UNITED
NATIONS

EP

United Nations
Environment
Programme

Distr.
LIMITED

UNEP/OzL.Pro/ExCom/43/42
10 June 2004

ORIGINAL: ENGLISH

EXECUTIVE COMMITTEE OF
THE MULTILATERAL FUND FOR THE
IMPLEMENTATION OF THE MONTREAL PROTOCOL
Forty-third Meeting
Geneva, 5-9 July 2004

PROJECT PROPOSAL: SERBIA AND MONTENEGRO

This document consists of the comments and recommendation of the Fund Secretariat on the following project proposal:

Phase out

- National CFC phase-out plan (first tranche) — UNIDO and Sweden

PROJECT EVALUATION SHEET
SERBIA AND MONTENEGRO

SECTOR: Phase out ODS use in sector (2003): 412 ODP tonnes

Sub-sector cost-effectiveness thresholds: n/a

Project Title:

(a) National CFC phase-out plan (first tranche)

Project Data	**Phase out**	
Enterprise consumption (ODP tonnes)		
Project impact (ODP tonnes)		412
Project duration (months)		84
Initial amount requested (US $)		632,700
Final project cost (US $):		
Incremental capital cost (a)		2,906,200
Contingency cost (b)		162,050
Incremental operating cost (c)		
Total project cost (a+b+c)		3,068,250
Local ownership (%)		100%
Export component (%)		0%
Amount requested for first tranche (US $)	464,700	168,000
Cost effectiveness (US $/kg)		7.46
Counterpart funding confirmed?		n/a
National coordinating agency	Ministry of Protection of Natural Resources and Environment Protection, Republic of Serbia	
Implementing agency	UNIDO	Sweden

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

PROJECT DESCRIPTION

1. The former Yugoslavia (including Serbia and Montenegro) ratified the Vienna Convention and the Montreal Protocol in April 1992. The ratification of the London and Copenhagen Amendments by the Government of Serbia and Montenegro is at its final stage. The Government of Serbia and Montenegro submitted a National CFC Phase-out Plan (NPP) for consideration at the 43rd Meeting of the Executive Committee. The implementation of the NPP will result in phasing out the remaining CFC consumption in the country by 2010, which was estimated to be 412 ODP tonnes in 2003.

ODS consumption

2. On the basis of Decision 35/57 the remaining CFC consumption eligible for funding was calculated at 640.1 ODP tonnes. Since the 35th Meeting, the Executive Committee has approved several investment phase-out projects and the renewal of the institutional strengthening project with a total associated phase-out of 122.3 ODP tonnes. Currently, the remaining eligible CFC consumption stands at 517.8 ODP tonnes.

3. The CFC consumption in Serbia and Montenegro has decreased from 1995 - 1996 levels due to the stagnation of economic activities in the last decade that affected all sectors. Some of the recent consumption reduction was also achieved through activities in the manufacturing sector funded by the Multilateral Fund. However, in recent years, the demand for CFC within the industry including the air-conditioning and refrigeration sector has been increasing with the recovery and improvement of the economic situation. The historical data on Article 7 CFC consumption appearing in the project document are presented in the following table:

Year	1995	1996	1997	1998	1999	2000	2001	2002	2003
Article 7 Consumption Data	820	896	832	519	549	307	262	370	412

4. A survey was conducted in 2003 to identify remaining manufacturers in aerosol, refrigeration and foam sectors that still use CFCs. As a result, 2002 and 2003 data on actual use of CFCs have been obtained on an enterprise-by-enterprise basis. The survey has been carried out in refrigeration end-user sub-sectors in order to calculate CFC consumption in the refrigeration servicing sector on the basis of 2002 data using available statistics on a number of refrigeration equipment units and applying averaged charge amounts and leakage rates. The 2003 consumption in the refrigeration servicing sector has been estimated through extrapolation of 2002 consumption using growth of about 14%. The distribution of estimated 2003 CFC consumption in ODP tonnes is shown in the table below:

Sector	Aerosol	Foam	Refrigeration manufacturing	Refrigeration service	Total
CFC-11	23	25.5	1.6	7	57.1
CFC-12	5.8	0	14	335	354.8
CFC-114	0.14	0	0	0	0.14
TOTAL	28.9	25.5	15.6	342	412

Policy instruments

5. In 1998, the Ozone Office was set up in the country when the institutional strengthening project was approved by the Executive Committee. Under the import licensing system introduced in the country, all imports of controlled ODS (Annex A, Group I) are licensed by the Ministry of Foreign Trade. The Customs service in Serbia and Montenegro is in the process of reorganizing and harmonizing to correspond with the regulations and practice of the European Union. Annex B substances will be included in the list of controlled ODS to be subject to the import licensing system during 2004. As of April 2004, a regulation banning the import of second hand refrigeration equipment has been enacted in Serbia and Montenegro.

Foam sector

6. All the manufacturing companies in the country producing rigid and flexible foam have received assistance from the Multilateral Fund and currently, they are in different stages of conversion to non-CFC based technology. The remaining consumer of CFC-11 manufactures extruded polystyrene for packaging material, and is included in the present NPP. Several other newly established SMEs produce foams. They are using non-CFC blowing agents.

7. The large foam manufacturer has chosen butane as a blowing agent. Butane technology is commercially proven and viable, cost-effective, and is available in Serbia and Montenegro. Butane, however, is highly flammable and requires stringent safety precautions. The conversion to butane technology would require modification of existing manufacturing facilities, replacement of existing CFC-11 storage, pumping and metering systems and installation of safety and alarm systems. The conversion project also includes transfer of technology, training by international experts, and safety certification.

8. Incremental costs for conversion of this enterprise are US $563,090. However, the verified CFC consumption at this enterprise in 2003 was 25.5 ODP tonnes. Therefore, the portion of eligible incremental cost of US $209,000 is requested in the NPP with a cost-effectiveness of US $8.22 per kg ODP.

Aerosol sector

9. Only one company produces pharmaceutical aerosol products with CFC propellants. In 2003 the company used 28.8 ODP tonnes of CFCs as propellants. The production of aerosols will be converted to hydrocarbon propellant technology. Because of the flammable nature of the alternative technology, stringent safety standards apply to production equipment and production and storage premises. Incremental costs are requested at US $125,000, including technology transfer, safety audit and training of personnel. The requested amount includes also US $30,000 for research, clinical testing and registration of new products. The cost-effectiveness of the project is US$ 4.34/kg ODP.

Refrigeration manufacturing sector

10. The Executive Committee has approved four investment projects, which included conversion of 11 major manufacturers of domestic, commercial and compressor refrigeration

equipment. In 2003, all of these enterprises stopped using CFCs in their production. UNIDO identified ten small- and medium-sized enterprises eligible for assistance from the Multilateral Fund which are still using 15.1 ODP tonnes of CFC-11 and CFC-12 in the production of commercial refrigeration equipment. The remaining enterprises will be converted to HFC-134a technology for refrigerant charging and to HCFC-141b transitional technology in foam operations. Incremental costs of US $227,700 are requested for modification of existing and new production equipment. The cost-effectiveness of the project is US $15.06/kg ODP.

11. UNIDO indicated that the choice of HCFC-141b as an interim technology was made by the enterprises following a discussion with them on available alternatives and relevant decisions of the Executive Committee regarding the use of HCFC-141b as an interim foam blowing agent substitute. The justification for the use of transitional technologies and the required letter from the Government are included in the proposal.

Refrigeration servicing sector

12. The refrigeration and air-conditioning service sector has the largest demand for CFC-12, and a small demand for CFC-11 and R-502. The 2002 demand for servicing in different refrigeration sub-sectors was calculated at 299 ODP tonnes including 287 ODP tonnes of CFC-12, 9.3 ODP tonnes of CFC-11 and 2.6 ODP tonnes of CFC-115. The common practice in all service sectors is to release (vent) the refrigerant from the system during most types of service and repairs. The practice of using recovery or recycling equipment is not established in Serbia and Montenegro as the price of CFC-12 has been relatively low and the supporting infrastructure (e.g. reusable cylinders) is currently not available to service enterprises. Very few service enterprises attempt to recover CFC. As there are no regulations prohibiting the release of refrigerants to the atmosphere and no capability to analyze or clean refrigerants that cannot be reused on site, recovery of refrigerants is rare in air conditioning and refrigeration installations and it only occurs for large installations. The motivation for service companies to invest in recovery equipment is low. Enterprises that have recovered CFC report problems in identifying where to send the recaptured refrigerant for reclaiming, and where to store it. The potential for long-term savings achieved with recovery/recycling equipment has not yet been recognized by the local market.

13. There are about 1,500 refrigeration servicing shops in the country employing about 2,600 servicing technicians, including about 1,500 unregistered service personnel. There are more than 20 major importers who are supplying the market in Serbia and Montenegro with CFCs and other refrigerants. Current indicative prices for CFCs and other refrigerants are presented in the table below:

Refrigerant	Unit price US $/kg	Refrigerant	Unit price US $/kg
CFC-11	3.00	HFC-134a	8.90
CFC-12	4.30	R-404A	18.50
HCFC-22	4.30	R-407C	19.10
R-502	16.00	R-410A	21.70
		R-507	19.10

14. The NPP emphasizes that urgent measures should be taken to stop the increase of the use of CFC in refrigeration servicing to enable Serbia and Montenegro to be in compliance with the 50% reduction obligation for the year 2005, followed by the 85% reduction obligation in 2007. The NPP identifies the prerequisites for successful reduction in CFC consumption in the servicing sector by changing the way that the installation and service of the equipment is carried out. This includes ensuring that emissions of refrigerants to the atmosphere are always minimized, through good service and recovery practices as well as skills to handle alternative refrigerants. This will require education for new technicians and the existing workforce, and access to the necessary equipment. Active involvement of all parties (refrigeration technicians, Government, local authorities, equipment and component suppliers, and end-users) is essential. It is also important to provide incentives for companies to apply new and better procedures and practices. A well-planned public awareness campaign targeting primarily trade companies and end users and coordinated with all other measures will be of key importance.

15. The NPP outlines the specific measures and implementation schedules to achieve the above objectives as follows:

(a) Licensing and certification schemes.

(b) Education and training of new and existing service technicians.

(c) Targeted public awareness raising activities

(d) Creation of a process to establish a "Code of Practice".

(e) Creation of a system to reuse ODS (recovery, recycling and reclamation).

(f) Legal and enforcement measures needed to drive the change.

Requested budget

16. A grant of US $3,068,250 is requested in three tranches from 2004 to 2006. The budget includes costs of project management and technical assistance calculated at US $555,000. The administration costs are: UNIDO, the lead implementing agency, 7.5 % of its project costs (US $204,881); Sweden, co-implementing agency for certain activities in the servicing sector, 13% of its project costs (US $43,745).

SECRETARIAT'S COMMENTS AND RECOMMENDATION

COMMENTS

17. At the time of submission of the project document (14 April 2004), the latest complete data submitted by Serbia and Montenegro to either the Fund or Ozone Secretariats was for 2002. The Secretariat therefore based its consumption analysis on 2002 data. This analysis indicated

that, when the claimed consumption in the servicing sub-sector was added to the consumption in the manufacturing sub-sector arising from approved investment projects in Serbia and Montenegro, the total sector consumption was greater than the figure reported under Article 7. In the context of relevant decisions of the Executive Committee the Secretariat indicated to UNIDO these data discrepancies, and queried specifically the level of consumption calculated in the project document for the servicing sub-sector, which was 44% percent greater than the reported 2002 figure.

18. Subsequently, during the review of the project, Serbia and Montenegro reported complete sectoral data for 2003 to the Fund Secretariat on 10 May 2004, and reported complete Article 7 Data for 2003 to the Ozone Secretariat on 4 June 2004. Both sets of data reflected the increases over 2002 consumption indicated in the project document, and resolved sub-sectoral discrepancies. The Secretariat completed its review on the basis of the officially reported 2003 data.

19. The Secretariat discussed at length with UNIDO and Sweden several issues related to collection and reporting of CFC consumption data, projected CFC demand and the proposed reduction schedule in the phase-out strategy. According to the NPP, the CFC consumption in Serbia and Montenegro was 263 ODP tonnes in 2001, 370 ODP tonnes in 2002, 412 ODP tonnes (estimated) in 2003, and 450 ODP tonnes (estimated) in 2004, which represented reduction/growth of -15%, 40%, 11% and 9.2%, respectively. The Secretariat indicated that, due to implementation of conversion projects in the refrigeration manufacturing sector, new non-CFC based equipment has replaced the CFC-based equipment and should be reflected in lower CFC demand for servicing. The Secretariat discussed with UNIDO the methodology for calculating CFC demand for servicing in different sub-sectors. It was agreed to reduce the calculated 2004 demand in the domestic refrigeration sub-sector by 2.0 metric tonnes. It was agreed that the estimated CFC demand in 2004 would not exceed 410 ODP tonnes.

20. The Secretariat is still discussing with UNIDO a number of outstanding issues related to the draft agreement, including incremental costs, the disbursement schedule and the CFC reduction schedule. Advice on the outcome of these discussions will be provided prior to the meeting of the Executive Committee as appropriate and taking into account the requirements of Decision 41/80.

