12 Consumption: 4,500 kg

Compressor suppliers: Tecumesh, Embraco, Danfoss

Total Weight of PU Foam Consumed		=	13,333 Kg
Unitary Equipment PU Formulation (weight %): =	MDI		- 43.0%
	Polyol		- 42.0%
	CFC 11		- 15.0%
Consumption of CFC 11 used as PU Foam blowing agent		=	2,000 Kg
Consumption of CFC 12 used as Refrigerant		=	4,500 Kg

TOTAL CFC Consumption in 2001:

CFC 11	=	**2,000 Kg**
CFC 12	=	**4,500 Kg**
TOTAL	=	**6,500 Kg**

SHOT SIZES & CAPACITY OF REPLACEMENT HIGH PRESSURE FOAM DISPENSER, etc.

The enterprise has a total of two manual cabinet foaming jigs, and one adjustable door/panel foaming jig. The relevant data on shot sizes is provided in the following table:

The maximum shot size of PU foam is 9.800 Kg.

The foam chemicals reaction time (cream time) is 15 seconds.

The foam should be injected into the molds in 7.5 seconds (50% of the cream time) in order to facilitate good quality foam and good insulation properties.

S = M/Tc x 60

S = Size of the foaming machine (Kg/min)
M = Maximum Injection (Kg)
Tc = Critical Time to inject foam into the cavity (50% of the cream time) (seconds)

S = 9.800Kg/7.5 seconds = 1.307 Kg/second = 78.40 Kg/min

THE REQUIRED CAPACITY OF THE REPLACEMENT HIGH-PRESSURE FOAM DISPENSER IS THEN 80 Kg/minute.

OVERALL DENSITY OF EXISTING CFC 11 FOAM FORMULATION = 42.0 Kg/M3

ANTICIPATED OVERALL DENSITY OF WATER BLOWN FORMULATION= 50.4 Kg/M3

ANNEX 2

INCREMENTAL OPERATING COST CALCULATIONS

1. Incremental Operating Costs resulting from replacing the CFC 11 Blowing Agent in the PU Insulation Foam with water-blown PU-foam (US$)

SAGA	CFC 11	WATER BLOWN	Difference
Raw Material Consumption per Kg of Foam produced			
• Kg of MDI	0.460	0.520	0.06
• Kg of Polyol	0.420	0.480	0.06
• Kg of Blowing Agent	0.120		(-0.12)
Prices in US$/Kg			
• MDI	2.40	2.40	-
• Polyol/Blowing Agent Pre-mix	2.60	2.86	0.260
Cost per Kg of Foam Produced			
• MDI	1.104	1.248	0.144
• Polyol/Blowing Agent Pre-mix	1.404	1.373	(0.031)
• **TOTAL COST per Kg of FOAM**	**2.508**	**2.621**	**0.113**
Kg foam used per annum (2001)	13,333		
TOTAL ANNUAL INCREMENTAL OPERATING COST FOR CFC 11 REPLACEMENT WITH WATER BLOWN PU-FOAM (US$)	**1,507**		

2. Incremental Operating Costs resulting from replacing the CFC 12 Refrigerant with HFC 134a (US$)

SAGA	CFC 12	HFC 134a	Difference
Refrigerant			
• Cost of Refrigerant in US$/Kg	2.86	6.50	
• Kg of Refrigerant per Refrigerator (average)	0.750	0.675	
• Number of Refrigerators	6,000	6,000	
• **COST FOR REFRIGERANT**	12,870	26,325	**13,455**
Compressors			
• Cost per Compressor	47.92	52.71	
• Number of Compressors	6,000	6,000	
• **COST FOR COMPRESSORS**	287,520	316,260	**28,740**
Condensers			
• Cost per Condenser (average – see Note 2.)	n/c	n/c	
• Number of Condensers (see Note 1.)	4,500	4,500	
• **COST FOR CONDENSERS**	n/c	n/c	-
Filter/Dryers			
• Cost per Filter/Dryer (average – see Note 2.)	0.953	1.191	
• Number of Filter/Dryers (see Note 1.)	6,000	6,000	
• **COST FOR FILTER/DRYERS**	5,718	7,146	**1,428**
Capillary Tubes			
• Cost per Capillary Tube (average – see Note 2.)	1.479	1.849	
• Number of Capillary Tubes (see Note 1.)	6,000	6,000	
• **COST FOR CAPILLARY TUBES**	8,874	11,094	**2,220**
TOTAL ANNUAL INCREMENTAL OPERATING COST FOR CFC 12 REPLACEMENT WITH HFC 134a (US$)		**45,843**	

ANNEX 3

COMPANY LETTER OF COMMITMENT
(on company note paper)

.....*(enterprise name)*....., represented by Mr. ..... (*Director, or other responsible position*), hereby confirms having received a copy of an ODS phase-out project, prepared on behalf of the aforementioned enterprise and on behalf of the Government of Paraguay by the United Nations Development Programme (UNDP).

..... *(enterprise name)* ..... hereby acknowledges the following:

a) It agrees that the UNDP / UNOPS will implement this project as approved by the GEF and as described in the project document, for which ..... *(enterprise name)* ..... will be one of the beneficiaries;

b) It accepts the project as proposed in the project document;

c) It will completely phase-out the use of CFCs upon project completion;

d) It will use only zero-ODP technologies for the aerosol filling operation as stipulated;

e) It will dispose of any equipment that has been replaced under this project in compliance with the stipulations that have been drawn up in the project document;

f) It will provide funds for items that are included in this project but are specifically excluded from funding by GEF as well as for items included in this project and required for a successful completion but that, while eligible, exceed the available budget and contingencies;

g) It will allow monitoring inspections by the UNDP or designate during project implementation and thereafter to verify proper implementation and subsequent operation without the use of CFCs.

.....
(date)

.....
(Authorised Signature & Enterprise Chop)

ANNEX 4

LIST OF EQUIPMENT TO BE RETROFITTED, DETROYED, OR RENDERED UNUSABLE, DURING PROJECT IMPLEMENTATION, OR FOLLOWING SUCCESSFUL PROJECT COMPLETION AT SAGA

EQUIPMENT TO BE REPLACED WHICH WILL BE DESTROYED/RENDERED UNUSABLE FOLLOWING SUCCESSFUL PROJECT COMPLETION:

1. FOAM EQUIPMENT

   - Stationary mixer

2. REFRIGERATION EQUIPMENT

   - 1 x evacuation and R12 charging station – enterprise own design.

EQUIPMENT TO BE RETROFITTED DURING PROJECT IMPLEMENTATION :

1. FOAM EQUIPMENT

   - No foam equipment to be retrofitted.

2. REFRIGERATION EQUIPMENT

   - No refrigeration equipment to be retrofitted

ENTERPRISE DECLARATION

1. SAGA undertakes to destroy, or render unfit for further use with ODS, the aforementioned Stationary foam mixer, and the enterprise own-design evacuation and R12 charging station.

Authorised Signature: _____

Date: _____

LIST OF EQUIPMENT TO BE RETROFITTED, DETROYED, OR RENDERED UNUSABLE, DURING PROJECT IMPLEMENTATION, OR FOLLOWING SUCCESSFUL PROJECT COMPLETION AT "SAGA"

EQUIPMENT TO BE REPLACED WHICH WILL BE DESTROYED/RENDERED UNUSABLE FOLLOWING SUCCESSFUL PROJECT COMPLETION:

1. FOAM EQUIPMENT
- Stationary mixer

2. REFRIGERATION EQUIPMENT
- 1 x evacuation and R12 charging station – enterprise own design.

EQUIPMENT TO BE RETROFITTED DURING PROJECT IMPLEMENTATION :

1. FOAM EQUIPMENT
- No foam equipment to be retrofitted.

2. REFRIGERATION EQUIPMENT
- No refrigeration equipment to be retrofitted

ENTERPRISE DECLARATION

1. SAGA undertakes to destroy, or render unfit for further use with ODS, the aforementioned Stationary foam mixer, and the enterprise own-design evacuation and R12 charging station.

Authorised Signature: Deputy director

Date: 11.03.02

«ՍԱԳԱ» SAGA 01502986

Սագա ՍՊԸ ՀՀ, Երևան, Աշտարակի 37, Կիևյան 8 հեռ.: (3 741) 53 47 75, 22 69 25. E-mail:saga@arminco.com

"SAGA" COMPANY LETTER OF COMMITMENT

"SAGA" company, represented by Mr. Yengibaryan, hereby confirms having received a copy of an ODS phase-out project, prepared on behalf of the aforementioned enterprise and on behalf of the Government of Armenia by the United Nations Development Programme (UNDP).

"SAGA" company hereby acknowledges the following:

a) It agrees that the UNDP / UNOPS will implement this project as approved by the GEF and as described in the project document, for which "SAGA" company will be one of the beneficiaries;

b) It accepts the project as proposed in the project document;

c) It will completely phase-out the use of CFCs upon project completion;

d) It will use only zero-ODP technologies for the aerosol filling operation as stipulated;

e) It will dispose of any equipment that has been replaced under this project in compliance with the stipulations that have been drawn up in the project document;

f) It will provide funds for items that are included in this project but are specifically excluded from funding by GEF as well as for items included in this project and required for a successful completion but that, while eligible, exceed the available budget and contingencies;

g) It will allow monitoring inspections by the UNDP or designate during project implementation and thereafter to verify proper implementation and subsequent operation without the use of CFCs.

March 11, 2002

Deputy director .....

Սագա ՍՊԸ ՀՀ, Երևան, Աշտոցի 37, Կիևյան 8 հեռ.: (3 741) 53 47 75, 22 69 25. E-mail:saga@arminco.com

ANNEX E
SUB-PROJECT COVER SHEETS

ANNEX E5: Subproject 2.4 : Awareness and Incentive programme

COUNTRY	: ARMENIA	**IMPLEMENTING AGENCY**	: UNDP

PROJECT TITLE : AWARENESS AND INCENTIVE PROGRAMME

IN CURRENT BUSINESS PLAN : YES (UNDER GLOBAL PROGRAMME)

SECTOR : Refrigeration

SUB-SECTOR : COMM. AND INDUS. REFRIGERATION SECTOR

ODS USE IN SECTOR

CURRENT (2000) : 154.01 ODP TONNES

ODS USE IN SUBSECTOR (ESTIMATE) : 16.59 ODP TONNES

PROJECT IMPACT : 5 ODP TONNES

PROJECT DURATION : 5 YEARS (2002-2006)

TOTAL PROJECT COST

INCREMENTAL CAPITAL COST	: US$ 446 638
CONTINGENCY	: US$ 0 (INCENTIVE PROGRAMME)
INCREMENTAL OPERATING BENEFITS	: NOT APPLICABLE (INCENTIVE PROGRAMME)
TOTAL PROJECT COST	: US $ 446 638

LOCAL OWNERSHIP : 100 %

EXPORT COMPONENT : 0 %

REQUESTED GRANT : US$ 464 902

GRANT-EFFECTIVENESS : US$ 8.9 /KG (NO THRESHOLD)

AGENCY SUPPORT COST : US$ 37 192

TOTAL PROJECT COST TO GEF : US $482,369

STATUS COUNTERPART FUNDING : See details on incentive mechanism

MONITORING MILESTONES : Included in document

NATIONAL COORDINATING AGENCY : National Ozone Office - Armenian Republic

PROJECT SUMMARY

This project is to eliminate ODS consumption in the commercial and industrial refrigeration end-user sector involving equipment replacement, retrofit solutions are neither feasible nor cost-effective. Instead, an incentive programme is being proposed. Its objective is to encourage refrigeration end-users to replace, or permanently retrofit, their existing ODS based equipment to use zero-ODP, or low-ODP refrigerants.

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

This project will eliminate the use of 5 ODP Tonnes in the refrigeration sector, and as such is important in helping the Armenian Government meet its obligations under the Montreal Protocol

Prepared by: Dr. Adham Khalil, Eng./NOU

Date: March 2002

PROJECT COVER SHEET

COUNTRY : **ARMENIAN REPUBLIC** **IMPLEMENTING AGENCY** : UNDP

PROJECT TITLE : **Awareness and Incentive programme**

IN CURRENT BUSINESS PLAN	: YES (under global programme)
SECTOR	: Refrigeration
SUB-SECTOR	: Commercial and Industrial Refrigeration sector
ODS USE IN SECTOR	
Current (2000)	: 154.01 ODP Tonnes
ODS USE IN SUBSECTOR (estimate)	: 16.59 ODP Tonnes
PROJECT IMPACT	: 5 ODP Tonnes
PROJECT DURATION	: 5 years (2002-2006)
TOTAL PROJECT COST	
Incremental Capital Cost	: US $ 446 638
Contingency	: US $ 0 (incentive programme)
Incremental Operating Benefits	: Not applicable (incentive programme)
Total Project Cost	: US $ 446 638
LOCAL OWNERSHIP	: 100 %
EXPORT COMPONENT	: 0 %
REQUESTED GRANT	: US $ 446 638
GRANT-EFFECTIVENESS	: US $ 8.9 /kg (no threshold)
AGENCY SUPPORT COST	: US $ 37 192
TOTAL PROJECT COST TO GEF	: US $ 482 369
STATUS COUNTERPART FUNDING	: See details on incentive mechanism
MONITORING MILESTONES	: Included in document
NATIONAL COORDINATING AGENCY	: National Ozone Office - Armenian Republic

PROJECT SUMMARY

Further to a survey in Armenian Republic, it has been established that due to the large number of enterprises involved, and the limited GEF funds potentially available to the Armenian Republic for projects to eliminate ODS consumption in the commercial and industrial refrigeration end-user sector between 2002 – 2006, individual enterprise projects involving equipment replacement, retrofit, or "drop-in" refrigerant solutions are neither feasible nor cost-effective. Instead, an incentive programme is being proposed. Its objective is to encourage refrigeration end-users to replace, or permanently retrofit, their existing ODS based equipment to use zero-ODP, or low-ODP refrigerants. Applications for the incentive payments will be sent to the Armenian Republic National Ozone Office during the period 2002-2006 which will oversee this programme together with UNDP. Incentive payments will be based on ODP consumption when equipment is replaced, or the cost of permanent retrofit and ODS consumption, and will range from US$ 500 – US$ 15,000.

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

This project will eliminate the use of 5 ODP Tonnes in the refrigeration sector, and as such is important in helping the Armenian Government meet its obligations under the Montreal Protocol.

Prepared by: Dr. Adham Khalil, Eng./NOU

Date: March 2002

PROJECT OF THE GOVERNMENT OF THE ARMENIAN REPUBLIC

AWARENESS AND INCENTIVE PROGRAMME

1. PROJECT OBJECTIVE

The objective of this project is to provide an incentive to the Armenian Republic enterprises, in the commercial and industrial refrigeration end-user sectors, that wish to replace or permanently retrofit their existing refrigeration equipment so as to eliminate the consumption of CFC-12 or R-502 by replacement with zero-ODP, or low-ODP refrigerants.

2. SECTOR BACKGROUND

The Armenian Republic became a Party to the Montreal Protocol on 1 October 1999 as a non-Article 5 (1) country (i.e. developed country). It subsequently started the process of ratifying the London Amendments, the Copenhagen Amendments and the other Montreal Amendments.

A Country Programme is submitted to the Global Environmental Facility (GEF) in March 2002. It showed that there was a total ODP consumption in 2000 of 173.48 ODP Tonnes of Annex A and B of Group I chemicals of which 171.18 ODP Tonnes or 89.9 percent were used in the refrigeration sector.

According to official records and interviews with importers and users, the consumption in the refrigeration sector has decreased from 202 ODP Tonnes in 1995 and to 191 ODP Tonnes in 1997 (baseline period). The baseline consumption is 196.48 ODP Tonnes. This decrease in consumption is due to the decline in the economic situation in the country, advancing age of the refrigeration equipment in the country as well as the clandestine imports of ODS. In 1998 this consumption has decreased to about 196.5 ODP Tonnes and in 1999 the consumption decreased again to 180.5 ODP Tonnes.

A general survey in the refrigeration sector was carried out by the Ministry of Nature Protection with assistance from the Global Environmental Facility through UNDP and UNEP. The survey determined that with a population of about 3.8 Million in the year 2000, there were, about 870,000 Domestic Refrigerators. There are also some 5,000 Freezers, 3,800 Shelf Refrigerators, 9,000 Display Freezers, 4,200 Commercial Refrigerators, 1,600 Cold Rooms used for conservation of fruits and at least 3 CFC-12 Chillers. There are also some 15 CFC-12 Ice cream plants and some 15 HCFC-22 Ice Cream Plants as well as some Ammonia operated plants. There are at least 95 other refrigeration equipment used in the milk industry. These use CFC-12 or HCFC-22. There are also at least 8 HCFC-22 Chillers, 115 HCFC-22 Refrigerated Trucks, and 16 HCFC-22 Wagons.

In 2000 there were a number of domestic air-conditioning systems in the country. The exact number could not be determined.

A survey is ongoing covering end users in the refrigeration sector. It is carried out by a National Consultant under the Ministry of Nature Protection of the Armenian Republic. This survey covers the commercial and industrial refrigeration end-user sector (only cold-stores). There are a number of large cold room complexes in the country. As an example the "Dzjunik Cold Rooms Complex" is in

Yerevan. It has a 13000 Tonnes capacity and has 28 Cold Rooms. Some use CFC-12 and others use Ammonia as refrigerants.

This project aims at eliminating 5 ODP Tonnes out of the consumption in this sub-sector. The balance of this consumption may be decreased thanks to the legislative measures which were already put in place in Armenian Republic.

3. GENERAL JUSTIFICATION FOR A REFRIGERATION END-USER PROJECT

A decision was taken at the 28th Meeting of the Executive Committee, providing guidance on this new sub sector (decision 28/44). The guidelines were approved for an initial period of 18 months (i.e. till the end of 2000). They require that certain conditions be met which are listed below. Our comments (mostly received from the National Ozone Office in Armenian Republic) are added in *italics*:

1. that the country has production and import controls on CFCs and CFC-based equipment in place and effectively enforces, and restricts the deployment of CFC components.

2. that the time of seeking compensation in the form of grants for end-user conversions, the country can establish that its major remaining consumption is for the servicing of refrigeration and air-conditioning equipment;

    - *As indicated in the RMP, almost all of the remaining CFC consumption is in the refrigeration-servicing sector.*

3. to establish the above, that comprehensive data on the profile of all remaining consumption has been determined and made available;

    - *It is for this reason, that UNDP has assisted Armenian Republic in the formulation of the RMP. A detailed profile of remaining consumption is included therein.*

4. that either no other possible activities would allow the country to meet its CFC control obligations, or the comparative consumer price of CFCs, relative to substitute refrigerants, has been high for the last year and is predicted to continue to increase.

    - *The project forms part of the refrigeration strategy as proposed in the RMP, together with training activities for customs officers and the completed recovery/recycling scheme. Apart from that, there are no further activities that could be funded to assist the country in meeting the CFC freeze and other Montreal Protocol control measures.*
    - *The price of CFC-12 in January 2002 was reported by the Ministry of Nature Protection of the Armenian Republic to be about 4 US$ / kg up from 2.5 US$/kg in the year 2000.*

In addition, the Executive Committee approved additional guidelines pertaining to the RMP's that puts further restrictions on the development of end-user projects (decision 31/48). It stipulates that any further assistance in the refrigeration sector should be part of the strategy of the RMP, and that only 50% of additional funds above what would normally be approved under an RMP could be obtained until the year 2007. The Government fully understands the implications of this policy, and it is for this very reason that

- *an incentive programme with limited funding is being proposed*
- *the duration of this programme is extended throughout 2006. Any enterprise that wishes to come forward with a request for an incentive, can do so whenever they decide to replace their refrigeration system anyway, and can do so between now and 2006. However, as the incentive programme will be operated on a first come, first served, basis it is expected that it will lead to early reductions in ODS consumption.*

4. TECHNOLOGY OVERVIEW AND SELECTION

The following three options are potentially available to an end-user in the commercial and industrial refrigeration sector to eliminate CFC consumption:

1. Replacement of the existing CFC based refrigeration system with a system designed to use a zero-ODP, or low-ODP refrigerant. This option requires a major investment in new equipment. New equipment based on zero-ODP refrigerants such as HFC-134a, R-404A, R-507, hydrocarbons – R-290, R-600, R-600a, and mixtures thereof, or ammonia, is commercially available and all can be considered as "once off" permanent replacement with no further change in refrigerant necessary for the lifetime of the equipment. New equipment based on the use of a low-ODP HCFC refrigerant such as HCFC-22 is also commercially available. Whilst this may currently be an environmentally acceptable solution, it should be regarded as an interim solution that will require a further change to a zero-ODP refrigerant at some future date.