RECOMMENDATION

21. Pending.

- - - -

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

PROJECT OF THE GOVERNMENT OF SERBIA AND MONTENEGRO

The Government of SERBIA AND MONTENEGRO requests UNIDO and Sweden to submit the project listed in Table 1 below to the Executive Committee of the Multilateral Fund for the Implementation of the Montreal Protocol for consideration at its 43rd Meeting.

Section I: ODS Consumption Data

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

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

3. The Government has been advised by the NOU that the agreement to the project provides a commitment to ensure that the phase-out of the validated consumption indicated in Table 1 below is realized and yields a sustained permanent aggregate reduction in the country's consumption of Annex A Group I substances. Accordingly, SERBIA AND MONTENEGRO acknowledges that its remaining consumption of Annex A Group I substances calculated in accordance with Decision 35/57 will be reduced by the amount of the phase-out realized.

Table 1: Projects Submitted to the 43rd Meeting of the Executive Committee

Project Title, Sector	Type of ODS	Validated Consumption (ODP Tonnes), (Year)	ODP to be Phased Out (ODP Tonnes)	Residual ODP (ODP Tonnes)	Implementing Agency
National CFC phase-out plan	CFC	412	412	0	UNIDO Sweden
Total		(X)	(Y)	(X)-(Y)	

Remaining amount of Annex A Group I substances prior to submission of the above project calculated according to Decision 35/57.	517.8 ODP tonnes
Remaining amount of Annex A Group I substances following approval of the above project.	105.8 ODP tonnes

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

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

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

6. The implementing agencies in cooperation with the National Ozone Unit are requested to conduct safety inspections where applicable and keep reports on incidences of fires resulting from conversion projects.

Section III: Projects Requiring the Use of HCFCs for Conversion

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

(a) has reviewed the specific situations involved with the project as well as its HCFC commitments under Article 2F, and

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

Name and signature of responsible Officer:

Miroslav Spasojević

Designation: Ozone Manager

Date: 24 May 2004

Serbia and Montenegro

Telephone: 381 11 2160 956

Fax: 381 11 2158 793 ; 381 11 3225 828

E-mail: smiroslav@yahoo.com

Projects of the Government of SERBIA AND MONTENEGRO *Date:* _____

PROJECT COVER SHEET

COUNTRY	**: Serbia and Montenegro**	
LEAD IMPLEMENTING AGENCY	**: UNIDO**	
CO-IMPLEMENTING AENCY	**SWEDEN**	
PROJECT TITLE	**: National CFC phase-out plan**	
PROJECT IN CURRENT BUSINESS PLAN	**: Yes**	
SECTOR	**: Multi sector**	
ODS USE IN SECTOR (2003) :	**: 412 ODP tonnes**	
PROJECT IMPACT	**: 412 ODP tonnes**	
PROJECT DURATION	**: 2004 – 2006**	
PROJECT COST	**: USD 3,068,250**	
LOCAL OWNERSHIP	**: 100%**	
EXPORT COMPONENT	**: Nil**	
REQUESTED GRANT	**: USD 3,068,250**	
COST-EFFECTIVENESS	**: USD 7.46 per kg ODP**	
IMPLEMENTING AGENCY SUPPORT COST	**: USD 248,626**	USD 204,881 (UNIDO) USD 43,745 (SWEDEN)
TOTAL COST OF PROJECT TO MULTILATERAL FUND	**: USD 3,316,876**	
FINANCING ARRANGEMENT	**: Project cost**	**Grant with support cost**
2004 tranche	**: USD 632,700**	**USD 689,393**
2005 tranche	**: USD 907,000**	**USD 980,965**
2006 tranche	**: USD 1,528,550**	**USD 1,646,519**
STATUS OF COUNTERPART FUNDING	**: N/A**	
PROJECT MONITORING MILESTONES INCLUDED	**: Yes**	
NATIONAL COORDINATING AGENCY	**: Ministry of Protection of Natural Resources and Environment Protection, Republic of Serbia**	

PROJECT SUMMARY: The present national CFC phase-out plan (NCPP) aims at phasing-out all the remaining consumption of Annex A, Group I substances (CFCs) in Serbia and Montenegro over the period of 2004 – 2010. A series of investment, non-investment, and technical support activities are proposed to assist the country to achieve this target. The present NCPP will enable the Government of Serbia and Montenegro to totally phase-out the CFC consumption by January 01, 2010. Considering this multi-faceted approach it is crucial that flexibility be given to the Government of Serbia and Montenegro to adapt or modify its strategies during implementation of this plan as the need arises.

The Government of Serbia and Montenegro requests about US$ 3 million as the total funding from the Multilateral Fund for the total consumption phase-out of all CFCs in the country. The funding will be paid out in instalments as specified in the Agreement. Being a performance based Agreement, future payments will be conditioned to meeting the performance targets and conditions specified in the Agreement. The approval of this project will substantially contribute to the ability of the country to meet its Montreal Protocol obligations.

Prepared by: SEI[1]/UNIDO/ Ministry of Protection of Natural Resources and Environment Protection, Republic of Serbia — Date: 6 April 2004

Reviewed by: being arranged — Date:

[1] Stockholm Environment Institute

CONTENTS

Chapter 1. General information and background

The present project proposal consists of a national sector CFC phase-out plan (NCPP) in Serbia and Montenegro. The proposal aims at reduction of the consumption of Annex A, Group I substances, CFCs in Serbia and Montenegro in compliance with the Montreal Protocol obligation. The plan has a duration of 7 years (funding is requested for 6 years).

The present NCPP was prepared by Ministry of Protection of Natural Resources and Environment Protection, Republic of Serbia – the Ministry in charge of ozone issues in the Republic of Serbia and Montenegro[2] with the assistance from UNIDO and Sweden, using the US$ 105,000 that was approved at the 40th meeting of the Executive Committee to assist in the preparations of an NCPP. UNIDO has assisted the country in preparing the sector plan for the manufacturing sector, and the Government of Sweden has assisted the country in preparing the sector plan for the refrigeration servicing sector.

The Union of Serbia and Montenegro (SEM) is an Eastern European union with a total area of 102,000 km^2 with a population of 10.7 million inhabitants. The industry and the country have been severely hit by the deep economic crisis in second half of the 80-ties followed by the imposed economic and political sanctions during 1992 – 1996, and the recent war conflict in 1999.

The former Yugoslavia (including Serbia and Montenegro) ratified the Vienna Convention and the Montreal Protocol in April 1992. Despite of the governmental situation in the country of recovery, the ratification of the London and Copenhagen Amendments is at the final stage at relevant Government's authorities at the level of State Union and the two member Republics. Inclusion of Annex B substances in the list of ODS submitted to the import license procedures are to be effected during 2004. Serbia and Montenegro is strongly committed to achieve the phase-out target as stipulated by the Montreal Protocol.

[2] According to the Law on Implementation of Constitutional Charter, the Ministry of Foreign Affairs and Ministry of Foreign Economic Relations is in charge of international cooperation and issues related to the Montreal Protocol. At the level of Council of Ministers of S&M (Government) there is no Ministry of Environment. Republic of Serbia has Ministry for Protection of Natural Resources and Environment and Republic of Montenegro Ministry of the Environment. To avoid duplication and overlapping, the two Republican Ministries agreed to establish system of "focal points" in charge of the implementation of international agreements and conventions where S&M is a party. According to this agreement, "focal point" for Vienna Convention and Montreal Protocol will be in the Ministry of Serbia. The system is at an early stage of implementation, but it is expected that Montreal Protocol "focal point" will be in charge of issuing import and export licenses for controlled substances, preparation of new regulation, collection and dissemination of data and similar.

Chapter 2. Impact of the proposal

2.1 Basic data on the country consumption of CFCs

Serbia and Montenegro's baseline average consumption of Annex A, Group I substances for the period from 1995 to 1997 amounted to 849.2 ODS tonnes. The country has always been in compliance with the Montreal Protocol control measures for the CFC consumption from 1999.

Relevant data for Multilateral Fund assistant scheme are given below.

Table 1. CFC Consumption data related to MFMP assistance for Serbia and Montenegro, ODP tonnes.

Baseline consumption	849.2
Starting point established by Decision 35/57	640.1
Consumption funded since the starting point	122.3
Remaining eligible consumption un-funded as of submission of the proposal	517.8

2.2 Assessment of the consumption reduction schedule

The past CFC consumption in the country is shown in Table 2. The country is in compliance with the Montreal Protocol obligation for freeze of the CFC consumption.

Serbia and Montenegro has no CFC production. All CFC consumed for manufacturing and servicing purposes are imported mainly from Western Europe. SEM is classified as a high volume consuming country.

The CFC consumption in the Serbia and Montenegro has decreased from the level in 1995 - 1996 due to the stagnation of economic activities in last decade that affected all sectors. Some of the recent consumption reduction was also achieved through activities in the manufacturing sector funded by the Multilateral Fund. However, in recent years, the demand of CFC within the industry including the air-conditioning and refrigeration sector is increasing with recovery and improvement of the economic situation, as evidenced by recent economic growth; the GDP growth rate was 5.5 % in 2001, 4 % in 2002 and 3 % (estimate) in 2003.

Table 2. CFC Consumption trend in Serbia and Montenegro

Year	1995	1996	1997	1998	1999	2000	2001	2002	2003
Article 7 Consumption Data	820	896	832	519	549	307	262	370	412

Under the present NCPP, the Government targets to reduce the CFC consumption in the schedule as given in Table 3.

Table 3. CFC Consumption reduction schedule, in ODP tonnes

Year	2003	2004	2005	2006	2007	2008	2009	2010
Montreal Protocol Reduction Schedule	849.2	849.2	424.6	424.6	127.38	127.38	127.38	0
Total consumption, all sectors	**412**	**450**	**420**	**276**	**125**	**85**	**45**	**0**
Total reduction by on-going activities, all sectors	79	0	0	0	0	0	0	0
Total reduction by new activities, all sectors	0	0	20	124	143	40	40	45
Aerosol sector	28.8	28.8	28.8	0.0	0.0	0.0	0.0	0.0
reduction by on-going			0	0	0			
reduction by new activity				29				
Foam sector	25.5	25.5	25.5	25.5	0.0	0.0	0.0	0.0
reduction by on-going	0	0	0	0	0	0	0	0
reduction by new activity	0	0	0	0	26	0	0	0
Refrigeration manufacturing sector	15.6	15.6	15.6	0.0	0.0	0.0	0.0	0.0
reduction by on-going	79	0.0	0.0	0.0				
reduction by new activity	0	0.0	0.0	15.6	0.0	0.0	0.0	0.0
Refrigeration service sector	342.0	342.0	322.0	242.0	125.0	85.0	45.0	0.0
reduction by on-going	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
reduction by new activity			30.0	100.0	125.0	40.0	40.0	45.0

As seen in Table 2, the CFC consumption has been increased in years 2001 – 2003, reflecting the economic recovery in the country. Manufacturers in refrigeration and foam sectors under the MLF assistance has practically no CFC consumption in 2003, and there is no new MLF projects, therefore no additional reduction is envisaged. Accordingly it is expected that the consumption in 2004 will be slightly increased.

In 2003, the CFC consumption in the manufacturing sector remained only in aerosol, foam and refrigeration sectors. This relatively small consumption will be phased out through relevant programmes proposed in this NCPP. The major CFC consumption exists in the refrigeration service sector. With a series of activities proposed in NCPP, the service usage of CFCs will be gradually reduced. With this arrangement, Serbia and Montenegro will achieve the 50% reduction target in 2005, 85% reduction in 2007 and zero consumption after 2010 in terms of the CFC consumption. The detail of the reduction plan is described in Chapter 4.1.1.

Chapter 3. Data collection and validation

3.1 Methodology for data collection

Data of CFC consumption

CFC Consumption data are reported to the Montreal Protocol Secretariat according to the definition of the Montreal Protocol; i.e., Consumption = Production + Import – Export. The distribution of the CFC use in the country was determined by NOU through an extensive survey of relevant industries including CFC suppliers and distributors, and a survey for the consumption in the various sectors including the servicing sector.

Data of manufacturing sector

The team of the national experts was established in the national consulting firm named MPG. Under the contract of UNIDO, the team conducted the survey of remaining manufacturers in refrigeration, foam and aerosol sectors, that still use CFCs, to identify eligible enterprises. The survey team also conducted the survey of end-users in respective sectors.

For the Survey the team has used following information resources; -

Serbian Chamber of Economy – Data bank on registered enterprises (manufacturers of refrigeration and air conditioning equipment, other manufacturing sectors using CFCs and end users);
Belgrade Chamber of Economy – Data bank on registered enterprises;
Directory of enterprises, published by Media International Group in cooperation with responsible government authorities and chambers of economy, 2002;
Quarterly journal KGH (Air conditioning, heating and refrigeration);
Data from the first country programme for phasing-out ODS in FRY, 1998;
Personal knowledge of the team members and their contacts with professional in the industrial community.

After preparation of the list of enterprises to be subject of the survey written information was send in registered mail. Set of documents was composed of following documents:

- Explanatory letter containing information concerning Montreal protocol, obligations as a party to the MP, reasons for collecting the data concerning their consumption of CFCs and the final objective of the survey, i.e. preparation of NCPP.
- Supporting letter from the Ministry of Protection of Natural Resources and Environment, giving legitimacy for the realization of this task,
- Questionnaire in Serbian language.