2. Retrofit of existing refrigeration equipment to use a zero-ODP refrigerant. This option, that will prolong the useful lifetime of the existing equipment, is technically feasible for some but not all existing equipment. The age of the equipment, and the economics of retrofit versus replacement must be considered. The retrofit option should only be selected if the evaluation of the initial cost and operational costs over the anticipated remaining lifetime of the equipment is substantially lower than the initial and operating costs of a new installation. For newer equipment (post 1995), the initial cost of the retrofit option should be quite low as such equipment is usually designed for use with either CFC or HFC refrigerants and the procedure is thus simplified. Retrofit from a CFC refrigerant to a zero-ODP refrigerant such as HFC-134a, R-404A, R-507, or a hydrocarbon, may be regarded as a "once off" permanent solution with no further conversion of refrigerant necessary during the lifetime of the equipment.

3. Drop-in Ternary Blend Replacement Refrigerants containing HCFCs. The objective of this option is also to prolong the useful lifetime of the existing equipment but at lower initial cost. This can be achieved in some equipment by the use of ternary refrigerant blends typically containing HCFCs and HFCs, and sometimes Hydrocarbons. Blends with different properties are available to replace CFC-12, R-500, and R-502 over a wide range of operating conditions. However, in some equipment the use of these blends will also require similar system changes as in retrofit, namely a change of compressor oil and the filter dryer, and adjustment or replacement of the expansion device. Whilst the lower initial cost than retrofit to a HFC refrigerant for some equipment may be attractive, both the operating cost and availability of the refrigerant blend must be considered. Conversion from a CFC refrigerant to a low-ODP refrigerant blend that contains HCFCs must also be considered as an "interim" conversion that will require a further change to a zero-ODP refrigerant at some future date. It should also be noted that:

- By definition, a "drop-in" refrigerant implies minimal system changes and little more than simple replacement of one refrigerant with another. In this case the conversion can easily be reversed and the elimination of CFC consumption may not be sustained.
- "Drop-in" conversions from CFCs to ternary refrigerant blends containing HCFCs have seen limited application in Article 5 countries due to the poor availability and relatively high cost of these refrigerants. Such considerations are important given the high refrigerant loss rates typically found in aging commercial and industrial refrigeration equipment.
- Extra care is also necessary in the handling and use, as well as the recovery and recycling of ternary refrigerant blends containing HCFCs. Appropriate steps must be taken to avoid possible contamination of CFC-12 refrigerant being recovered for recycling under the National Recovery and Recycling programme.

In conclusion, the equipment replacement option is clearly expensive and the level of funding that could be obtained from the Global Environmental Facility would only be sufficient to cover the costs of equipment replacement at a fraction of the estimated 100 enterprises in the commercial and industrial refrigeration end-user sector. The permanent retrofit of a CFC based refrigeration system to use a zero-ODP refrigerant will be a technically, environmentally, and sound financial proposition for a number of end-user enterprises. The sustainability of CFC replacement by "drop-in" refrigerants based on ternary blends containing HCFCs is uncertain and highly dependent on refrigerant loss rates and the replacement refrigerant availability. Considering this, the potential for accidental contamination of CFC-12 during recovery and recycling activities, and the limited GEF resource that is available, the funding of "drop-in" conversions to eliminate CFC consumption is not considered the best use of available GEF funds.

Based on the foregoing technology review, rather than using all the potentially available GEF funding that a country could obtain till 2007 to eliminate CFC consumption at only a small number of the estimated end-users in the commercial and industrial refrigeration end-user sector, an incentive programme is being proposed instead. This programme is described in detail in Sections 5 and 6 of this document.

5. PROJECT DESCRIPTION

Under this project any commercial or industrial refrigeration end-user enterprise that decides to replace, or retrofit its existing CFC-12 or R-502 based refrigeration equipment can apply to receive an incentive payment towards the cost of the replacement equipment, or retrofit. Only enterprises that select replacement equipment, or retrofit based on non-CFC refrigerant technology would be eligible to receive an incentive payment.

The two components of the project are:
- Information dissemination and monitoring activities.
- Incentive programme.

The first component focuses on informing the end-users in Armenian Republic about the existence of the incentive programme and follow up on applications for incentives received from them. Activities will include
- placement of advertisements in newspapers

- printing of info-leaflets about the programme to be mailed to end-users and/or distributed to the industry associations covering the refrigeration end-users
- holding of a National Workshop targeting the end-users
- review and evaluation of the applications received by end-users
- annual meetings to report on the progress of the programme

The second component consists of the grant incentives to be provided to end-users applying for an incentive payment. The conditions whereby end-users may receive an incentive payment and the calculation of the grant amount are given in the next section of the document.

6. CONDITIONS TO BE MET TO RECEIVE AN INCENTIVE PAYMENT.

1. Sector. The enterprise must belong to the commercial or industrial refrigeration end-user sub-sector. This sub-sector includes refrigeration systems used in food-storage (cold stores and silos), fisheries, meat-processing plants, breweries, hospitals, hotels, restaurants, supermarkets, etc. Enterprises with chillers, air-conditioning, MAC, refrigerated transport (trucks, rail) are not included in this programme.

2. ODS and Alternatives. The Ozone Depleting Substances (ODS) to be eliminated under this programme will be limited to CFC's and R-502. Commercial or industrial refrigeration end-user enterprises that will be considered under this incentive payment project will therefore have to replace, or retrofit their existing CFC-12 or R-502 based refrigeration system with a non-CFC refrigerant-based system. The use of drop-in refrigerants will not be considered for an incentive payment. End-users enterprises will have a choice regarding which alternative non-CFC refrigerant-based technology they choose but the choice is limited to zero-ODP systems, or systems using simple HCFCs.

3. Duration and Modality. The programme may run during a period of six years (2002-2006). This duration could be shorter if the total funding of the incentive programme is exhausted before 2006. Enterprises, which send an application for a grant incentive, will be evaluated on a first-come first-served basis. Applications will be addressed to the National Ozone Office, Ministry of Nature Protection - Armenian Republic and the local UNDP-office in Yerevan. The international and national consultants will technically evaluate the applications. An enterprise can only apply once during the six-year period, even if it has several refrigeration systems. However, an enterprise can combine several of its systems in its request for an incentive.

4. Eligibility. Enterprises will only be eligible if they were in existence before 25 July 1995. In addition, the end-user equipment that will be replaced must also have been installed before 25 July 1995. Proof of this must be attached to the application.

An end-user enterprise wishing to apply for an incentive payment will have to include the following information in its application for an incentive payment:

- Details of the proposed conversion, which must be based on proven and mature technology.
- Details of the costs of the proposed equipment replacement, or retrofit.
- Details of the costs of the current CFC refrigerant, and the proposed replacement refrigerant.

- An estimate of the changes in performance efficiency and refrigerating capacity that will result from the conversion.
- Confirmation that it can meet established local and international safety, health, and environmental standards related to the new refrigerant.

(Note: Where existing equipment is to be replaced, the new equipment supplier will be expected to provide full technical support, and to provide all the required information on issues relating to safety, health, and the environment, during normal operation and emergency situations. Similar information in the form of Material Safety Data Sheets will be expected to be provided by the refrigerant supplier for conversions involving both equipment replacement, and retrofit.)

5. ODS Consumption. Applications must also contain information which establishes the average of the annual ODS (CFC or R-502) consumption "C" over the last 3 years, and invoices showing this ODS consumption must be attached to the application. The ODP of CFC-12 is 1.0, while the ODP of R-502 is 0.34 (according to UNEP's Refrigeration TOC handbook). For this reason, the consumption will be calculated as

"C" = "Average CFC Consumption" + 0.34 x "Average R-502 Consumption"

6. Baseline Equipment. Applications must contain information describing the current refrigeration equipment at the end-user enterprise. This description will include the nature of the equipment, model, brand, year that the equipment was installed, as well as the price at purchase, serial number, capacity, ODS-charge, etc. Copies of the purchase order and invoice should be attached to the application, if available.

7. Recovery & Recycling of the CFC-12 and R-502 Refrigerant Charges in the Baseline Equipment. The CFC-12 or R-502 refrigerant charge in the existing equipment that is to be replaced, or retrofitted, must be recovered and recycled. This should be co-coordinated through the National Recovery & Recycling Programme operated under the auspices of the National Ozone Office in Yerevan.

8. Conditions and determining the Grant "G".
The grant "G" that will be paid to the applicant depends on the consumption "C" as determined in 5. above. It will be derived from the following table:

Consumption "C" (kg)	Incentive (US$)	Cost Effectiveness Ranges US$/Kg	
		from	To
<10	500	>50	50
10-20	1,000	100	50
20-50	2,500	125	50
50-100	5,000	100	50
100-200	7,500	75	38
200-300	10,000	50	33
300-400	12,500	42	31
>400	15,000	38	<38

Following completion of the conversion, invoices must be produced by the end-user enterprise to confirm the total costs incurred by the enterprise during the conversion process involving either

equipment replacement, or retrofit. These invoices will relate to the purchase of capital cost items, to local works carried out by the enterprise, the cost of the initial charge of the replacement compressor lube oil, and to the cost of the initial new charge of the replacement refrigerant plus HFC-134a used for leak testing.

The cost data submitted by the enterprises will first be reviewed by the National Consultant who shall ensure that all of the required information has been provided. The complete cost data information, together with any comments from the National Consultant, shall then be reviewed by the International Consultant who will make a formal recommendation on the eligible level of the incentive payment to UNDP, the National Ozone Office in the Armenian Republic, and the local UNDP-office in Yerevan.

To receive the full incentive payment, an end-user enterprise must be able to demonstrate that the total costs for the conversion exceed the incentive payment as calculated based on the ODS consumption and as described above. In the case that the total costs for the conversion are less than the incentive payment as calculated based on the ODS consumption, then the incentive payment to the enterprise will be limited to the verified eligible costs incurred in the conversion.

It should also be noted that the amount "G" is based on 100 % Article-5 or CEIT ownership. Funds for part Article-5 or CEIT ownership will be reduced on the percentage of Article-5 or CEIT ownership of the enterprise.

9. Payment Modality and Destruction of Equipment.

Upon receipt of an application for an incentive payment for an enterprise, 40% of the incentive amount, or 40% of the estimated cost if this is lower than the incentive amount, can be paid up front if the documentation as described in paragraph 4. is found satisfactory and if the application itself is found to be acceptable. The eligible balance will only be paid after the conversion to non-CFC refrigerant-based equipment has been completed, the total cost data has been reviewed and the International Consultant has made a formal recommendation on the actual level of the incentive payment, and formal certification that the replaced baseline CFC refrigerant-based equipment has been destroyed/dismantled/rendered unusable with CFCs according to GEF policy decisions and guidelines. (This will involve a Certificate signed by the National Ozone Office in Armenian Republic, the National Consultant, and the enterprise together with appropriate photographic evidence). It is clearly understood that the replaced baseline equipment will never be sold to another enterprise, neither within Armenian Republic nor abroad. Since the GEF payment is only an incentive, the enterprise will be allowed to keep any scrap value of the destroyed ODS-based equipment.

7.0 PROJECT COSTS

The project budget is as follows:

Budget Line Description	US$
International Expert to provide overall guidance, evaluate incoming applications for incentive payments, follow up on these requests with the National Consultant or Subcontractor, and final review and recommendations relating to the level of incentive payment (home base with one visit to the country for workshop)	18 000
National Consultant or Subcontractor for information, monitoring activities, certification of destruction of replaced baseline equipment, and preliminary review of cost data for the conversion process.	12 000
National Workshop for informing End-Users	10 000

Local Travel within the country	5 000
Sundries (local telephone, fax, advertisements in papers, reporting)	8 000
Incentives to the End-Users	392 736
Contingencies	902
TOTAL	446 638

Notes: 1. The services of the consultants will be on a part-time basis and cover a six-year period.
2. No contingencies are being requested for this incentive-based programme.

8.0 COST EFFECTIVENESS (CE)

Cost effectiveness for the project is **US$ 446 638 / 5 000 kg = US$ 8.9 / kg**

Note. The Armenian Republic being a LVCC, the CE does not apply

9.0 PROJECT IMPLEMENTATION AND MONITORING

The contracting of the international consultant and all local activities will be implemented through National Execution. A special arrangement will be found for adequate compensation to the UNDP Country Office in Yerevan for the necessary follow-up over the 6-year period.

Year	1				2				3				4				5				6			
Quarter	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
MF Project approval	x																							
Project document signature		x																						
Contracts Awarded		x																						
National End-User Workshop			x																					
Visit International Consultant			x																					
Incentive Programme Running				x	X	x	X	x	x	x	X	X	x	x	X	x	x	x	x	x	x	X	x	
Yearly Review Meeting				x				x				X				x				x			x	
Project completed																							x	
Completion report																								x

MILESTONES FOR PROJECT MONITORING

TASK	MONTH*
(a) Project document submitted to beneficiary	**3**
(b) Project document signature	**3**
(c) Contracts awarded	**6**
(d) National Workshop Held	**9**
(e) Incentive Programme Running	**10-71**
(h) Submission of project completion report	**72**

* as measured from project approval

10. PROJECT IMPACT

This project will eliminate the use of 5 Tonnes of ODS.

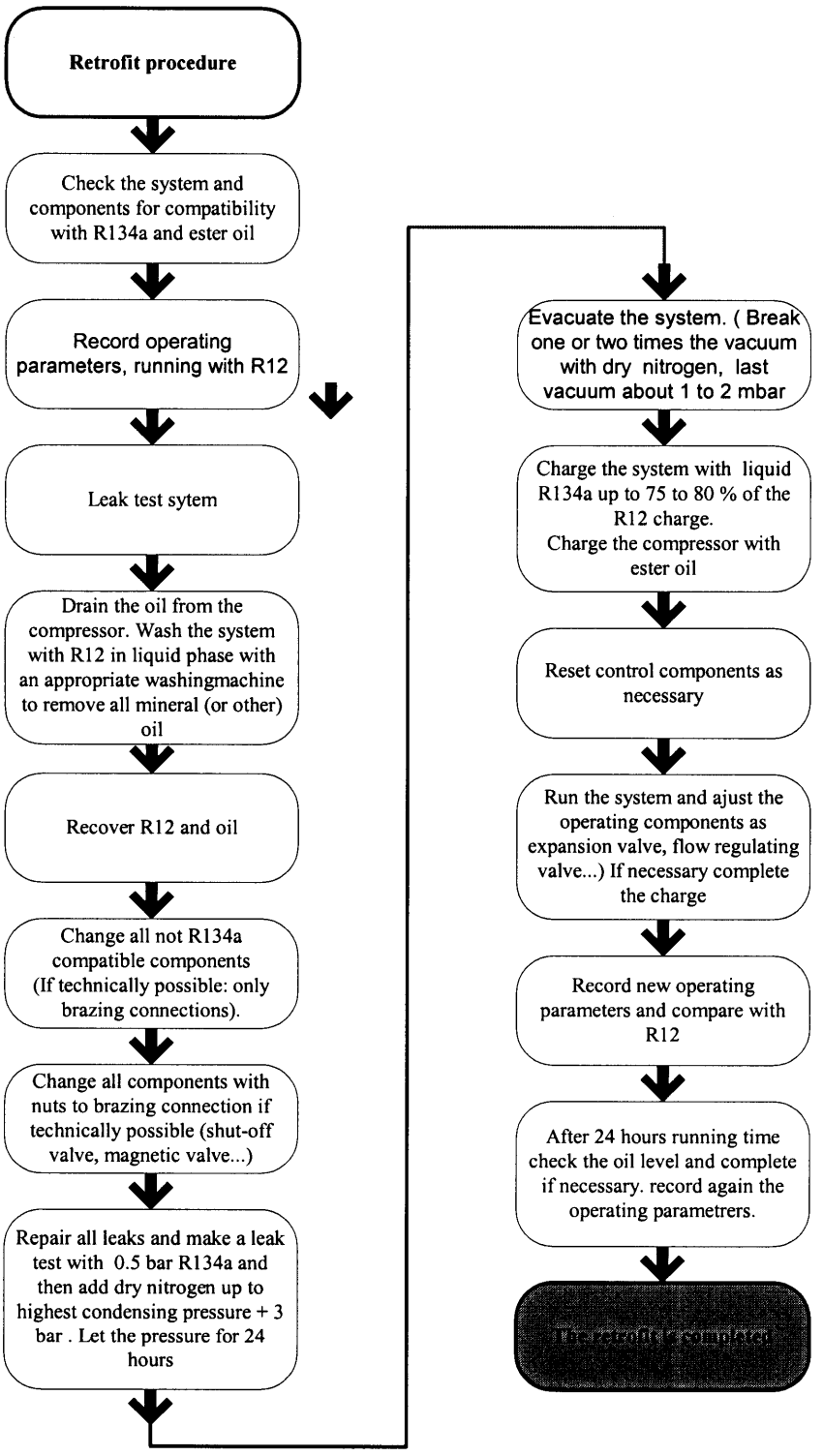
11. ANNEXES

Annex-1: Flow Chart information on Retrofit Procedure for conversion from CFC-12 to HFC-134a.

Annex-2: Letters of support

ANNEX – 1

RETROFIT PROCEDURE FOR CONVERSION FROM CFC-12 TO HFC-134a



ANNEX E
SUB-PROJECT COVER SHEETS
ANNEX E6: Subproject 2.5: Monitoring the Activities in the RMP

COUNTRY : **ARMENIAN REPUBLIC** **IMPLEMENTING AGENCY** : UNDP

PROJECT TITLE : **MONITORING THE ACTIVITIES IN THE RMP**

IN CURRENT BUSINESS PLAN		: YES
SECTOR		: *Refrigeration*
SUB-SECTOR		: REFRIGERATION
ODS USE IN SECTOR	**CURRENT (2000)**	: 158.21 ODP TONNES
ODS USE IN SUBSECTOR		: 158.21 ODP TONNES
PROJECT IMPACT		: N/A
PROJECT DURATION		: 5 YEARS (2002-2006)
TOTAL PROJECT COST		
INCREMENTAL CAPITAL COST		: US $ 50 000
CONTINGENCY		: N/A
INCREMENTAL OPERATING BENEFITS		: NOT APPLICABLE
TOTAL PROJECT COST		: US $ 50 000
LOCAL OWNERSHIP		: 100 %
EXPORT COMPONENT		: 0 %
REQUESTED GRANT		: US $ 50 000
GRANT-EFFECTIVENESS		: N/A
AGENCY SUPPORT COST		: US $ 4 000
TOTAL PROJECT COST TO GERF		: *US $ 54 000*
STATUS COUNTERPART FUNDING		: N/A
MONITORING MILESTONES		: *Included in document*
NATIONAL COORDINATING AGENCY		: NATIONAL OZONE OFFICE - ARMENIAN REPUBLIC

PROJECT SUMMARY

The project aims at monitoring the activities related to the refrigeration sector as per the Refrigeration Management Plan. These include training of refrigeration technicians in the proper modern techniques of maintenance and repairs, recovery and recycling of refrigerants specially CFC-12. A refrigeration technician will be contracted to undertake this assignment. He will report to the National Ozone Office who is responsible for all the activities relating to the Ozone Issue in the country.