This communication was followed by many telephone explanations, e-mail communications and, finally, with large number of visits to manufacturers of refrigeration and air conditioning (20 companies were visited), manufacturers using CFCs in other sectors (7 companies) end users (38 end users) and consultations with other stakeholders who could give some useful information such as Ministries and other government institutions, academic institutions, professional organizations, and some importers of ODS.

As a result of the this process, information gathered are;

1. Manufacturers of refrigeration and air conditioning equipment, 24.
2. Enterprises in other sectors:
   - Foam production (soft, rigid and poly styrene), 4
   - Aerosol production (pharmaceutical industry), 4
3 End users of refrigeration and air conditioning equipment using CFC, 10

4. Non civil sector – end users of refrigeration and air conditioning as cumulative figure for consumption of CFC -11, CFC -12 and HCFC-22.
5. Importers of CFC and other controlled substances

Data of the refrigeration service sector

Sweden contracted with a national consulting firm, that has experiences with survey of the refrigeration industry and market in Serbia and Montenegro, for the collection of information required for preparation of the refrigeration service sub-sector phase out plan, including:

Estimation of total number of workshops,
Estimation of total number of technicians
Current service practices,
Potential service providers,
Market situation of CFCs,
CFCs commercial supply routes,
CFCs and alternatives trends,
Pricing and taxation of CFCs,
Industrial statistics of production and import of refrigeration and air-conditioning equipment,
Technical institutions and vocational training centres,
Industrial associations,
Governmental Agencies relevant to ODS issues,
Amount of CFCs in installed units.

The demand for CFC-12 and R-502 for servicing of refrigeration and air conditioning systems in stationary, as well as automotive/mobile equipment, is calculated based on available statistical data, data from questionnaires filled by importers, servicing companies, contractors and end users and interviews with stakeholders in each sector. CFC-11 is used to service large centrifugal chillers and for flushing all types of refrigeration and air conditioning systems to clean them from acids and other contaminants after compressor failures or other problems. The consumption of CFC-11 is based on analyses of the chiller sector and interviews with stakeholders in all sectors of the industry. Collected data has been discussed and verified with trade and stakeholders representatives in the Resource Group during several sessions of the data gathering and analysing process.

3.2 Sector distribution of the remaining eligible CFC consumption

The sector distribution of the consumption of CFCs in 2003 is given below.

Table 4. Distribution of CFC consumption in 2003

Sector	Aerosol	Foam	Refrigeration manufacturing	Refrigeration service	Total
CFC-11	23	25.5	1.6	7	57.1
CFC-12	5.8	0	14	335	354.8

CFC-113	0	0	0	0	0
CFC-114	0.14	0	0	0	0.14
CFC-115	0	0	-	-	-
TOTLAL, Metric tonnes	28.9	25.5	15.6	342	412
TOTAL, ODP tonnes	28.9	25.5	15.6	342	412

Chapter 4. General strategy of reduction of CFC consumption

4.1 Curtailing CFC demand in the manufacturing sector

A majority of the CFC usage in the aerosol sector was already reduced by the efforts of the industry without any assistance by the Multilateral Fund. The sterilant (solvent) sector usage was phased out through the implementation of the MP project. The remaining CFC consumption at one pharmaceutical aerosol manufacturer (28.8 ODP tonnes) will be phased out with the project included in the NCPP. All the consumption in these sectors will be totally phased-out either by this program or the technical assistance component in the NCPP by 2006.

On-going foam projects at two major foam manufacturers were operationally completed in the end of last year to have phased out 109 ODP tonnes of CFC-11. There are foam manufacturers in the country with approximately 70 ODP tonnes CFC use. Under the program included in the NCPP, all foam consumption of CFC will be phased out by 2007.

In the refrigeration manufacturing sector, there are ten SMEs under two umbrella projects. All of enterprises in the umbrella projects have phased out CFC usages in 2002 - 2003. The multilateral fund project with the assistance of Italy at the domestic appliance manufacturer, Obod with the impact of 95 ODP tonnes has been implemented with some delay. However, the enterprise reduced the use of CFC (majority of CFC-12 and a part of CFC-11), and the 2002 consumption was 65 ODP tonnes, and that in 2003 was zero. The project is expected to be completed by July 2004.

There are still manufacturers in the refrigeration sector relying on CFCs for production of commercial refrigeration products. The 2002 consumption was about 15 ODP tonnes, mainly CFC-12 for charging. Eligible enterprises for funding will be assisted by the project included in the NCPP, and the total CFC usage will be phased out by 2006. Through the technical assistant component in the NCPP such as workshops, and awareness promotion, non-eligible enterprises will be encouraged to convert their production technology to non-CFC technology.

As a summary, there will be no CFC consumption in the manufacturing industry by 2007. This is a very important step forward to achieve the 2007 compliance for the country.

Although the reduction of CFC consumption will be progressed significantly by implementing the NCPP in the manufacturing sector, it is also required to have phased out a part of CFC consumption in the refrigeration service sector in a few years in order to achieve the 2005 and 2007 compliance.

4.2 Curtailing CFC demand in the servicing sector

Considering the relatively long time required for realization of implication of service sector program, it is essential to start relevant activities as soon as possible. Particularly policy establishment and its enforcement for the service sub-sector as well as customs training would be urgent actions to be taken through the NCPP implementation. This will be followed by technicians training to reduce emission of CFC from installation as a result of better service practice after training, and an effective system to reuse CFC.

Through the above arrangement, the service usage of CFCs will be reduced gradually as planned in Table 3, so that the country will achieve the total phase-out of CFC consumption

4.3 Policy instruments

This chapter describes the policies that will be introduced to support the phase-out plan and its implementation, in light of the experiences to date with the policies and actions already taken to reduce production and consumption of CFCs in Serbia and Montenegro. Since the late eighties the Government of Serbia and Montenegro has been applying a policy approach using a mix of instruments in the form of voluntary agreements with private sector, adoption of legislation and regulation. The Government of Serbia and Montenegro will reinforce this approach to ensure an appropriate implementation of the phase-out program in the country.

Past policy and actions for phase-out

In 1997, through the financial assistance of the Multilateral Fund and in cooperation with UNIDO, Yugoslavia prepared its Country Programme (CP).

The ODS phase out Country Programme has two objectives; first, to provide an overview of the situation in Serbia and Montenegro with respect to ODS consumption, ODS industry structure as well as response to the Montreal Protocol by ODS consuming enterprises. Second, to realize ODS phase out strategy endorsed by the Government and other stakeholders.

The Country Programme is a reflection of commitment of Serbia and Montenegro to comply with the obligations as a party to the Montreal protocol. It provides the framework within which financial assistance from the Multilateral Fund for the realization of the Montreal Protocol is requested, especially for the implementation of ODS replacement projects at enterprise level and its effectiveness in reducing the ODS consumption in accordance with ODS phase strategy chosen.

Country Programme covers an Institutional Strengthening and 13 investment projects. Within Institutional strengthening project, "Country Ozone Office" was created at the Ministry for Development, Science and Environment, after Federal Government reconstruction located in Federal Secretariat for Development and Science. It was planed that 13 investment projects, totaling $ 9.5 million to be realized in 5 industrial sectors, will be focused on conversion from non-ozone friendly to ozone- friendly technologies.

i) Progress made with the project implementation

In 1994, the Government adopted a plan called "Plan of Action for the Ozone layer Protection' which contains series of measures with administrative and economic nature and actions to be conducted in prevision of the country compliance with the forthcoming Protocol obligations

1st July 1999 freeze of CFCs Annex A
1st January 2002 freeze of halons
1st January 2005 50% reduction Annex A substances
1st January 2007 75% reduction Annex A substances
1st January 2010 total phase out of Annex A substances.

The Ministry for Development Science and Environment was chosen as the lead department for the implementation of the CP. Two Ministries and Secretariats, Yugoslav Chamber of Economy and ODS consuming enterprises are fully involved in the program.

Acknowledging the fact that there is a need for strengthening the existing institutional framework in order to control and monitor effectively the implementation of the CP, the Federal Ministry for Development, Science and Environment created an internal management structure for ODS phase out.

In that respect, an institutional strengthening project was introduced for funding, the first three years term starting the first quarter of 1998. The set-up of this Ozone Office is on going between the government and UNIDO. Once established, the Ozone Office is the main link between the users of ODS and the Government agencies and bodies that are responsible for monitoring and controlling these substances (e.g. Ministry for Health, Custom's Office, Chamber of Economy, Bureau of Standards etc.). Among other multiple assignments, the Ozone Office will be in charge of ensuring that the CP is effectively implemented in accordance with their related timetables. Additionally, the monitoring of the ODS consumption and the reporting to the Ozone Secretariat as stipulated by the Protocol is among the main responsibilities of the Ozone Office.

ii) Progress of Country Program

In last years following activities has been done within the framework of Country Program.

Hernofarm Henionied Pharmaceutical company from Vrsac, received $ 0.62 m grant from Multilateral fund for phasing out of 54.6 MT of ODS (CFC-113), by introducing new ozone friendly technology in production of chemo - dialyzers. The project is completed.

Elektroindustria "OBOD", Cetinje, a largest manufacturer of domestic refrigerators in the country received an $ 1,683 m grant from Italy as the bilateral contribution to MFMP for replacement of CFC-11 and CFC-12 with cyclopentane and HFC-134a, as ozone friendly substances.

Chemical Industry "Prva Iskra', Earle, a largest producer of polyurethane products (soft and rigid foams), received $ 0.58 million grant for replacement of CFC-11 by methylene chloride in its two factories.

Ten small and medium size enterprises in Serbia (5 privately owned), producing commercial refrigeration equipment received $ 0.95 million grant from MFMP for replacement of CFC-11 and CFC-12 with HCFC-141b and HFC-134a as Ozone friendly substances. Project is realized in two steps; first one encompassing 7 enterprises was completed by 2002 - 2003, and 3 others by the end of 2003.

"Vatrosprem" Co., Belgrade, a largest producer of fire frightening equipment, received $ 0.25 m for establishment of 'Halon bank", one storing capacity for collecting of "used halons" before their chemical destruction. Project was realized during 2003.

Institutional strengthening project "Ozone secretariat", given $ 0,14 m grant has an overall responsibility for designing, monitoring and implementing the ODS phase out strategy.

Realization of the above-mentioned projects has twofold dimension. First, transfer to ozone-friendly technologies has positive environmental impact, at a local but also at the global level. Second, accommodation to Montreal Protocol regulations offers to these companies possibility to export their products, what would not be a case with old technologies. In the same time improved technology offers them better position in the

privatisation process and searching for strategic partner. ANNEX 1 lists approved MLF projects.

Recent policy instruments

During the NCPP preparations the NOU has reviewed information related to and examples of comprehensive import/export licensing systems that will assist SEM in the process to further develop the import/export licensing system.

All imports, and eventually of controlled ODS (Annex A, Group 1) are licensed by Ministry of Foreign Trade referring to permits issued by Ministry for Labor Health and Social Policy[3]. Any license applicant must fulfil two conditions, -

a. To be a registered end-user company, or a registered trade company in charge of supplying one ODS consuming sector or having an end-user certificate delivered by its clients. Licenses are not granted to individuals.

b. To have capabilities (skilled personnel and storage facilities) of handling chemical substances.

The Customs service in SEM is in the process of reorganization and harmonization with the regulations and practice of EU.

[3] For methyl bromide, and in the near future for Annex B substances, permits are respectively delivered by the Ministry of Agriculture and the Ministry for Development Science and Environment. Licenses (and permits) are granted for a period of one year.

Chapter 5. Manufacturing sector implementation program

5.1 Foam sector implementation program

5.1.1 Current situation of the foam sector

In Serbia and Montenegro the following types of foams are produced: rigid polyurethane (PU) foam for refrigeration, rigid PU foam for sandwich panels, flexible slab stocks for furniture and bedding, flexible moulded PU foam for automotive industry, extruded polystyrene sheets (EPS) for packaging.

There are several companies producing soft and rigid polyurethane foams and extruded polystyrene. Largest is Prva Iskra in Baric, that operates in this sector ore than 30 years. In Prva Iskra chemical complex, there are three companies using CFCs. Largest is FIM, producing rigid foams in a form of sandwich panel for construction purposes manufactured on the continuous line. This factory is at the final stage of total phase-out the use of CFC through project financed by MLF on substitution of R-11 with n-pentane. The company Prva Iskra Polyurethane within Prva Iskra Holding produces soft foams with methylenchloride already substituting R-11 under the project financed by MLF, which was completed in 2003. In Prva Iskra FIM holding, there is a small production factory for special products of rigid foam still using CFC-11 for foaming.

At the moment Laminat, Bajina Basta is largest consumer of CFC-11 for production of extruded polystyrene for production of trays for food packing and other type of packaging materials. Investment project is included in the present NCPP.

Three other small companies which have batch production of rigid foams with CFC-11 were identified in Pozega to produce insulation panels for food storage, which is important for the region.

Last year company DELTAMATIC, Mramor near Nis, started production of extruded polystyrene. It's annual consumption of blend R-22 /R-141b (40 kg/h) is about 300 tonnes. The company is planning to substitute this blend with some of hydrocarbons. There are several other SMEs newly established to produce foams. They are using non-CFC blowing agents.