IMPACT OF THE PROJECT ON COUNTRY'S MONTREAL PROTOCOL OBLIGATIONS

This project will ensure that the refrigeration projects are implemented as designed thus adhering to the phase-out schedule given in the Country Programme and as such is important in helping the Government meet its obligations under the Montreal Protocol

PREPARED BY: DR. ADHAM KHALIL, ENG. / NOU **DATE: MARCH 2002**

PROJECT COVER SHEET

COUNTRY : **ARMENIAN REPUBLIC** **IMPLEMENTING AGENCY** : UNDP

PROJECT TITLE : **Monitoring the Activities in the RMP**

IN CURRENT BUSINESS PLAN	: YES
SECTOR	: Refrigeration
SUB-SECTOR	: Refrigeration
ODS USE IN SECTOR **Current (2000)**	: 158.21 ODP Tonnes
ODS USE IN SUBSECTOR	: 158.21 ODP Tonnes
PROJECT IMPACT	: N/A
PROJECT DURATION	: 5 years (2002-2006)
TOTAL PROJECT COST	
Incremental Capital Cost	: US $ 50 000
Contingency	: N/A
Incremental Operating Benefits	: Not applicable
Total Project Cost	: US $ 50 000
LOCAL OWNERSHIP	: 100 %
EXPORT COMPONENT	: 0 %
REQUESTED GRANT	: US $ 50 000
GRANT-EFFECTIVENESS	: N/A
AGENCY SUPPORT COST	: US $ 4 000
TOTAL PROJECT COST TO GERF	: US $ 54 000
STATUS COUNTERPART FUNDING	: **n/a**
MONITORING MILESTONES	: Included in document
NATIONAL COORDINATING AGENCY	: National Ozone Office - Armenian Republic

PROJECT SUMMARY

The project aims at monitoring the activities related to the refrigeration sector as per the Refrigeration Management Plan. These include training of refrigeration technicians in the proper modern techniques of maintenance and repairs, recovery and recycling of refrigerants specially CFC-12. A refrigeration technician will be contracted to undertake this assignment. He will report to the National Ozone Office who is responsible for all the activities relating to the Ozone Issue in the country.

IMPACT OF THE PROJECT ON COUNTRY'S MONTREAL PROTOCOL OBLIGATIONS

This project will ensure that the refrigeration projects are implemented as designed thus adhering to the phase-out schedule given in the Country Programme and as such is important in helping the Government meet its obligations under the Montreal Protocol

Prepared by: Dr. Adham Khalil, Eng. / NOU

Date: March 2002

PROJECT SUMMARY

The project is to carry out the monitoring activities listed in the Refrigerant Management Plan (RMP). Its duration (five years) corresponds to the longest duration of the other RMP-activities (i.e. the awareness/incentive program).

In order to attain the objectives of the Recovery and Recycling Project, a local consultant trained in refrigeration will have to be contracted to collect the data from all the workshops that are included in the Recovery and Recycling Project. These workshops are located all over the country.

The duties of the National Consultant will also cover the other activities enumerated in the RMP.

An international Consultant shall travel to the country at regular intervals to follow up on the activities of the RMP and advise on corrective measures when and if necessary.

COST OF PROJECT

Activity or Item Number	Description	Cost in US Dollars
1	One (1) National Consultant in	36,000
2	Transportation and other logistical arrangements for the National Consultant	8,000
3	Sundries	6,000
4	Agency Support Costs (8%)	4,000
	TOTAL	54,000

Milestones: The National Consultant will produce one detailed report per year, showing the progress in the implementation of the RMP activities, and the gradual phaseout of the CFC consumption in the refrigeration sector.

ANNEX E
SUB-PROJECT COVER SHEETS

ANNEX E7: Subproject 3.1: Phase-out of CFC 11/12 mixture in the Manufacture of aerosols

COUNTRY:	ARMENIA	IMPLEMENTING AGENCY:	UNDP

PROJECT TITLE:	PHASE-OUT OF CFC 11/12 MIXTURE IN THE MANUFACTURE OF AEROSOLS BY CONVERSION TO HYDROCARBON PROPELLANT AT YEREVAN HOUSEHOLD CHEMISTRY PLANT
IN CURRENT BUSINESS PLAN:	YES
SECTOR:	AEROSOLS
SUB-SECTOR:	AEROSOLS
ODS USE IN SECTOR (AVR. 1999-2001):	14.333 *ODP TONS*
ODS USE AT ENTERPRISE (AVR. 1999-2001):	14.333 ODP TONS CFC 11/12 MIXTURE
PROJECT IMPACT:	14.333 ODP TONS CFC 11/12
PROJECT DURATION:	36 MONTHS
TOTAL PROJECT COST:	
INCREMENTAL CAPITAL COST:	US$ 192,000
CONTINGENCY:	US$ 19,200
INCREMENTAL OPERATING SAVINGS:	(US$ 10,080) (NOT DEDUCTED)
TOTAL PROJECT COST:	US$ 211,200
LOCAL OWNERSHIP:	100%
EXPORT COMPONENT:	0%
REQUESTED GRANT:	US$ 211,200
AGENCY SUPPORT COST:	US$ 16,896
TOTAL COST TO GEF :	US$ 228,096
COST-EFFECTIVENESS:	14.7 US$/Kg (Sector threshold of US$ 4.4/Kg/year), but Low Volume ODS Consuming Country
STATUS COUNTERPART FUNDING:	ENTERPRISE COMMITMENT RECEIVED
MONITORING MILESTONES:	INCLUDED IN PROJECT DOCUMENT
NATIONAL CO-ORDINATING AGENCY:	MINISTRY OF NATURE PROTECTION

PROJECT SUMMARY

The enterprise Yerevan Household Chemistry Plant is only Aerosol filler in Armenia. This project will phase-out the use of 14,333 ODP tons of CFCs The selected CFC replacement technology is hydrocarbon propellant to replace CFC 11/12. The enterprise presently is operating with three aerosol filling line. Funds are requested for covering following items, of which enterprise is willing co-finance for US$ 35,200.

IMPACT OF THE PROJECT ON COUNTRY'S MONTREAL PROTOCOL OBLIGATIONS

This project will eliminate the use of 14,333 ODP tons, and such is important in helping Armenia to comply with the 50% reduction of Annex A group 1 substances by 2005.

PREPARED:	RISTO OJALA, IN COLLABORATION WITH THE MINISTRY OF ENVIRONMENT, FEBRUARY 2002
REVIEWED BY:	HARRY B. MCCAIN

PROJECT COVER SHEET

COUNTRY: ARMENIA	**IMPLEMENTING AGENCY:** UNDP
PROJECT TITLE:	Phase-out of CFC 11/12 mixture in the Manufacture of aerosols by conversion to hydrocarbon propellant at Yerevan Household Chemistry Plant
IN CURRENT BUSINESS PLAN:	Yes
SECTOR:	Aerosols
SUB-SECTOR:	Aerosols
ODS USE IN SECTOR (avr. 1999-2001):	14.333 *ODP tons*
ODS USE AT ENTERPRISE (avr. 1999-2001):	14.333 ODP tons CFC 11/12 mixture
PROJECT IMPACT:	14.333 ODP tons CFC 11/12
PROJECT DURATION:	36 Months
TOTAL PROJECT COST:	
Incremental Capital Cost:	US$ 192,000
Contingency:	US$ 19,200
Incremental Operating Savings:	(US$ 10,080) (Not deducted)
Total Project Cost:	US$ 211,200
LOCAL OWNERSHIP:	100%
EXPORT COMPONENT:	0%
REQUESTED GRANT:	**US$ 211,200**
AGENCY SUPPORT COST:	**US$ 16,896**
TOTAL COST TO GEF :	**US$ 228,096**
COST-EFFECTIVENESS:	14.7 US$/Kg (Sector threshold of US$ 4.4/Kg/year), but Low Volume ODS Consuming Country
STATUS COUNTERPART FUNDING:	Enterprise Commitment Received
MONITORING MILESTONES:	Included in Project Document
NATIONAL CO-ORDINATING AGENCY:	Ministry of Nature Protection

PROJECT SUMMARY

The enterprise Yerevan Household Chemistry Plant is only Aerosol filler in ARMENIA. This project will phase-out the use of 14,333 ODP tons of CFCs The selected CFC replacement technology is hydrocarbon propellant to replace CFC 11/12. The enterprise presently is operating with three aerosol filling line. Funds are requested for covering following items, of which enterprise is willing co-finance for US$ 35,200.

a) the propellants' storage, destenching column system and transfer system to the gassing unit:
" Fenced Hydrocarbon Propellant Cylinder Storage Farm including, storage rack, manifolding and related piping)" (US$ 10,000), "Destenching Column System (US$ 10,000), "The replacement of existing process pump" (US$ 4,000), "Emergency Shut-off Valve" (US$ 3,000).

b) the filling line:
" Site preparation for external filling room, ground work including ground insulation and 3 x 4 meters concrete slab foundation " (US$ 5,000), " Aerosol Production Facility with Safety Controls and Gas Management Systems " (US$ 150,000), "Extract ventilation in existing production area" (US$ 5,000) "Ex-proofed lighting" (US$ 2,000), "Grounding and lightning conductor" (US$ 1,000), "Fire fighting equipment" (US$ 4,000) and "Set of quality control gauges" (US$ 3,200).

and c) assistance in designing, installation, commissioning and training:
"Technology Transfer/Technical Advisory Services/Formulation Assistance" (US$ 20,000) and Local Safety Audit" (US$ 5,000), all associated with the new filling technology.

Net annual Incremental Operating Savings for four years associated with the technology change from CFC 11/12 to hydrocarbon propellant including the increased maintenance cost associated with HAP's is calculated to be US$ 10,084.

IMPACT OF THE PROJECT ON COUNTRY'S MONTREAL PROTOCOL OBLIGATIONS

This project will eliminate the use of 14,333 ODP tons, and such is important in helping ARMENIA to comply with the 50% reduction of Annex A group 1 substances by 2005.

Prepared: Risto Ojala, in collaboration with the Ministry of Environment, February 2002
Reviewed by: Harry B. McCain,

PROJECT TO PHASE-OUT ODS CONSUMPTION IN THE MANUFACTURE OF AEROSOLS BY CONVERSION TO HYDROCARBON PROPELLANT AT YEREVAN HOUSEHOLD CHEMISTRY PLANT.

1. PROJECT OBJECTIVE

The objective of this project is to phase-out the use of CFC 11/12 in the manufacture of Aerosols at YEREVAN HOUSEHOLD CHEMISTRY PLANT by replacement with hydrocarbon propellant. The enterprise is the only aerosol manufacturing enterprise in the aerosol sector in ARMENIA.

2. AEROSOL SECTOR BACKGROUND

The aerosol sector in ARMENIA is composed only by the Yerevan Household Chemistry Plant and presently based on the end use of various aerosols and as such this project will also act as **Terminal Aerosol Sector Phase-out project**.

The conversion will eliminate the use of 14.33 ODP tons, and as such will help ARMENIA to meet the country's obligations with the Montreal Protocol, especially the 50% reduction of Annex A Group 1 substances by 2005.

3. ENTERPRISE BASELINE DATA

Yerevan Household Chemistry Plant (HCP) is a 100% Armenian privately owned company and established in 1969. The aerosol operation commenced by 1985. HCP was one of the largest producer of household chemicals in Armenia, which fully satisfied the demand of the population of republic. Earlier its products were popular also in other republics of the former Soviet Union and in Eastern Europe in Poland, Hungary and Czechoslovakia. Factory produced more than 30 items of household chemical industry. Traditionally following were manufactured; Synthetic washing pastes, laundry detergents, scouring liquids, kitchen and bath room cleaning agents, aerosol products, car care products.

In 1995, on base of Yerevan Chemical Factory was established "Yerevan Household Chemistry Plant" OJSC. Presently factory is manufacturing aerosol products (hair spray, insecticide, technical silicone and deodorants), cleaning agents, laundry detergents and other household chemicals.

A UNDP consultant visited the enterprise in February 2002, found that the plant was in full operation and that the company is financially sound. Yerevan Household Chemistry Plant operation has 25 employees, and is based in an industrial area at Yerevan. 50 % of its produce is for national consumption and remainder to Russian Federation, Ukraine and Georgia. At present it is operating with three aerosol filling line (one Latvian made and two Armenian made)

The ODS used for aerosol filling is CFC 11/12 (50%/50%). The propellant CFC 11/12 is purchased in enterprise railroad tankers. CFC 11/12 is piped through the pump unit to the gassing unit. The annual average consumption of ODS during the three year period of 1999 - 2001 was 14,333 tonnes of CFC 11/12.

The company management showed considerable awareness of current efforts to phase-out ODS use in the production plant. They are in favor of the current efforts of CFCs phase-out in the Aerosol sector. With the existing aerosol lines in the factory, Yerevan Household Chemistry Plant cannot safely use hydrocarbons.

For that purpose safety measures and related installation need to be undertaken as described in paragraph 4.2.

More detailed baseline data on Yerevan Household Chemistry Plant is provided in **ANNEX 1**.

4. PROJECT DESCRIPTION

Yerevan Household Chemistry Plant currently uses CFC 11/12 as a propellant for the production of various aerosols. The total average annual baseline consumption, including losses, during the three year period of 1999 - 2001, and the ODP tons that will be eliminated by this project, are 14.33 ODP tons.

4.1. OVERVIEW & SELECTION for REPLACEMENT OF CFC 11/12

There are different possibilities to replace CFCs as propellants for industrial production of insecticides and technical aerosols. Existing technological alternatives include:

- Utilization of finger trigger pumps;
- Utilization of non-pressurized products;
- Utilization of hydrofluorocarbon propellants
- Utilization of hydrocarbon propellants.

The first two alternatives are not commercially feasible, as these alternatives do not produce good spray patterns, and the production cost is very high as compared to utilizing hydrocarbons. In principle those alternatives are based on the introduction of either new consumer habits or design modifications of and/or additions to the cans, bottles, valves and crimping systems.

Hydrofluorocarbons (HFCs) can be easily used in formulations for any aerosol applications. Common aerosol products such as perfumes, deodorants and shaving foams, utilizing the aforementioned technology are not competitive and hence are not manufactured in commercial scale using HFCs. Therefore, most of the aerosol industry manufacturing such products has converted their production program to the utilization of hydrocarbon aerosol propellants (HAP).

During the formulation mission in February 2002, the expert discussed in detail with the enterprise the different technology options described above. Yerevan Household Chemistry Plant in evaluating the technology options to replace CFC 11/12 considered the following criteria:

- Environmental acceptability
- Physical properties including pressure of the mixture and solubility of components
- Maturity of the technology
- Safety and applicability in the enterprise factory environment
- Legislation in the country
- Price, product availability, and cost-effectiveness
- CFC 11/12 replacement technology selected by competitors/importers in the country
- MLF EXCOM decisions

Considering that the hydrocarbon aerosol propellants are the main replacements for CFCs and will be made available in the country, give good spray patterns, and do not affect the ozone layer. Yerevan Household Chemistry Plant has decided to implement the phase-out process utilizing hydrocarbon propellants for the production of Aerosols.

4.2. Process Implications of Replacing CFC 11/12 with HAP

The use of HAP technology will require substantial changes to the aerosol filling and propellant storage and handling facilities because of the highly flammable nature of the substance. The adherence to the accepted safety standards available, such as EN, NFPA, or other internationally recognized standards, are required for UNDP implemented projects, as well as conformance with the statutory safety requirements or recommendations of the Local Authorities. The safety concept that has been used in most MLMP projects is as follows:

- Classify all identified hazard areas following IEC 79-10, second edition, 1986:

  Zone 0 — Where a constant amount of highly flammable/explosive liquids or gases can be expected. Areas inside hydrocarbon propellant gassing unit, pipes and tanks are Zone 0 (level, pressure and temperature controls). Materials must be explosion proof (EX) and grounded.

  Zone 1 — Where, from time to time, highly flammable liquids or gases may be expected. Areas in external filling room are Zone 1. Materials must be EX-e, -d or -ia and grounded. Zone 1 can generally be reclassified to Zone 2 by applying sufficient ventilation.

  Zone 2 — Where only by accident or scheduled maintenance highly flammable/explosive gases may be expected. Tank storage areas, water bath and packing are generally Zone 2-nonflammable. Material required is EX-n or with IP54 sealing. Grounding is required.

- Reclassify or restrict as many areas as possible by the application of engineered solutions such as ventilation, ionizing blowers, static dissipators, separation walls, etc.;
- Safeguard areas that cannot be reclassified through explosion proofing;
- Provide additional safe guarding through the use of a combustible gas monitoring system with sensors at designated potential emission points and a portable gas detector to be used as part of a formal monitoring plan for areas that do not have continuous monitoring;
- Provide adequate emergency response gear such as fire-fighting equipment;
- Train personnel in safe operating procedures, preventive maintenance, and emergency response. Use formalized procedures through the preparation of a safety manual and an emergency response plan;
- Use of an external expert or a technology transfer agreement to supervise all designs, the implementation and the start-up. The initial production start-up after conversion should be attended by experienced operating personnel.

THE USE OF HYDROCARBONS MUST CONFORM TO THE SAFETY REQUIREMENTS OF ALL RELEVANT LOCAL AND NATIONAL AUTHORITIES

In cold climates, safety is a serious problem in the filling room. Every milliliter of liquid propellant that leaks is converted to approximately 230 ml of gas, and this is flammable at less than 2 % concentration. Such a small filling room like proposed in this project, 3 meters by 3 meters by 2 meters contains 18 m^3. When multiplying this by 1.8% (the LEL of iso-butane) and then divide by 230 (the amount of gaseous iso-butane produced when 1 ml of liquid iso-butane is vaporized), we find that less than 1.5 liters of liquid iso-butane is needed to make filling room dangerous. As 0.9 ml leaks every time a can is filled by pressure filling, by

filling 1,580 cans the LEL of this filling room has been exceeded. This is less than an hour at 30 cans per minute.

Two more factors must be treated here. Obviously, any can or valve failures that occur in the filling room release large quantities of hydrocarbon immediately in the air, which makes it quicker to reach and exceed LEL. Also, this filling room in this project is being described as if its contents were homogenized; that is , that propellant leaks spread evenly throughout the room. In practice, the density difference between of air and propellants in their gaseous form, forces hydrocarbons to move to floor level, meaning that near floor level the LEL will be reached far quicker. It must be remembered that safety of the plant depends on completely avoiding flame or sparks on one hand, and at the same time under no conceivable circumstances allowing the concentration of hydrocarbons to approach the LEL. The only known answer to avoid concentrations of gas that near LEL is ventilation; and in cold climates this means artificial ventilation. The filling room (gassing room) must be enclosed to protect people working there from the elements. In this project, attempts are made to automate the gassing. The gassing of flammable propellant must be separated from the old filling area. The hydrocarbon tank farm, modular expandable product filling and crimping unit (complete with product filler, valve inserter and crimper), the external hydrocarbon filling room and flammable gas detection will be required to accommodate this change.

The existing indexing units, product filling and crimping units will be replaced by one complete indexing unit, which then will be connected by means of additional conveyors through the existing wall into this hydrocarbon filling room, The filling room, which is to be positioned external to the factory, comprises a reinforced thermal insulated steel structure with an explosion relief area located in the roof or wall. It will be fitted with a gas detection, primary and secondary ventilation, twin independent two speed ventilation, automatic fail-safe propellant shut off and filling room management system for interlocking and controlling the entire operation. The existing production area and hydrocarbon tank farm will be connected to this gas detection / management system. Another conveyor will be required to bring filled cans back to the production area to the existing manual hot water bath. Remainder of the production process will be handled by means of existing equipment.