In Table 5, major foam manufacturers are listed.

Table 5. Foam manufacturers in Serbia and Montenegro

Enterprise	Location	Product	CFC-11 2002 MT	CFC-11 2003 MT	Remarks
Prva Iskra FIM	Baric	PU continuous rigid panel	40	17	MP project on-going
Prva Iskra FIM Second factory	Baric	PU rigid panel	12		Using polyol pre-mixed with CFC-11
Prva Iskra, PI Polyurethani	Baric	PU flexible slab stock	35	11	MP project on-going
Deltamatic	Mramor	Extruded polystyrene	0	0	R-22 /R-141b,300 MT
Laminat	Bajina Bastra	Extruded polystyrene	72	54	Eligible for assistance
Djuka Pol	-	PU rigid foam	0	0	Phased out CFC
Mirkovic	Pozega	PU rigid foam	2	4	Using polyol pre-mixed with CFC-11
Termizol	Pozega	PU rigid foam	2	1	Using polyol pre-mixed with CFC-11
Radnik	Pozega	PU rigid foam	-	1	Using polyol pre-mixed with CFC

Listed polyurethane foam producers have started to use CFC-11 premixed polyol from 2000 in addition to neat CFC-11. CFC-11 Consumption given in Table 5 includes that in premixed polyol as well as consumption of stocked CFC-11. In 2003, Prva Iskra, Mirkovic, Termizol and Radnik use mainly CFC-11 in premixed polyol. Therefore, out of enterprises listed in Table 5, Laminat is only eligible for assistance by MLF. Detail of the company profile is given in ANNEX I.

5.1.2 Phase out plan of the foam sector

Among the alternatives currently available[4] Laminat has chosen to replace CFCs by conversion to butane as a blowing agent for production lines for extruded polystyrene. Butane technology is commercially viability and in line with the established policy of Serbia and Montenegro to phase out the use of ODSs.

Other reasons for the selection are:

- Proven technology in processing and product performance
- Environmentally friendly
- Adaptable to the existing equipment
- Cost-effective
- Available in Serbia and Montenegro in bulk delivery

[4] There are several options to replace CFC-11 from manufacturing of extruded polystyrene foamed sheets, such as atmospheric gases and their blends, hydrocarbons, including liquefied petroleum gas (LPG), HCFCs, HFCs and CO_2.

A draw back of butane is its high flammability, requiring very stringent safety precautions.

Modifications planned are as follows.

a) Retrofitting, renewal, modification, or replacing of certain parts of existing manufacturing facilities;
b) Replacement of existing CFC-11 storage, pumping and metering system with the system designed for butane;
c) Civil construction works to renew the building so that the safety standards are met. Construction of the storage facility for fresh products before transferring to a storage place.
d) Installation of fire, safety and alarm systems in the production area, butane storage area, butane pumping room and the technological storage facility to mitigate fire and explosion hazard from the use of butane;
e) Transfer of technology and training of the plant operators in the fields of production and safety by international experts.
f) Safety certification of converted plants by a specialized certification body.

The project detail and itemized incremental costs are given in Annex II.

5.2 Aerosol sector implementation program

5.2.1 Current situation of the aerosol sector

Pharmaceutical producers

In Serbia and Montenegro leading pharmaceutical companies are Hemofarm, Vrsac , Galenika, Belgrade, Zdravlje, Leskovac and Jugoremedija, Zrenjanin.

Hemofarm, Vrsac has already substituted its consumption of CFC-113 as sterilizer for production of chemo dialysers with high pressure steam through assistance of MLF (YUG/SOL/26/INV/08, impact 54.6 ODP tonnes).

Galenika is still using two types of CFC mixtures for production of two medical spray products in aerosol form in considerable quantities; over 28 tonnes on annual basis.

Until 2002, Zdravlje used CFC blends (R-11/12/114 as 23/54/23 % blend 5.784 kg) for production of two metered dose inhalers (Berotec, and Berodual). However since 2003, after privatisation of this company, these two inhalers are not produced any more, but imported from German company Boehringer Ingelhaim. Zdravlje is producing active substance for Hemik Co., Kikinda, which does service filling with deodorized iso-butane as propellant.

Jugoremedija is a consumer of one type of halogenated hydrocarbon for preparation of human anesthetics. According to information received during the field visit this product with commercial name Halotan is not ODS.

Cosmetic producers

Hemik is the largest producers of cosmetic products in spray form. However using its own resources, Hemik made substitution from CFC-11/12 consumption to iso-butane in 1992. Besides production its own cosmetics, Hemik is doing service feeling for several other producers of active substances, like the case of Zdravlje.

Table 6. Manufacturers in pharmaceutical and cosmetic industry, CFC usage in 2003 in T/year

No.	Manufacturer	Products	R-11/R-12 (80/20)	R-114/R-12 (60/40)	remarks
1.	Galenika	Medical aerosol	28.6	0.180	Eligible for funding
2.	Zdravlje	MDI Berotec, and Berodual	0	0	Stop production of MDI from 2003
3.	Jugoremedija	human anesthetics	0	0	"HALOTAN" (non ODS) is used
4.	Hemik	cosmetic spray	0	0	use iso-butane 1994
5.	Hemofram	chemo dialysers	0	0	R-113 sterilizer was phased out in 1999

Eligible enterprise

Galenika is only the eligible manufacturer of aerosol in the country for MLF assistance. The company is 100% owned by Serbian national. It was established in 1945 for manufacturing of various medical products.

A UNIDO staff member together with the NOU visited the enterprise in the beginning of 2004. Galenika is fully operational and financially sound. Presently the company has about 2,700 employees involved in production of a series of pharmaceutical products including medical spray. It is located in the vicinity of Belgrade and one hundred percent of its products are for the national consumption.

Galenika management showed considerable awareness of current efforts to phase-out ODS use in the industry. They are in favour of the current efforts of CFCs phase-out in the aerosol sector. Detailed baseline data on Galenika is given in ANNEX IV.

5.2.2 Phase-out plan of the aerosol sector

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

- Utilization of finger trigger pumps;
- Utilization of non-pressurized perfumes;
- 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 new consumer habits or design modifications of and/or additions to the bottles, valves and crimping systems.

During the formulation mission in the beginning of 2004, UNIDO discussed in detail with the enterprise the different technology options described above. In it's evaluation of the technology options to replace CFCs, considered the following criteria:

Environmental acceptability
Physical properties
Maturity of the technology
Safety and applicability in the enterprise factory environment
Price, product availability, and cost-effectiveness
CFC replacement technology selected by competitors/importers in Serbia and Montenegro
MLF EXCOM decisions

Considering that the hydrocarbon aerosol propellants are the main replacements for CFCs, and they are readily available in Serbia and Montenegro (although mainly imported and quality varies), they give good spray patterns and do not affect the ozone layer, Galenika has decided to implement the phase-out process utilizing hydrocarbon propellants.

ANNEX IIII describes the detail of the project.

5.3 Refrigeration manufacturing sector implementation program

5.3.1 Current situation of the refrigeration manufacturing sub-sector

The refrigeration industry has a long tradition in Serbia and Montenegro; back to the beginning of the 20th century.

There is one local manufacturers of domestic appliances, Obod. Some of domestic refrigeration appliances are imported. Industrial statistics indicate that there are about 5.5 million domestic refrigerators and freezers in Serbia and Montenegro. The failure rate of appliances made in Serbia and Montenegro is considered to be similar to the global average of 3%. The average life varies from 15 to 20 years.

As there is no economic viability of recovering and reusing refrigerants, it is general practice to release refrigerants into atmosphere while servicing domestic appliances.

In Table 9, representative OEMs in Serbia and Montenegro are listed. They are assisted by the Multilateral Fund for phase-out the use of CFCs in the manufacture. Implementation has been executed for these projects. Even the projects were completed at several enterprises and they started production of non–CFC appliances from 2002. OBOD from

Cetinje is in the final stage of the realization of the project of substitution of CFC-11 with cyclopentane, and CFC-12 with R-134a. It already substituted R-12 with R-134 a. Also, ten SMEs in Serbia manufacturing refrigeration equipment substituted R-11 with R-141b and R-12 with R-134a, seven of them by the end of 2002 and three of them by the end of 2003. All of OEMs phased out CFCs by 2003.[5]

Table 9. Manufacturers of refrigeration and air-conditioning equipment in SEM, consumption of CFCs for manufacturing purposes in MT

Enterprise	Location	Products	CFC use in 2002	CFC Use in 2003
Obod	Cetinje	-domestic refrigerators, freezers	65.5	0
Jugostroj	Belgrade	-commercial and industrial refrigerators -stationary air-conditioners - semi-hermetic compressors	4.2	0
Frigozika	Ruma	-commercial refrigerators, freezers	8.3	0
Prva Petoletka	Trstenik	-mobile refrigeration equipment -stationary self-contained cooling units - open compressors	4.3	0
EIAD	Nis	-commercial freezers -window air-conditioners -self contained air conditioning units	3.6	0
BS Inzenjering	Belgrade	-commercial refrigeration	1.8	0
Soko	Belgrade	- commercial refrigeration - self contained air conditioning units	4.4	0
Alfaklima	Knjazevac	- window air conditioners - industrial refrigeration	1.2	0
Arctic	Kraljevo	- mobile air conditioners for buses and truck cabin	1.4	0
Frigo Jagodina	Vihorska	- commercial refrigerators and freezers - insulation panels	0.4	0
Electrofrigo	Dobanovci	- commercial refrigerators	2.1	0

Approximately 40 - 50 small enterprises are working in the field of refrigeration. Some of them are service shops and with minor production capacity. Table 8 lists identified remaining enterprises in the sector. Out of enterprises listed, ten are verified as eligible for assistance by the Multilateral Fund. Their detailed information is given in ANNEX VI.

[5] Compressor project to convert the manufacture of open compressors with R-12 to R-134a was approved at Prva Petoletka (impact 2 ODP tonnes).

Table 8. Remaining enterprises in the commercial refrigeration sector, CFC consumption in 2003 for manufacturing in MT.

#	Enterprise	Location	CFC-11 foaming	CFC-12	R-502	CFC Total	Year established
1	AS Frigo	Horgos	500	1,500	150	2,050	1977
2	Duta	Svilanjnac	0	700	0	700	1986
3	Frigotehnika	Nis	0	120	20	127	1989
4	Jugoklima	Krusevac	0	220	0	220	1991
5	Freshness	Belgrade	0	235	42	130	1992
6	Frigosystem 2000	Mladenovac	780	2,100	0	2,880	1992
7	Frigomex	Belgrade	300	5,400	500	5,865	1992
8	Frigo elektro	Podgorica Crna Gora	0	1,360	0	1,360	1989
9	Filterfrigo	Beograd	0	970	0	970	1991
10	Arktik	Belgrade	0	700	350	816	1994
	total for eligible enterprises		1,580	13,305	1,062	15,117	
11	MP 96	Belgrade	0	40	-	40	1996
12	Hemofrigo	Leskovac	0	40	-	40	1996
13	Solarov	Novi Sad	0	180	-	180	1996
14	Pingvin	Becej	3	52	-	55	1998
15	SENA	Kragujevac	0	0	-	0	1999
16	Marting 33	Belgrade	0	50	-	50	1999
17	Arktik	Belgrade	0	0	-	0	-
18	Termofriz	Umka	0	0	-	0	-
19	EI Katodne cevi	Nis	-	-	-	0	-
20	EI stampna kola	Nis	-	-	-	0	-
21	EI tranzistori	Nis	-	-	-	0	-
	total for non eligible		3	362	-	365	-
	TOTAL					15,482	

5.3.2 Refrigeration manufacturing sector phase-out program

As seen in Table 8, there are ten identified remaining eligible small and medium size enterprises that are manufacturing commercial refrigeration equipment using CFCs. A few of them have facilities of foaming and refrigerant charging, and some have only refrigerant charging facility. They are still manufacturing products with CFC-11 and CFC-12. ANNEX V summarizes background information of these enterprises.

Alternative technology selected was HCFC-141b as foam blowing agent and HFC-134a as refrigerant. These substitutes are accepted and recommended by TEAP as alternatives to CFC-11 and CFC-12. Depending on the current baseline equipment, assistance for necessary production line modification will be provided.

The approach for implementing the investment component in the remaining eligible enterprises in the sector is executed as below:

Foam Operations

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

b) The HCFC-141b based foam will have an increased molded density with respect to the CFC-11 based foam, resulting in increased requirement of chemicals.

Refrigerant Operation

Compressors suitable and optimized for HFC-134a will be required.

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

c) The vacuum pumps will need to be suitable for use with HFC-134a. Retrofitting of vacuum pumps has not proven feasible or cost-effective in the past due to several factors (unsatisfactory condition, inaccessible suppliers, unavailability of parts, production downtime, etc) therefore appropriate quantities of new vacuum pumps suitable for the conversion, consistent with the baseline capacities, will be provided.

d) The existing refrigerant charging units/kits are not suitable for use with HFC-134a and cannot be retrofitted, and will therefore be replaced with automatic charging units or portable semi-automatic charging units suitable for HFC-134a duty.

e) The design/sizing of the refrigeration cycles need to be optimized to ensure the viability of the process and to maintain the product standards for performance and reliability, such

as reengineering evaporators and condensers, so as to ensure the levels of cleanliness and contamination that can be tolerated with HFC-134a, lengthening of the capillaries or changing the thermostatic expansion valve models, use of filter-dryers with finer pores, suitable for use with HFC-134a.