In addition the project will include supply of essential equipment components, installation materials, services for engineering design, installation and commissioning of the equipment required for the conversion, as well as on the job training of Yerevan Household Chemistry Plant staff. Funds are requested for

a) the propellants' storage, destenching column system and transfer system to the gassing unit:
" Fenced Hydrocarbon Propellant Cylinder Storage Farm including, storage rack, manifolding and related piping)" (US$ 10,000), "Destenching Column System (US$ 10,000), "The replacement of existing process pump" (US$ 4,000), "Emergency Shut-off Valve" (US$ 3,000).

b) the filling line:
"Site preparation for external filling room, ground work including ground insulation and 3 x 4 meters concrete slab foundation " (US$ 5,000), "Aerosol Production Facility with Safety Controls and Gas Management Systems including: Manual can loading, automated can feeding through the product filling and crimping, connecting conveyors to the external gassing room and back to the production area, external prefabricated gassing room with insulation, twin speed ventilation, primary and secondary ventilation, Gas management system with three detector heads, a gas pipe work set" (US$ 150,000) "Extract ventilation in existing production area" (US$ 5,000) "Ex-proofed lighting" (US$ 2,000), "Grounding and lightning conductor" (US$ 1,000), "Fire fighting equipment" (US$ 4,000) and "Set of quality control gauges" (US$ 3,200).

and c) assistance in designing, installation, commissioning and training:
"Technology Transfer/Technical Advisory Services/Formulation Assistance" (US$ 20,000) and Safety Audit" (US$ 5,000), all associated with the new filling technology. The services required for the proper project implementation (para 4.2 regarding safety refers) will include:

- assistance in the performance and supervision of the engineering designs for the modified plant facilities for a period of about 20 days;
- assistance in installation and commissioning of the new equipment including the gassing house and the hydrocarbons storage tank farm for about 10 days;
- assistance in training-on-the-job of the personnel of Yerevan Household Chemistry Plant in production, quality control, safety and safe operation procedures for about 10 days;
- a safety audit after the installation and before the commissioning by a recognized local safety certification body.

All other costs, which are related to the move of the production lines to the safer area will be borne by the enterprise (Yerevan Household Chemistry Plant) itself.

Net annual Incremental Operating Costs (Savings) for four years associated with the technology change from CFC 11/12 to hydrocarbon aerosol propellant are calculated to be US$ 6,280, which are, however, not deducted from the ICC, since this project can be considered as terminal aerosol sector phase-out.

5. PROJECT COSTS

5.1. ESSENTIAL INCREMENTAL CAPITAL COSTS

Description	US$ (Enterprise contribution)	US$ (GEF contribution)
Fenced Hydrocarbon Propellant Cylinder Storage Farm including, storage rack, manifolding and related piping	10,000	
Destenching Column System and related piping to the gassing room		10,000
Process pump (transfer pump)		4,000
Emergency Shut-off valve		3,000
Site preparation for external filling room, ground work including ground insulation and 3 x 4 meters concrete slab foundation	5,000	
Aerosol Production Facility with Safety Controls and Gas Management Systems including: Manual can loading, automated can feeding through the product filling and crimping, connecting conveyor to the external gassing room, external prefabricated gassing room with insulation, twin speed ventilation, primary and secondary ventilation, Gas management system with three detector heads and a gas pipe work set.*		150,000
Extract ventilation in existing production area	5,000	
Ex-proofed lighting	2,000	
Grounding and lightning conductor	1,000	

Fire control and extinguishers: 50 kg trolley mounted powder fire extinguisher, 10 units of 9 kg ABC-portable fire extinguishers	4,000	
Set of quality control gauges (crimp height, crimp diameter, pressure and vacuum)	3,200	
Technology Transfer/Technical Advisory Services/Formulation Assistance**		20,000
Local Safety Audit	5,000	
INCREMENTAL CAPITAL COST (US$)	**35,200**	**187,000**
Enterprise Contribution (US$)		35,200
TOTAL INCREMENTAL CAPITAL COST (US$)		**222,200**

Note (*):Taxes, customs and storage fees (if any) at the customs are not included in the price of machinery and will not be covered by the project funds provided by the Multilateral Fund.

Note (**): Includes technology transfer, technical advisory services, fees, travel costs, communication.

5.2. INCREMENTAL OPERATING BENEFITS

Yerevan Household Chemistry Plant is using CFC for the production of Aerosols. The main parameters to take into account when switching from CFCs to hydrocarbon are the following:

- hydrocarbons are much lighter than CFC. Therefore, if the same volume is used as for CFC to fill in the can, this latter will appear very light. For marketing reasons, in order to compensate this effect, the company will fill the cans 20% more by volume, as recommended by the UNEP aerosol conversion technology handbook,
- the final quantity of hydrocarbon used by volume will be about same as for CFC 11/12,
- the quantities for other chemicals i.e. alcohol and essential ingredients will also be changed slightly. Therefore, the I.O.C. are calculated based on the difference of prices between hydrocarbon, additives and CFCs and cost of maintenance new equipment.

Annex 2 details the calculations of the Incremental Operating Costs (benefits). The 4 years NPV of these benefits is US $ 1,208, which is not subtracted from the Incremental Capital Cost, since this project can also be considered as terminal aerosol sector phase-out project.

Incremental operating benefits are calculated for FOUR YEARS and are based on the average annual consumption during the years 1999 - 2001. Details of the calculations are provided in **ANNEX 2**.

PHASE-OUT OF CFC 11/12 - Annual Costs for Materials:	US$ 7,125
TOTAL ANNUAL INCREMENTAL OPERATING SAVINGS (US$)	US$ 7,125
TOTAL FOR FOUR YEARS (US$): 3.17 x 9,798	**US$ 22,586**

Increased maintenance cost, 2% of capital investment, 2% x US$ 197,200 x 3.17 = US$ 12,502

TOTAL OPERATING SAVINGS	**US$ 10,084**

5.3. TOTAL PROJECT INCREMENTAL COSTS

DESCRIPTION	US$
Capital cost for CFC 12 Phase-out (GEF)	187,000
Evaluation Mission	5,000
Contingencies (10%)	19,200
Subtotal	211,200
Executing Agency Fees	16,896
TOTAL INCREMENTAL CAPITAL COST FOR GEF	228,096

TOTAL COST FOR THE FUND **US$ 228,096**
% GEF eligible Ownership **100%**

5.4. PROJECT COST EFFECTIVENESS & FUNDING REQUESTED FROM GEF

(a) TOTAL PROJECT COST	= US$ 228,096
(b) LESS PROJECTS SUPPORT SERVICES	= US$ 16,896
(c) TOTAL ODS ELIMINATED	= 14,333 ODP Kg
PROJECT COST-EFFECTIVENESS (a-b)/c	**US$ 14.7/Kg**

6. FINANCING PLAN

The total project incremental costs are US$ 246,400. Yerevan Household Chemistry Plant requests funding of US$ 211,200 representing 85,70 % of the Incremental Costs of US$ 246,400, in line with the GEF eligible country ownership of the enterprise. The remaining balance of US$ 35,200 will be shouldered by Yerevan Household Chemistry Plant.

7. PROJECT IMPACT

This project will eliminate, with the use of 14,333 ODP kg per year. This is based on the annual average ODS consumption during the three year period of 1999-2001.

8. PROJECT IMPLEMENTATION

8.1 MANAGEMENT

UNDP will oversee the successful implementation of this project, and will provide technical advice during project execution. The implementation of all project activities will be carried out according to the UNDP rules, regulations and procedures.

The project will include the supply of some equipment, installation materials, safety and quality control devices, which are necessary for the safe performance of the production process utilizing Hydrocarbon Propellant, also devices for the design, installation and commissioning and on-the-job training services for Yerevan Household Chemistry Plant's staff, as conditional above. In order to guarantee a proper transfer, in particular of the new aerosol technology using the highly flammable hydrocarbon propellants, the selected contractor (technology and equipment supplier) is requested to issue "an operational Safety Statement" according to internationally recognized safety certification body for the recommended technological solution.

For the operation of new technology using highly flammable and explosive materials, the authorization for the operation must be received from the related national authority; and the production line(s) has(have) to be controlled regularly by the responsible local authority in coordination with the Ozone Office. The local authority should be already involved by counterpart (Yerevan Household Chemistry Plant) in cooperation with the Ozone Office at the engineering stage of the plant modification to avoid further difficulties during construction and commissioning of the plant.

Any construction work needed to accommodate the equipment for the new aerosol technology using hydrocarbon propellant will have to be carried out by the counterpart (Yerevan Household Chemistry Plant). The relevant details are not reflected in the project document. The specifications for any construction work will be coordinated by Yerevan Household Chemistry Plant and elaborated by a local construction company after project approval and as outcome of the necessary site inspection and related discussions between plant staff, the selected international contractor (technology and equipment supplier) and UNDP project staff. It is estimated that 36 months following the approval of the project, the complete conversion of the production line addressed by this project document will have been carried out. The proposed tentative work plan for the project implementation is indicated below, followed by the corresponding table with the milestones for monitoring of the project.

PROJECT SCHEDULE

IMPLEMENTATION SCHEDULE

Activities / Months	3	6	9	12	15	18	21	24	27	30	33	36
GEF Project approval	X											
Submit Project doc. For signature	X											
Project document signature	X											
Equipment specifications verification		X	X									
Equipment procurement				X	X	X						
Installation /retrofitting of equipment						X	X	X				
Training							X	X	X			
Testing and trials								X	X	X		
Production start-up										X		
Phase in										X		
Project completed											X	
Completion report												X

9. MILESTONES FOR PROJECT MONITORING

MILESTONES FOR PROJECT MONITORING

TASK	MONTH*
(a) Project document submitted to beneficiary	3
(b) Project document signature	3
(c) Bids prepared and requested	6-9
(d) Contracts Awarded	12-18
(e) Equipment Delivered	18-24
(f) Training Testing and Trial Runs	24-30
(g) Commissioning	30-33

* as measured from project approval

10. REQUIRED REGULATORY ACTION

The company must contact local authorities to determine whether permits are required for use and / or storage of propane and butane.

11. ANNEXES

ANNEX 1: Yerevan Household Chemistry Plant - Baseline Data
ANNEX 2: Incremental Operational Cost Calculations.
ANNEX 3: Yerevan Household Chemistry Plant - "Letter of Commitment" .
ANNEX 4: List of Equipment to be Retrofitted, Destroyed, or Rendered Unusable, During Project Implementation, or Following Successful Project Completion.
ANNEX 5: Project Technical Reviews.

ANNEX 1

ENTERPRISE BASELINE DATA

FULL NAME:	Yerevan Household Chemistry Plant
ADDRESS:	Arshakynyats 1250, Yerevan, ARMENIA
CONTACT PERSONS:	Mr. Karen Khachatryan – Managing Director Mr. Iskhan Khachatryan – Director
TEL:	Tel. (+374-1)-48-16-30, 48-15-41 and (+374-9) 409364
FAX:	(+374-1) 53-80-17
E-mail:	aroil@excite.com
CONTACT PERSON IN THE MINISTRY OF INDUSTRY:	Mr. Mher Torchyan
TEL:	Tel. +374-1-58-96-05, +374-1-61-84-49
SHAREHOLDERS	Open Joint-Stock Company
No. of employees in aerosol operation	25 (220 in total in the company)
YEAR OF ESTABLISHMENT	1969

BASELINE EQUIPMENT:

EQUIPMENT	MAKE/ MODEL	SERIAL No.	CAPACITY / CANS/MIN	YEAR	PROPOSED ACTION	DISPOSAL PLAN
Product filler/ Crimper/Gasser/ Conveyors/Water Bath	Latvia (automatic)	Not available	16 cpm 8,000 cans/day	1985	To be replaced	To be destroyed
Product filler/ Crimper/Gasser/ Conveyors	Armenia (automatic)	Not available	8 cpm 4000 cans/day	1985	To be replaced	To be destroyed
Product filler/ Crimper/Gasser/ Conveyors	Armenia (semi-automatic)	Not available	3000 cans/day	1995	To be replaced	To be destroyed

Photographs were taken by the UNDP consultant (electronically) and can be made available if needed.

BASELINE PRODUCTION DATA - 1998 - 2000

Year	Description	Production Volume
1999	Aerosols	200,000
2000	Aerosols	120,000
2001	Aerosols	110,000
Average	Aerosols	143,333

BASELINE ODS CONSUMPTION DATA 1998 - 2000

Year	Activity	CFC 11/12 kg/year
1999	Production of Aerosols	20,000
2000	Production of Aerosols	12,000
2001	Production of Aerosols	11,000
Average	Production of Aerosols	14,333

Hence, the project is prepared based on the annual average consumption during the three year period of 1999-2001 of 14.3 MT of CFC11/12 mixture.

ANNEX 2

INCREMENTAL OPERATING COST (SAVINGS) CALCULATIONS

(The incremental operating savings are calculated for illustrative purpose, but are not deducted from the Incremental Capital Costs, since the implementation of this project facilitates complete aerosol sector phase-out and, therefore, can be considered as terminal umbrella project in the manufacture of aerosols in the Republic of Armenia)

1. Incremental Operating Benefits resulting from replacing the CFC 11/12 propellant in the aerosol manufacture (US$)

Formulations including propellant losses:

Material	CFC -formulation w-%	HAP-formulation w-%
Solvent (alcohol)	63.57%	80.75%
Perfume	0.71%	1.00%
Propellant	35.72%	18.12%

	CFC 12 formulation			HAP formulation		
Material	Consumption kg/year	Cost/kg US$	Cost US$	Consumption kg/year	Cost/kg US$	Cost US$
Solvent	25,308	1.50	37,962	30,767	1.50	46,151
Perfume	281.85	90.00	25,367	396.88	90.00	35,719
Propellant	14,333	2.20	31,533	6,902	0.85	5,867
Total	39,923		94,862	38,066		87,737
Annual savings US$	**7,125**					
The four year NPV of the Incremental Operating Savings are calculated as follows	The operating benefits 3.17 x US$ 7,125=				US$ 22,586	
	Increased maintenance cost, 2% of capital investment, 2% x US$ 337,200 x 3.17 = ...				US$ 21,378	
	Total operating savings				**US$ 1,208**	

ANNEX 4

LIST OF EQUIPMENT TO BE RETROFITTED, DESTROYED, OR RENDERED UNUSABLE, DURING PROJECT IMPLEMENTATION, OR FOLLOWING SUCCESSFUL PROJECT COMPLETION AT YEREVAN HOUSEHOLD CHEMISTRY PLANT.

EQUIPMENT TO BE REPLACED WHICH WILL BE DESTROYED/RENDERED UNUSABLE FOLLOWING SUCCESSFUL PROJECT COMPLETION:

BASELINE EQUIPMENT:

EQUIPMENT	MAKE/ MODEL	SERIAL No.	CAPACITY / CANS/MIN	YEAR	PROPOSED ACTION	DISPOSAL PLAN
Product filler/ Crimper/Gasser/ Conveyors/Water Bath	Latvia (automatic)	Not available	16 cpm 8,000 cans/day	1985	To be replaced	To be destroyed
Product filler/ Crimper/Gasser/ Conveyors	Armenia (automatic)	Not available	8 cpm 4000 cans/day	1985	To be replaced	To be destroyed
Product filler/ Crimper/Gasser/ Conveyors	Armenia (semi-automatic)	Not available	3000 cans/day	1995	To be replaced	To be destroyed

Authorised Signature: _____

Date: _____

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ՔԻՄԻԱՅԻ ԳՈՐԾԱՐԱՆ ՔԲՋ

РЕСПУБЛИКА АРМЕНИЯ
ЕРЕВАНСКИЙ ЗАВОД
БЫТОВОЙ ХИМИИ АООТ

REPUBLIC OF ARMENIA
YEREVAN HOUSEHOLD CHEMISTRY PLANT JSC

N " " 2002

YEREVAN HOUSEHOLD CHEMISTRY PLANT
LETTER OF COMMITMENT

Yerevan Household Chemistry Plant JSC, represented by Mr Khachatryan, hereby confirms having received a copy of an ODS phase-out project, prepared on behalf of the aforementioned enterprise and on behalf of the Government of Armenia by the United Nations Development Programme (UNDP).

Yerevan Household Chemistry Plant JSC hereby acknowledges the following:

a) It agrees that the UNDP / UNOPS will implement this project as approved by the GEF and as described in the project document, for which Yerevan Household Chemistry Plant JSC will be one of the beneficiaries;

b) It accepts the project as proposed in the project document;

c) It will completely phase-out the use of CFCs upon project completion;

d) It will use only zero-ODP technologies for the aerosol filling operation as stipulated;

e) It will dispose of any equipment that has been replaced under this project in compliance with the stipulations that have been drawn up in the project document;

f) It will provide funds for items that are included in this project but are specifically excluded from funding by GEF as well as for items included in this project and required for a successful completion but that, while eligible, exceed the available budget and contingencies;

g) It will allow monitoring inspections by the UNDP or designate during project implementation and thereafter to verify proper implementation and subsequent operation without the use of CFCs.

March 11, 2002

Deputy director _____

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РА Ереван, Аршакуняц 125а, Тел. (374 1) 48 15 41, Тел./Факс (374 1) 53 80 17
125a, Arshakuniats str., Yerevan RA, Tel. (374 1) 48 15 41, Tel./fax (374 1) 53 80 17
E-mail: aroil@excite.com

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[redacted]

РЕСПУБЛИКА АРМЕНИЯ

ЕРЕВАНСКИЙ ЗАВОД БЫТОВОЙ ХИМИИ АООТ

REPUBLIC OF ARMENIA

YEREVAN HOUSEHOLD CHEMISTRY PLANT JSC

" " 2002

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LIST OF EQUIPMENT TO BE RETROFITTED, DETROYED, OR RENDERED UNUSABLE, DURING PROJECT IMPLEMENTATION, OR FOLLOWING SUCCESSFUL PROJECT COMPLETION AT YEREVAN HOUSEHOLD CHEMISTRY PLANT JSC

EQUIPMENT TO BE REPLACED WHICH WILL BE DESTROYED/RENDERED UNUSABLE FOLLOWING SUCCESSFUL PROJECT COMPLETION:

1. FOAM EQUIPMENT
- Stationary mixer

2. REFRIGERATION EQUIPMENT
- 1 x evacuation and R12 charging station -- enterprise own design.

EQUIPMENT TO BE RETROFITTED DURING PROJECT IMPLEMENTATION :

1. FOAM EQUIPMENT
- No foam equipment to be retrofitted.

2. REFRIGERATION EQUIPMENT
- No refrigeration equipment to be retrofitted

ENTERPRISE DECLARATION

1. YEREVAN HOUSEHOLD CHEMISTRY PLANT JSC undertakes to destroy, or render unfit for further use with ODS, the aforementioned Stationary foam mixer, and the enterprise own-design evacuation and R12 charging station.

Authorised Signature: _____ Deputy director

Date: March 11, 2002

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125a, Arshakuniats str., Yerevan RA, Tel. (374 1) 48 15 41, Tel./fax (374 1) 53 80 17
E-mail: aroil@exchte.com

ANNEX G
FUTURE BENCHMARKS/MILESTONES

Under the circumstances, the following benchmarks and phase-down steps (as developed with input from Armenia) could help ensure an orderly transition and serve to measure progress in the phase-out process until 2005. The proposed import limits are supposed to leave some room for stockpiling:

1 June 2003	Import export licensing system in place; tax on import of ODS introduced; system for licensing refrigeration technicians established; ban on import of ODS-based equipment, and import quotas for CFCs.
30 June 2005	All investment projects final (incl. R&R) completed
31 December 2006	GEF Project completed

Armenia has chosen to follow the phase-out schedules applicable to Article-5 countries.