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

A workshop will be organized for the industry to introduce alternative technology and use of new refrigerants. A part of the equipment will be procured and delivered to the country by UNIDO based on their financial rule and regulation and in accordance with NOU. The planned project duration is 30 months, and the CFC consumption in the sub-sector will be phased out by 2006.

The detailed capital investment for each eligible enterprises is summarized in ANNEX VI.

Chapter 6. Refrigeration service sector implementation program

6.1 Overview of the service sector

There are no MLF projects approved for the refrigeration service sector.

The refrigeration and air-conditioning service sector has the largest demand for CFC-12, and small demand for CFC-11 and R-502.

The common practice in all service sectors is to release (vent) the refrigerant from the system during most types of service and repairs. The practice of using recovery or recycle equipment is not established in the Serbia and Montenegro as the price of CFC-12 has been relatively low and the supporting infrastructure (e.g. reusable cylinders) is currently not available to service enterprises. Only few service enterprises try to recover CFC but without proper equipment and procedures. As there are no regulations prohibiting the release of refrigerants to the atmosphere and no capability to analyze or clean refrigerants that cannot be reused on site, recovery of refrigerants is rare in air conditioning and refrigeration installations and it only occurs for large installations. Enterprises that have recovered CFC report problems in identifying where to send the recaptured refrigerant for reclaiming. This has resulted in a storage problem for these companies.

As there are no legal requirements to recover ODS and customers are often only interested in quick and cheap repairs, the motivation for service companies to invest in recovery equipment is low. They note that it would be difficult to compete with service shops that continue to offer quick recharge or repair. The potential for long term savings achieved with recovery/recycling equipment are not yet recognized by the local market.

6.1.2 CFC Use in commercial refrigeration and air-conditioning

The major applications in the commercial service sector include: supermarkets, restaurants, hotels, butcheries, confectioneries, bakeries and cold rooms. These applications in the Serbia and Montenegro use in the most cases systems with self-contained display cases and cabinets of the plug in type. Larger installations use condensing units connected to single, or sometimes a few, display cases or cold rooms. There are a number of large centralized systems in the Serbia and Montenegro.

The dominant refrigerant for commercial refrigeration is CFC-12, used widely for most applications in this sector. The consumption in this sector is by nature difficult to establish on the basis of installed units as a significant amount is for on site installation performed by service companies. The import statistics for equipment in this sector is not accurate since equipment is not often declared in detail. The import of second hand equipment is also significant and also often not declared in detail.

The life expectancy of CFC compressors in the commercial refrigeration sector is expected to be three to five years. This data has been supported by the service enterprises in the Resource Group. When the compressor fails, it is replaced with a new compressor but the unit is normally not changed. This time frame is low by world standards. The short life time of compressors, lack of recovery equipment and the practice of topping-up after leaks without proper leak detection and subsequent repair, results in a very high reported leakage rates.

The short life expectancy of compressors can be explained by a lack of understanding of good practice during manufacturing, installation and service. As an example, it is not common practice to use protection gas (nitrogen) to avoid internal oxidation during brazing. This short life time increases the service demand and causes a significant increase in CFC emissions. The new alternative refrigerants and new oils are more hygroscopic (moisture absorbing). If they are exposed to the atmosphere, they absorb unacceptable amounts of moisture. If the service methods are not upgraded, the failure rate of equipment using HFCs will increase even further with an even higher cost as a consequence.

CFC Use in Condensing Units

Condensing units and compressors assemblies and compressors for on site assemblies are imported in Serbia and Montenegro. Larger cold storage facilities are traditionally built to use ammonia systems but small cold rooms commonly use CFC-12 especially with low temperature were R22 is more problematic. More than 40 %of the restaurants and hotels, which are approximately 19 000 in Serbia and Montenegro, have cold rooms with condensing unit for food storage. Cold rooms with condensing unit are common in butcheries (3 000 units). Larger supermarkets and chains of supermarkets use cold rooms with condensing unit for food and meat storage. There are in total about 25 000 condensing units in Serbia and Montenegro with average charge of 10 kg of CFC-12. With 30 % of leakage there is an estimated consumption of 75 Mt per year in this sector.

CFC Use in Display Refrigerators and Freezers

There are more then 15 local manufacturers of display cases, but significant part of the market is covered by imported display cases. Some companies on the market buy used display cases on the European market and import them to Serbia and Montenegro. They are then assembled with compressor, charged with CFC-12 and sold on the local market. Some of them are changed to non-CFC alternatives but due to the low price of CFC-12 the use of CFC-12 is still frequent.

Almost all end users in this sector have more than three display cases per facilities which are 375000 units with average charge of 2 kg. With 10 % of leakage there is an estimated consumption of 78,75 Mt per year in this sector.

CFC Use in Central Refrigeration installation for Supermarkets and Hotels

Central installations with CFC are rare in this sector, and exist only in large supermarkets and big hotels. There are about a hundred central installations with average charge of 100 kg of CFC-12. Complexity of the installation result in a expected leakage rate of 40 % or 4 t per year.

CFC Use in Stationary Air-conditioning with CFC-11 Chillers

Chillers are used mainly in larger building complexes such as hotels, sport arenas, commercial buildings, industrial complexes and government buildings. Since 1990, all installations have used HCFC 22, HFC 134a or HFC 407C. The part of the chiller manufacturer that used CFC-11 consist of a limited number of large companies, and in Serbia and Montenegro exist only CFC-11 chillers from four USA companies: York, Carrier, Trane and Westinghouse. York has their own subsidiary, York international, Carrier is represented by RCCM, Trane is represented by Tehnokooping wheras Westinghouse does not have any representation in Serbia any more. A survey of representatives of manufacturer show that there are about twenty chillers with CFC-11 in Serbia and

Montenegro: York have ten chillers (two chillers in Leskovac, two in Gornji Milanovac, two in Novi Sad, one in Podgorica etc), Carrier have seven chillers (four in Belgrade, two in Milocher – Montenegro etc), Westinghouse have three chillers in Niš and Trane had few chillers but there are all replaced with new. The average size of these centrifugal chillers is 2000 kW using total amount of 2 Mt CFC-11 for servicing annually.

6.1.3 CFC Use in industrial refrigeration

Food processing industry is one of the most developed sectors of Serbia and Montenegro's industry. In large applications it is common to use non-ozone depleting ammonia as refrigerant, but in small and medium size applications CFC-12 is prevalent.

There are 400 fruit and vegetables processing plant in Serbia and Montenegro. Many of them are cold stores with process line for fruit and vegetables freezing especially in central Serbia where frozen fruit is important export business. Small cold stores with classic chamber for fruit freezing with R12 as refrigerant are common. Each cold store has large annual consumption of refrigerants because of large quantities of refrigerants in each system, complexity of the system and quality of on site installation. Significant consumption of CFC12 for first filling is still taking place as there is no ban on installation of CFC equipment.

There are more than 160 dairies and milk processing plants in Serbia and Montenegro. Large dairies use ammonia as main refrigerant in the process plant. However, even these dairies use CFC-12 in mobile vessels and collecting stations for collecting milk from small individual farmers. Mobile systems have higher leakage rates than stationary systems due to the use of rubber hoses, strong vibrations and severe ambient conditions.

From about hundred slaughter houses and meat processing plants 60 % use R12 for maintenance of ambient conditions and cold stores.

CFC-12 is still common in chocolate production, wine production, pastes processing and other parts of food processing industry. There are more then 1300 companies in industrial sector with 20 to 200 kg of CFC-12 annual consumption. The measures required to phase out CFC consumption in this sector are similar to those for commercial refrigeration. However, because each system represents a large amount and is built on-site for the specific application, knowledge of each system's special conditions will be important to achieve good reliability. Based on interviews with contractors and the end users, CFC use is calculated to be 90.3 Mt per year.

6.1.4 CFC Use in domestic appliances

According to the 2002 census, there are 3,131,156 households in the Serbia and Montenegro (2,981,156 in the Serbia and about 150,000 in the Montenegro). The official statistics shows that 95 percent of the households have refrigerator and 50 percent freezer. We can make the assumption that there are 4.5 million refrigerators/freezers in private households in Serbia and Montenegro and an additional number in commercial use (offices, lunch rooms and similar). Taking into account that according to the custom data for the last 4 years, 548,953 refrigerators or freezers have been imported almost all with R134a or R600a, this would lead to assumptions that there are over 4 million refrigerators/freezers in operation with CFC.

The traditional design of CFC-12 refrigerators and freezers contains (according to the interviews with servicemen that work in this sector) on average, 150 grams CFC-12. There

are 4 million refrigerators with a total installed stock of CFC of 600 t. The leakage rate in this sector is low (1-2 %) but service of these systems is done with release of the total charge and repairs are often followed by a burst of CFC-12 blown through the system to remove air and moisture before the system is fully charged. The result is that each service involving work in the refrigeration circuit results in an emission of more than the original charge of the unit. The average service interval in this sector is 10 to 15 years. The emissions in this sector are calculated to about 5 % or 30 Mt per year.

6.1.5 CFC Use in transport refrigeration

CFCs such as CFC-12 and R-502 are commonly used in refrigerated trucks and trailers as well as in containers. These systems often have higher leakage rates than stationary systems due to the use of rubber hoses, strong vibrations and severe ambient conditions. The measures required for this sector are similar to those for commercial refrigeration. Retrofit to HFCs is common both internationally and in the Serbia and Montenegro. Interviews with stakeholders in transport sector and main service companies in this sector show that there are about 500 trailers and containers in international transport and about 2000 devices in inner transport in the Serbia and Montenegro. The annual use of CFCs for the servicing of transport refrigeration, based on interviews and discussions with the market leading enterprises is calculated to be 5 Mt of CFC-12 and 2,56 Mt of CFC-115 (as a component in R-502).

6.1.6 CFC Use in mobile air-conditioning

It is not common in Serbia and Montenegro to have air conditioning in a car and the same for buses, except buses for long tourist travel. There is no manufacturer of cars with air conditioning in Serbia and Montenegro and new imported cars have air conditioning with alternative refrigerants. Manufacturers of cars from which Serbia and Montenegro import cars from use alternative refrigerants from 1995 and onwards. The official statistic, custom data and interviews with stakeholders show that there are 500 buses and about 5000 cars with CFC in air conditioning system. Buses have about 8 kg of refrigerant and car about 1 kg of CFC in the air conditioning system. The leakage rates are comparable with data for older CFC mobile air conditioning systems in other countries, 40 % for cars and 50 % for buses. Based on the above mentioned calculation there are emissions of about 4 Mt CFC per year.

6.1.7 CFC Use for flushing

Flushing systems with CFC-11 during servicing are common practice in the refrigeration and air-conditioning service sector in Serbia and Montenegro today. Flushing is done to clean a refrigeration air-conditioning system after a malfunction or failure that may have caused oil or refrigerant to decompose or contaminants to enter the system. CFC-11 is used, because it is a low pressure refrigerant with good solvent properties. This practice is common for small companies in commercial servicing sector; it isn't common in industrial servicing sector. Field visits with service companies and information supplied by questionnaires and interviews with service companies show that the consumption for flushing is significant. Half of the companies that answer the questionnaire report using CFC-11 for flushing. Interviews with servicing companies show that they used about 0.1 kg of CFC-11 for each kilo of CFC-12 refrigerant they used. If this would be representative for half of the commercial CFC-12 market, it would indicate a use of about 7 Mt.

6.1.8 CFC service usage by application

In average, domestic refrigeration systems are serviced once in 10-15 years. It is estimated that there are about 5.5 million fridges and freezers, 70,000 to 90,000 commercial refrigeration units, 100,000 to 140,000 window air-conditioning and 2,500 – 3,000 transport refrigeration units (trucks and trailers).

Table 9 summarizes the use of CFC in the refrigeration and air-conditioning service sector in Serbia and Montenegro. It should be noted that the service demand of CFC include also a significant amount for installation of new and second hand CFC equipment. There is currently no legislation covering a ban on on-site installation of new or second hand CFC equipment and CFC refrigerants are available at low prices.

Table 9. Summary of estimated CFC usage for 2002 in the refrigeration and air conditioning service sector in Serbia and Montenegro

CFC Constituent	Application	kg per application	kg per substance in service sector
CFC-11	Chillers	2,000	9,339
	Flushing	7,339	
CFC-12	Household Refrigerators	30,000	287,070
	Mobil air-conditioning	4,000	
	Transport Refrigeration	5,000	
	Central refrigeration for Supermarkets	4,000	
	Display case refrigerators	78,750	
	Condensing units	75,000	
	Industrial Refrigeration	90,320	
CFC-115	Transport refrigeration	2,560	2,560
TOTAL CFC Consumption			298,969

The consumption for the different service sectors is based on available statistics of number of units, normal charge sizes and leakage rates, and has been validated by interviews with the trade companies.

6.1.9 The workforce

Training system

There has been no official program for vocational training of servicemen in air conditioning and refrigeration sector supported by Ministry of Education. New servicemen come from secondary schools with three different programs: Mechanic for heating and refrigeration (in 23 schools with 480 pupils per year), electro mechanic for thermo and refrigerating devices (in 24 schools with 750 pupils per year) and electro technician for refrigerating and thermo devices (in 5 schools with 200 pupils per year). These are 3 or 4 years programs with theoretical and practical education. Present schools do not have equipment necessary for training of servicemen in refrigeration sector. Programs in these schools are not specialized. They train "general" servicemen in heating, ventilation, air conditioning, piping and refrigeration. Practical work after school form servicemen specialization.

There are short courses offered by some Public Universities for servicing of domestic refrigerators and commercial refrigeration/air conditioning but these courses are unofficial and are not under control of the Ministry. There is a course for automotive air conditioning organized by the largest company in the automotive air conditioning sector but this course has no official status. As there is no certification/licensing system and requirements for servicemen there are many servicemen without any formal education in this field of work. Adequate education is required only for owners of registered workshops but there majority of the service providers in this sector are not registered and work in the informal sector. .

If somebody wants to register a new enterprise he only has to have a diploma from an appropriate secondary school. There are requirements only for engineers in contractor companies and welding specialists.

Since servicing of units with alternative refrigerants such as HFC requires a higher skill level, most service technicians are not equipped with proper equipment and knowledge for handling HFC and the new lubricants for these which are much more humidity sensitive than traditional oils. In addition, the significant price differential between CFC-12 and HFC 134a has proven to be a major reason for service technician to charge the repaired units with CFC-12 without any consideration as to whether the units were originally designed for, and suitable for use with CFC-12.

Service shops

Several existing databases (Serbian Chamber of Commerce and Industry, Montenegro Chamber of Commerce, Commercial Court Register, Union of Engineers and Technicians of Serbia) have been used to survey the service enterprises to establish the number of enterprises.

There are 150 companies small and medium in size with average of 7 servicemen that work in industrial and commercial sector and which business are only service and manufacturing of refrigeration/air conditioning systems. In this sector there are about 1 000 servicemen. The dominant user of CFC-12 in the Serbia and Montenegro is the industrial sector which is result of the dominating food processing industry. Companies which work in the industrial sector also work in commercial refrigeration on. These two sectors have a significant overlap whereas these companies normally do not work in mobile air conditioning, transport refrigeration and domestic appliances.

There are 5 major companies and 150 independent workshops with about 200 servicemen in the Serbia and Montenegro that work in automotive air conditioning and transport refrigeration. Some of these companies and workshops work are mainly focused on general car repair, and some of them are active in commercial refrigeration.

There are 200 registered service providers in the domestic, refrigeration/air conditioning sector, but the survey of the workshops, remarks from questionnaires and discussions at meetings with the Resources Group show that there are 800 unregistered workshops, too. There are about 1,500 servicemen in this sector. These workshops work mainly in domestic appliances and on smaller commercial equipment. As mentioned, there is an overlap between this and the industrial refrigeration service providers.

According to on the data in the existing databases and the survey described above, estimated number of service enterprises and service technicians in Serbia and Montenegro are as follows.

Total number of service workshops; 1,500,
Number of shops for stationary refrigeration; 1,300 (87 %)
Number of shops for mobile air conditioning and refrigeration sector; 200 (13 %)
The total number of service technicians; between 2,500 and 2,700.

6.1.10 CFC Supply and price information

As there is no production of CFCs in Serbia and Montenegro, the entire requirement is satisfied by imports. There are more than 20 major importers who are supplying market in SEM with CFCs and other refrigerants. Present indicative prices for CFCs and other refrigerants are in Table 12.

Table 10. Price information of refrigerants

Refrigerant	Packing (kg)	Unit price US$/kg
CFC-11	280.0	3.0
CFC-12	6,8	4,7
	13,6	4,3
	22,7	4,3
HCFC-22	6,8	4,6
	13,6	4,3
	22,7	4,3
	61,0	4,3
	62,0	4,3
R-502	13,6	16.0
HFC-134a	6,8	9,7
	13,6	8,9
R-404A	10.9	18.5
R-407C	11,3	19,1
R-410A	11,3	21,7
R-507	11,3	19,1

6.2 Phase-out strategy of the refrigeration service sector

It is inevitable to take necessary measures to stop the increase of the service use of CFC, in order for Serbia and Montenegro to be in compliance with the 50% reduction obligation for the year 2005, but in particular followed by the 85% reduction obligation in 2007. The sector phase-out plan framework for the refrigeration servicing sector is, therefore, of essential importance for Serbia and Montenegro's compliance with the Montreal Protocol. As Serbia and Montenegro is a big country with about 1 000 -1 200 service enterprises, several years will be needed in order to implement the plan. It should be started as soon as possible to enable the country to meet its obligation for the years 2005, 2007 and 2010.

The conditions and constraints for the sector phase-out plan in Serbia and Montenegro are described below.

- The refrigeration and air-conditioning industry must be developed in a sustainable manner.
- Employment must be kept in all related industries, particularly in small and medium sized enterprises (SMEs), which play a major role in the refrigeration service sector. Even more employment may be created as a result of successful implementation with focus on preventive service rather than exchanging components after failures.
- The demand of CFC refrigerants for servicing and maintenance of existing CFC refrigeration and air-conditioning equipment must be met and must be supplied through the national recovery, recycling and reclamation project.
- Good service practice must be introduced.
- The service sector in Serbia and Montenegro is not well coordinated due to the huge number of SMEs involved.
- The SMEs are frequently working in the informal sector as service is a business that require a small investment to get started.
- Availability of CFC will be limited in the near future.
- Legislation framework in Serbia and Montenegro need to be upgraded.
- The energy efficiency of existing and future refrigeration and air-conditioning is important for Serbia and Montenegro from economical aspects.
- Energy efficiency as well as minimized emissions of ODS and HFCs are important for the global environment, not only from the ozone layer depletion but also to minimize the Global Warming Impact of the industry.
- The rapid implementation on new Directives and Standards in EU affecting this industry is a challenge and will require an upgrade of the whole industry. To integrate the measures for training, certification and licensing well in the trade can help Serbia and Montenegro to phase the challenge of harmonization with EU requirements.

The key to success is to change the way that the installation and service of the equipment is carried out. This includes ensuring that emissions of refrigerants to the atmosphere are always minimized, proper methods for brazing, evacuation and recovery as well as that the technicians acquire skills to handle alternative refrigerants. This will require changes in education for new technicians and upgrade of the existing workforce of refrigeration technicians. It will also require that they have access to the necessary equipment. Active involvement of all parties - refrigeration technicians, Government and local authorities, equipment and component suppliers as well as end-users - in the challenging process of phasing out ODSs is essential. It is also important to provide incentives for companies to apply new and better procedures and practices. A well-planned public awareness campaign targeting primarily trade companies and end users and coordinated with all other measures will be of key importance.

It is not easy for service technicians to market a change of service methods if they are associated with increased short term costs. Only through well coordinated measures with a mixture of incentives and legal requirements that is well accepted in the industry will the service sector adopt to new service practices. As there is an awareness among key players in the trade with regard to the benefits associated with an upgrade of the competencies/skills and work methods, the government will be able to cooperate with the industry to implement this plan in the best manner.

Most of the companies active in the service of refrigeration and air-conditioning are small or medium sized. To ensure an effective phase out in the service sector, different measures

will be required than those employed for the phase out of CFCs in the manufacturing industry.

Project components with specific activities or actions, objectives and modalities of implementation in each project component are elaborated on below.

In the process of developing this NCPP to phase out CFCs the interest to limit and phase out the use of all ODS should be taking into account as well as the intention to harmonise Serbia and Montenegro with EU. The EU Directive 2037/2000 on substances that deplete the Ozone Layer require several of the in this NCPP proposed measures for all Ozone Depleting Substances (ODS). ODS include besides the CFCs also HCFCs such as the frequently used HCFC22 (R22) with a phase out date in EU of 2010. It will be important for the authorities and industry to form a good cooperation in order to deal with the changes required within the refrigeration and air-conditioning industry.

6.3 Proposed measures

The list below provides a general overview on the measures that are considered necessary in order to achieve the required CFC reductions in the refrigeration and air-conditioning servicing sector. The measures can be divided into a number of main areas:

1. Licensing and certification schemes.
2. Education and training of new and existing service technicians.
3. Targeted public awareness raising activities
4. Creation of a process to establish a "Code of Practice".
5. Creation of a system to reuse ODS (recovery, recycling and reclamation).
6. Legal and enforcement measures needed to drive the change.

None of these measures will, on its own, significantly reduce the consumption of CFCs in Serbia and Montenegro. It will require a combination of measures and their combined effect to create a situation where the market is rapidly moving towards alternative technologies. It is only when the necessary competencies, commercial incentives and legal requirements are present that the industry will take an active involvement in the CFC phase out process.

6.3.1 Certification and licensing system

When phasing out CFC consumption in the refrigeration service sector, the key to success will be to change the way that installation and service of equipment is carried out. To ensure that emissions of refrigerants to the atmosphere are minimized should be a priority. To achieve this may require significant changes in service practice for many companies. These changes in behavior will require investment in education/training of service technicians and also investments in the necessary equipment needed to adopt the best service practices. There must also be incentives for the companies to adopt these new service practices and to ensure that companies that upgrade their skills and equipment can be competitive on the market.

With a legal requirement in Serbia and Montenegro that only properly licensed companies will have the right to work on refrigerant containing systems and buy environmentally hazardous refrigerants, there will be a strong incentive for the companies to participate in

the phase-out process. This will create a level playing field and not give disadvantage to companies who would otherwise compete with "bad practice" often due to lack of competency and equipment.

All EU member states are required to "define the minimum qualification for the personnel involved" in service of Ozone depleting substances and Serbia and Montenegro intend to initialize a licensing requirement for enterprises working with refrigeration and air-conditioning service.

A certification system will be important in order to establish a national "standard" of required education for technicians.

Definitions

There are many variations on licensing/certification/licensing schemes which have been implemented and there may be confusion with the vocabulary of these schemes. In this paper the following definitions will be used.

- Certification: Certification is a system "certifying" individuals. Certification can be used to show that an individual has achieved a specified competencies required to perform certain tasks. Different levels of certification can be required for different types of work performed by different industry segments.
- Licensing: Licensing is a system that approves a company or an individual (i.e. a juridical or physical person) that has the required knowledge and access to the necessary equipment to perform certain tasks. It may also be a requirement of licensing that the company does certain other things, such as keep records or comply with a code of practice.

Certification/licensing system

An improved level of training and change of work methods have proven to greatly reduce the number failures in the refrigeration and air-conditioning service sector. The result is lower cost for repairs and increased life time expectancy of equipment as well as decreased energy consumption.

The benefits of a certification system will also include the improvement of Serbia and Montenegro industries' competitiveness and international recognition of the Serbia and Montenegro work force as a skilled one, both when working abroad and when international companies are evaluating the possibility of investing in Serbia and Montenegro.

There are many ways an certification/licensing system can enhance the ODS phase out.

- Licensing identifies qualified companies so that end users such as equipment owners and purchasers can ensure that they get a high quality service and long-term reliability. To maintain a register of licensed companies will also allow the government authorities to easily communicate changes in legislation and simplify distribution of public awareness material.
- The License will be a marketing asset for installers and service providers.
    - Having official approval reduces the competitiveness of companies/individuals that do not have a license and continue doing "business as usual".
    - It gives increased credibility for licensed companies that introduce modern methods, which may have higher initial, but lower long term costs.

- Licensing can be used to limit the access of refrigerants so that only qualified (licensed) people/organisations can purchase them.
- Licensing will increase the possibility of enforcing import limitations, because illegal uses of refrigerants can be traced more easily through the supply chain.
- By taking concerted action in the public sector and in the society as a whole, further support for the licensing system may be derived:
    - Government agencies/companies can require all government business/contracts to be directed to licensed companies.
    - Agreements can be established with large end users such as supermarket chains, breweries, gas stations and fast food chains to require that their local organisations use licensed service providers for installation and services.
    - In public awareness material the government can inform the public about the content of the licensing scheme and tell the public to only use licensed companies.

For practical reasons it is expected that a certification program should include a strategy to certify the existing work force according to a transitional schedule and to establish the long term certification as part of the national training scheme.

To be effective, a licensing system for the refrigeration servicing sector should be designed so that it ensures that any person or company handling refrigerant during installation, servicing, disposal or any other action where the refrigerant might be released, has the ability and equally importantly, the necessary equipment to perform their work in a way that ensures minimal losses of refrigerant to the atmosphere. This ensures that ODSs as well as HFCs are not released during service or from the system during operation. This will require the person to follow a "Code of Good Practise" (which is discussed separately).

To be licensed would require the company to:

- Have staff with certified competence for the type of work they will be licensed for
- Have necessary equipment for the type of work they will be licensed for
- Commit themselves to comply with the relevant "Code of Practice"
- Commit themselves to abide by relevant legislation and requirements implemented by relevant authorities.
- Annually or semi annually submit relevant information for license renewal and be submitted to follow-up/inspections

To achieve this objective usually means that by a date set in legislation all companies working in the industry must show proof that they fulfil these requirements. The licence system can be administered by a joint trade initiative but with requirement from the government to fulfill for example environmental targets set up. To achieve sustainability the cost of administration should be covered by fees charged to receive the license.

The plan is to institute a trade operated licensing scheme with government supervision ensuring that proper environmental consideration is taken into the requirements (e.g. an acceptable Code of Practice is established partly supported through this plan, relevant requirements on competencies and equipment are also established partly supported through this plan). To make the scheme sustainable the cost of administration should be covered by a license fee. The plan will support the initiation/design of the scheme based on experiences in other countries like Sweden and the Netherlands.

<u>Certification</u>

Certification is a prerequisite to achieve a license, but it can also be a requirement for technicians performing any work on a refrigerant circuit. To achieve this certification means to pass an examination to show that the person understands and will comply with an agreed Code of Practice. They must show that they have a basic knowledge about the depletion of the ozone layer and the international efforts to phase out ODS. They should also have an understanding of the relevant legislation controlling ODSs in Serbia and Montenegro and the technical skills to comply with these laws. These requirements should be introduced into the regular vocational training program where future technicians are trained to ensure long-term sustainability of a competent workforce.

A lack of technical knowledge on how to reduce leaks, install and service systems in a proper way to improve reliability (especially with the alternative refrigerants) will delay the phase out of CFCs and reduce the acceptance of alternatives.

The exams for existing workforce should include both theoretical and practical competencies. It is important that modern techniques to reduce leaks, evacuate systems, use alternative refrigerants and the new oils, as well as recovery equipment are incorporated in tests. Training programs that only focus on phase out legislation and recovery have proven to have a limited effect as technicians lack the necessary skills to work with the alternatives. Therefore they continue to use the older refrigerants.

Compliance with licensing and certification systems

To ensure compliance with the licensing system (i.e. to ensure the largest number of people obtain certification and licensing) most countries have made it an offence to sell CFCs and HCFCs to a person or company that is not licensed.

Workshops are often required to keep logbooks of all refrigerants bought and sold and to record the licensing number of the person buying or selling. Sometimes this record is held by the company and is only presented upon demand by the authorities. In other cases it is reported annually to a designated authority. By monitoring refrigerant sales it becomes difficult for non-licensed service provider to continue to purchase refrigerants as well as making illegal import more difficult when customers need to keep records of all purchases.

It is important that a license can be withdrawn for companies that do not fulfil their requirements and do not adjust their practice to what is required.

6.3.2 Training and introduction of certification for existing workforce

When introducing a system to certify technicians it is necessary to develop an introduction scheme to make it possible to get the majority of the active work-force certified within a limited period of time. Any training that is required must, during this phase, be limited. A prerequisite to participate in the training should be practical experience in the area the applicant wants to be certified for. When the certification scheme is introduced the training aimed at technicians should mainly cover the new areas (legislation, recovery/recycle, alternatives and code of practice) and should not include the basic training. The length of training for experienced technicians must be minimized.

During the introductory phase technicians with practical experience should be able to get certified by participating in a shorter update training (3 to 4-day training course) and passing an exam to prove their knowledge of new legislation and updated work methods.

Although some may already have the necessary skills and knowledge, experience from other countries suggests that a combination of a short compulsory training course with an exam might achieve the best outcomes for reducing ODS emissions and speeding the adoption of the alternatives.

To maintain the credibility of the licensing system the customer must experience that the services provided by a licensed workshop are of high quality and in the longer term lead to reduced costs. It will be important to find the best possible balance between this aspect and the need to limit the mandatory training requirements for the existing workforce in the introductory phase.

After the introductory phase, training in the established vocational training (or higher education) system should be required to get certification. It is planned that approximately 10 schools in the vocational schools that already have some education in this sector should be upgraded with proper training and equipment to do the practical components required for proper training. Currently these school only give theoretical training whereas all hands-on training is done during work training within companies.

To use the same infrastructure for the upgrade of existing work force in Serbia and Montenegro as for the long term sustainable supply of service technicians will be the most cost effective solution.

6.3.3 Training and certification of "new" technicians

For new technicians, a detailed training scheme should be established within the system for vocational training. The number of training schools required to train the desired number (200-300) of technicians required annually by the industry is estimated to 10 schools based on the distribution of population centers. To give a good training the schools need to have programs including theory as well as practical training that are up to date on legislation, environmental as well as technical aspects. This will require the schools to have relevant equipment to train the students in proper work methods. Besides these training centers giving a specialised training there will be a continued need for the introduction courses in refrigeration and air-conditioning that are today given at a larger number of schools in Serbia Montenegro. These are aimed to technicians that do not work with refrigeration circuit directly but often work with systems related to refrigeration (such as electricians and ventilation technicians). The development of a training scheme for new technicians should not lead to the postponement of the development and implementation of an licensing system for the existing workforce.

The possibility of the certification scheme allowing for more than one level of competencies is planned. Different levels of certification can then be used as requirements in the licensing system to allow requirements to vary between trade sectors (e.g. domestic, commercial and MAC)

<u>Higher education for design and construction</u>

The existing system to license engineers for design and construction should be evaluated if it can be updated to include relevant conditions to design and construct systems that fulfil the relevant environmental and technical requirements required for the future. The introduction of new legislation, standards, a "code of practice" and new products will require new competencies of the engineers and this should normally be reflected in a licensing system.

6.3.4 Requirements for equipment

A licensing system should be supported by a legal requirement for a licensed company to have and use proper service equipment that can recover ODSs (and HFCs). It should also be a requirement to own necessary equipment to search for leaks and service refrigeration systems. Standards for acceptable equipment are usually set by the industry in cooperation by the Government. A licensing system for Serbia and Montenegro should have different equipment requirements for different sectors of the industry as the equipment needed varies between sectors such as MACs, domestic appliances and commercial refrigeration. A voucher scheme for purchasing refrigeration service tool kits will be developed.

6.3.5 Code of practice

A "code of practice" (some times referred to as a "code of good practice") is a document that sets out the procedures for what is "good practice" and what the minimum standards that should be used within a trade is. Codes of practice are usually drawn up by representatives from the trade and then supported or endorsed by the relevant government agency. A code of practice does not normally have a specific legal status, but will often clarify how general statements in legislation should be interpreted in specific situations. In the case of codes of practice for refrigeration and air-conditioning, this might include relevant technical standards and advice on pressure vessel regulations, safety and building regulations as well as ways to reduce the use and emissions of ozone depleting substances. Compliance with a "code of practice" will often be used by end-users and consultants to specify a minimum standard for a project to avoid them having to cover all details in contracts. In many countries courts will treat a "code of practice" as the lowest standard that a customer can expect if nothing else is said in the contract.

A "code of practice" usually covers also areas where international and national standards do not give clear guidelines. The refrigeration and air-conditioning sector and specifically the installation and service sectors are areas where there is a need to establish what good practice is to create "a level playing field" for technicians that offer services to consumers and end-users that often lack the skills required to evaluate the technicalities. To work according to good practice will make it easier to avoid unfair competition from companies that are taking short-cuts.

Without a "code of practice", clarifying the lowest acceptable way to carry out service, the authorities may have to introduce detailed regulations to achieve the necessary phase-put of ODSs. There are many disadvantages with authorities making detailed regulations in a technical area to achieve environmental effects. The regulations are difficult to change and become static because it is a complex process to revise them if or when technological improvements occur. It is usually more practical for the authorities to participate in ongoing discussions with a trade committee to achieve set targets. Being involved in preparing and implementing a code of practice gives the initiative to the companies and organizations in the trade to establish a framework to work under fair competition to achieve the environmental commitments as well as delivering an improved quality of service to equipment owners.

It will be an important step in the phase-out program for Serbia and Montenegro to establish a "code of practice". Adoption of the code will also be an important factor in establishing a workforce of an international standard. There are several existing codes that

can be taken as examples and adopted to local conditions. In some countries, codes of practice have been prepared for different sections of the refrigeration and air-conditioning industry. For example, there may be separate codes for domestic refrigeration, automotive air-conditioning, commercial refrigeration etc. In other countries, only one or two more generalised codes have been developed for the whole industry. In EU there are an ongoing process of harmonising all member states technical standards and this includes significant areas of what is normally included in the codes of practice in each country. All member states will have to up-date their codes and standards to all "Harmonised standards".

To establish a process to develop an agreed code of practice in a trade dominated by small and medium sized companies (SMEs) will require the formation of a trade cooperation structure to deal with the issue. The financial support required for this body should be discussed within the NCPP. Involving the existing trade organisations that represent the different sectors will be important to develop this structure. When developing a code it will also be necessary to establish that the code of practice can be integrated into legislative structures and information measures.

The government will have to participate in the process of developing the code of practice to ensure that it is an unbiased document and that it also meets objectives in the areas of environmental protection, technical standardisation, customer protection and health and safety aspects. Once a code is completed in Serbia and Montenegro, following the "code of practice" should be a condition for companies to obtain and retain licensing and/or business permits.

As Serbia and Montenegro is doing most of its business with Europe and has the intention to join EU in the future, the EN 378 standard (section 1-4) should be taking into account as it covers a lot of the areas relevant to a Code of Practice, if not all.

6.3.6 Infrastructure for re-use of refrigerants - recovery, recycling and reclamation scheme

The plan will initiate a project to facilitate the establishment of an infrastructure that allows the installed stock of CFCs to be used for as long as possible, thus minimising new imports and avoiding a shortage on the market for the small remaining demand after 2010. This will be achieved through requirements for recovery, recycling and reclamation of refrigerants.

A system for local recycling in each workshop is recommended for the larger MAC service shops where systems differ little and CFCs can be re-used in the same type of system. A system based on centralised reclamation centres is recommended for CFCs recovered in the stationary refrigeration and air-conditioning sector as the CFCs recovered in these sector normally will have to undergo a more qualified procedure unless the refrigerant can be reused in the same installation. Otherwise, the wider range of equipment types and refrigerants involved in this sector, will result in a significant risk of cross contamination of heavily contaminated or mixed refrigerants that could damage the equipment or lead to failure.

Reuse of the installed "stock" of CFCs will be essential to minimise disruption caused by the "phase-out" of "virgin" CFCs. CFCs can be reused many times without deterioration. Recovered and reclaimed CFCs will have a vital role to play to allow the market to convert to non-CFC technologies in an orderly manner by allowing existing equipment to continue to be serviced with CFCs.

If recovery, recycling and reclamation is to be successful it will be necessary for Serbia and Montenegro to develop an infrastructure to handle recovered CFCs. This infrastructure is also necessary if the Government is going to implement a credible non-venting policy. If recovered refrigerants cannot be handled it will be impossible to advocate recovery and many will simply not bother to try and recover them. A sytem for responsible handling of recovered ODS is also a requirement for all EU-member states.

To establish a reclamation capability in Serbia and Montenegro will require investment to establish the necessary infrastructure. This infrastructure would obviously need to include reclamation and analysing equipment. However, a significant part of the scheme would need to be to promote the use of refillable cylinders so that the CFCs can be safely collected and transported. The common "30lb" and "50lb" disposable cylinders are not designed to be refilled as the material will not withstand the contaminants such as acids and moisture.

The difference between allowed import and demand on the market can be made up by using reclaimed CFC and the reuse of CFC/HCFC/HFC will besides environmental advantages also reduce the need of import of these refrigerants thus benefiting the economy of Serbia and Montenegro. The potential for recovery followed by reclamation will depend on the number of systems being retrofitted or decommissioned. Establishing an infrastructure for reclamation (including cylinders, analysing equipment and process equipment for the cleaning of used CFC) will be required to facilitate the reuse of CFC from the stationary sectors. After proper handling and treatment, this refrigerant can be re-used to cover demand in any sector.

To establish the capability to reclaim recovered refrigerants in Serbia and Montenegro it is planned to establish five to six reclaim centers in cooperation with the refrigerant supply chain to utilise their logistics, existing infrastructure to handle refrigerants as well as their logistic network to access all customers. It is planned that four centers would cover Serbia whereas one would be based in Montenegro and one in Kosovo to cover all regions. These centers must be equipped with analysing capability to verify the quality of the reclaimed material.

The introduction of a recovery/recycling/reclamation scheme requires that all aspects including the sustainable financing of the operation of it is solved in close cooperation between the authorities and industry. The plan will support the investment cost whereas the operational cost must be covered through a system based on fees on new refrigerants to avoid that it becomes better business to release refrigerants than to recover and return them through the distribution chain. The establishment of the full scheme will be supported through this plan.

6.3.7 Demonstration projects and incentive program for retrofitting and replacement

ANNEX VI lists several end-users of CFC which will be included in the program. They will be assisted for retrofitting or replacement of existing CFC based equipment.

There are areas were the confidence in alternatives or retrofit methods are lacking there can be a need to perform demonstration projects that can be documented and used in public awareness/information campaigns to ensure technicians and end-users that methods exists. Internationally there is extensive material in this area available but local projects can fulfil a need to assist service companies/end-users to initiate the process to retrofit.

6.3.8 Policy measures

A. Import control

To import control include further updating of the import licensing system but also the border control required to enforce the regulations. The need of training and equipment to monitor and control the import should be evaluated and measures to upgrade these functions evaluated.

Current customs system

Imported ODS was recorded by the Federal Customs Directorate applying the Harmonized System adopted by Yugoslavia in 1991. It is now recorded by Customs offices in the Republic of Serbia and Montenegro respectively. Imports are registered at 12-digit level according to importers' declarations and suppliers' bills. For the year 1997, twelve companies were authorized to import, eight are end users and also distributors, four are trading companies. Most of importers are located in Belgrade.

Currently, there are two customs offices, one in Serbia and the other in Montenegro. During the process of harmonization of the tariff system in the country, which is a condition of EU, it was announced that there will be one joint bureau of Serbia and Montenegro customs in Belgrade.

Serbia and Montenegro have 83 border crossings: 44 road crossings, 12 railway, 11 river, 5 airports, 3 see-ports, 7 local crossings and 1 temporary seasonal crossing. There are 14 regional Customs offices in Belgrade, Kladovo, Dimitrovrgrad, Nis, Kragujevac, Novi Sad, Sombor, Vrsac,Zrenjanin, Subotica, in Serbia, Pristina at Kosovo and Metohija, Podgorica and Bar in Montenegro. The country has 126 customs offices and the number of employees is about 1,500.

From the organizational point of view Customs offices are organized in 4 sectors (legal issues, information systems and custom taxes, organizational and personal issues , financial and general services) and customs offices (those 14 mentioned above).

The Customs office is member of Intentional Customs association. Also it is important that Customs service is in process of reorganization and harmonization with the regulations and practice of EU. Training of customs officers proposed in the present project proposal is in line with processes of modernization and harmonization with legal system of EU.

Customs offices training

Customs officers are the first line of inspecting ODSs. Their knowledge of the environmental issues related to the Montreal Protocol needs to be updated and improved. They are not equipped with tools to detect CFCs and other ODSs and to discriminate them from non-ODS substances and equipment with alternatives.

The training of more than 120 customs officers (inspectors, controllers and customs policemen) will be executed by organizing five workshops, four in Serbia, one in Montenegro, to get them acquainted with the Montreal Protocol and related environment issues, and to enable them to identify controlled substances under the Montreal Protocol, and imported refrigerators, freezers and other refrigeration and air-conditioning equipment

using CFCs.[6] The experience obtained at customs authorities in non-A5 countries will be shared at training workshops.

CFC detection equipment will be provided to the 30 major customs points in the country. In addition, the project allows the customs department to update and improve a database of imported ODS.

B. Legal requirements

The section below does not consider whether these legal requirements are already in place, or how and where they should be specified – this will be discussed further on during the implementation of this NCPP. This section only summarizes the legal requirements that are considered to be needed to achieve the necessary CFC phase out reductions in time. As far as possible these should be built on the existing legal framework.

The provisions should primarily address CFCs but many requirements could be extended to cover also other ODS where this is appropriate and also alternative refrigerants that should not be handled irresponsible from environmental or safety aspects.

- Intentional venting of ODSs (and HFC) should be prohibited; this implies mandatory recovery of refrigerants during maintenance, servicing and at end-of-life (possibly with some exemptions, to be specified).
- Installation of new CFC systems should be prohibited.
- Filling of non-CFC systems with CFCs e.g. to fill CFCs in products/ equipment that was designed for or where a non-CFC system was previously installed ("backward retrofits") should be prohibited.
- Sale and use of small disposable containers ("mini cans", < 1 kg) with CFCs should be prohibited.
- Flushing with CFC-11 should be prohibited.
- Only licensed enterprises with certified persons should be allowed to service and decommission refrigeration and air-conditioning equipment designed for ODS refrigerants.
- Importers, dealers and retailers should only be allowed to sell ODSs to licensed enterprises/certified persons and to duly certified entities that utilize these substances for approved essential uses.
- The requirements for licensing of dealers, retailers and service providers with regard to training, equipment, etc., should be specified and differentiated based on the type of work to be conducted. This should include specifying the procedures and pre-conditions to acquire licenses. It should also include the procedures for certification of individuals to the required competence.
- Requirements for qualification of importers should be specified.
- Leak detection and corrective measures before recharge of refrigeration and air-conditioning systems should be mandatory.
- General legal requirements aimed at minimizing emissions (e.g. requirements for regular leak detection and maintenance, avoiding flare connections, proper methods to handle the new refrigerants, etc.) may need to be included in the legal text itself to ensure clarity or included in a Code of Practice with legal support.
- Retrofits to non-CFCs should be performed when this can be done at acceptable costs, e.g. when major repairs are performed. These regulations should then be detailed in a Code of Practice that can include design criteria and service procedures.

[6] "Training manual for customs officers" published by UNEP is a basis of training manual in the RMP Serbia and Montenegro.

- Requirements concerning record keeping and reporting, applicable to importers, dealers, retailers, service providers and equipment owners as relevant, should be included in the licensing and registration conditions and/or in the Code of Practice.
- A process to establish a code of practice is established.
- Licenses can be withdrawn if enterprises or persons no longer fulfil conditions.
- The date when each requirement enters into force should be specified.

Chapter 7. Implementation timeframe

Table 16 shows the timeframe for the implementation of activity in each project component in the present NCPP.

Table 11. Timetable for implementation of NCPP, Serbia and Montenegro

Year	2004		2005		2006		2007		2008		2009		2010
Approval		*											
Foam and aerosol sector programs													
Refrigeration manufacturing sector program													
Refrigeration servicing sector program													
Customs training													
Training of Trainers, Development of Training material (draft, translation, printing)													
Workshops													
Provision of identifiers to custom offices													
Technical assistance													
Technician training – Existing Workforce													
Selection of training center and Training of Trainers													
Development of training material													
3 – day training course													
Technical Assistance													
Technician training – Vocational schools													
Selection of training center and Training of Trainers													
Development of training material													
Specification of training equipment and equipment handed out													
Technical Assistance													
Equipment to service technicians													
Specification of equipment													
Voucher system established													
Delivery of equipment													
Technical Assistance													
Code of Practice													
Technical Assistance													
Establishment of system to reuse ODS													

Selection of centers including financial structure													
Determination of specification of equipment													
Equipment delivery to centers													
Training of centre staff													
Technical Assistance													
Incentive program													
Project Management and Coordination													
Coordination group set up													
Training of national experts													
Reports	*		*		*		*		*				
Targeted Information													
Auditing and Monitoring													
Technical assistance to authorities to update legislation													
Technical assistance to design licensing system for service technicians													

Chapter 8. Incremental costs

8.1 Manufacturing sector

Foam sector

Incremental costs for modification of existing extruder at Lamnat is estimated in ANNEX II. The total cost is US$ 563,090. However, the verified CFC consumption at this enterprise in 2003 is 25.5 ODP tonnes. Therefore, the part of the cost of US$ 209,000 is requested in the NCPP, which is possible funding for the polystyrene/polyethylene sub-sector with the cost effectiveness threshold of US$ 8.22 per kg ODP.

Aerosol sector

Incremental cost for conversion of CFC propellant to hydrocarbon at Galenika is shown in ANNEX IV. The costs comprise those for modification of production facility and for research and testing. The total requested grant is US$ 125,000 to phase out 28.8 ODP tonnes of CFCs. The cost effectiveness is US$ 4.34.

Refrigeration sector

The project cost detail is elaborated in ANNEX VI. Assistance will be provided for redesign of refrigeration cycles, charging unit, vacuum pumps and leak detector to all eligible enterprises. Out of ten enterprises, assistance will be given for modification of foam dispensers at three enterprises which have foam operation. The total incremental cost requested is US$ 227,700 and the cost effectiveness is US$ 15.06 per kg ODP.

Funding is requested in two instalments for above incremental costs. For non-eligible SMEs, a certain program will be conducted through the technical assistance component to encourage phase-out CFCs by introducing alternative technology and by informing the Government regulation.

8.2 Refrigeration service sector

The measures proposed to achieve the phase-out of CFCs in Serbia and Montenegro will, to some extent, be eligible for financial support from the Multilateral Fund under the Montreal Protocol, but there will be costs that have to be financed nationally. A summary of the detailed cost break down for the measures in the servicing sector is provided in Annex VIII.

The incremental cost for phase out of CFC in the service sector comprises those for:

- Establishing training capability for training of future work force (equipment and train the trainers).
- Training of the existing workforce.
- Development of training material.
- Administration of licensing scheme.
- Preparation of Code of practice.
- Investments in equipment for the service companies to be eligible for licensing.
- Investment in equipment to reuse refrigerants (e.g. recovery, recycling and reclamation equipment including necessary analyzing equipment for reclamation).
- Public awareness efforts.
- Custom training and equipment to identify refrigerants.

- Legislative and policy support
- Implementation, support and monitoring of the implementation.

The funding available from the Multilateral fund should be focused on areas that can not be easily be financed through regular channels or to make it possible to initiate/encourage activities that could otherwise be expected to be delayed or create undesired effects on the market.

Some of the funding requested above are included in the component of project management and technical assistance.

8.3 Summary of the project costs

The detailed cost breakdown for the activities described in the present national CFC phase out plan in Serbia and Montenegro is given in Annex VIII. The grant is requested in three tranches from 2004 and 2006, so that effective use of the allocated fund is ensured. The administration cost of UNIDO, who is the lead implementing agency, is 7.5 % of the project cost and 13 % of the project cost for Sweden, who will be co-implementing agency for certain activities in the servicing sector.

Chapter 9. Project Management

The overall management of the plan will be carried out by the Government of Serbia and Montenegro with the assistance of UNIDO and Sweden, who will be co-implementing agency for certain activities in the servicing sector.

9.1 Project management and co-ordination

Two offices in Serbia and Montenegro will coordinate the project implementation in each republic including following activities, -

- Reassessment and analysis of the sector.
- Selection of trainers for training of technicians.
- Selection of Vocational schools to be upgraded
- Selection of service workshops to be trained.
- Establish a licensing system for service technicians
- Establish voucher system for equipment to service technicians
- Selection of organization/or set up of organization to develop a Code of Practice
- Establish system (technical and financial structure) to reuse ODS
- Update the legislation including the import/export licensing system
- Awareness promotion.
- Auditing and Monitoring.
- Reporting.

The NOU as a focal point will be responsible for the national coordination of the whole future NCPP programme.

Selected national experts, as core human resources for preparation and implementation of the NCPP will be trained in the areas of advanced service technologies, trends of alternatives technologies and experiences obtained in other countries for the refrigerant management plan.

Although the awareness activity was executed for general issues of Ozone depletion and the Montreal Protocol, it is required to conduct the awareness promotion specifically for NCPP activities in Serbia and Montenegro. Target audience of the awareness activity is not only industries and service providers but also consumers who use refrigeration and air-conditioning equipment. This activity encourages more workshops to be involved in the future NCPP program.

The Ozone Office[7] will be responsible for monitoring the implementation of the phase-out plan, tracking the promulgation, and enforcement of policy and legislation. The office will assist UNIDO with the preparation of annual implementation plans and progress report to the Executive Committee.

The implementation of the phase-out plan will need to be closely aligned and coordinated with the various policy, regulatory, fiscal, awareness and capacity-building actions, which the Government of Serbia and Montenegro is executing, in order to ensure the consistency with the Government priorities.

[7] The Ozone office belongs to Ministry of Science and Environmental Protection, Republic of Serbia.

The phase-out plan for the whole refrigeration sector will be managed by a dedicated team, consisting of a coordinator to be designated by the Government and supported by representatives and experts from the implementing agencies and the necessary support infrastructure. The policy and management support component of the phase-out plan will include the following activities for the duration of the plan:

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

For implementation of service sector activities, the coordination office in the four regions of Serbia and Montenegro will coordinate the project implementation in each region for following activities, -

- Reassessment and analysis of the sector after the approval of the sector phase-out plan.
- Selection of trainers for training of technicians.
- Selection of Vocational schools to be upgraded
- Selection of service workshops to be trained.
- Establish a licensing system for service technicians
- Establish voucher system for equipment to service technicians
- Establish system (technical and financial structure) to reuse ODS
- Determination of the specification of equipment to be provided by the sector phase-out plan.
- Selection of organization/or set up of organization to develop a Code of Practice
- Assist NOU to update the legislation including further develop the import/export licensing system
- Awareness promotion.
- Auditing and Monitoring and report to NOU

Coordination offices are to be established in regions in the country. In each region, an advisory committee will be established consisting of representatives of the local governments (environmental departments and industry departments), customs offices, education and training institutions and industries.

The activities envisaged in the following are required for the coordination:

- A list of service workshops should be updated in terms of their CFC consumption, necessary equipment for recovery, their readiness to recover CFC, commitment to CFC phase out activity, capability and other factors relevant to the recovery and recycling scheme project.
- Possible institutes and/or enterprises for centers for training and recycling should be surveyed.
- The business criteria of refrigerant recycling center should be developed.
- Recipient service workshops of recovery machine should be determined.
- Un-recyclable refrigerants should be kept for further treatment at the proper site.

Further, local distribution of service equipment and equipment for establishment of infrastructure to reuse ODS , which will be procured through UNIDO bidding procedure and delivered to the country, should be executed.

9.2 Targeted information

An essential element in the project will be to make end-users/consumers and professional end-users of refrigeration and air-conditioning equipment (such as supermarket operators and commercial building owners) aware of the ODS phase-out and alternatives to CFCs. The project will also have to raise awareness of the long term benefits and cost savings of improved service procedures that will arise as a result from the service industry following good practices. An improved level of knowledge by customers (equipment owners) will encourage them to direct business towards service companies that are properly trained and proactive in promoting their good practices and compliance with the law.

A public awareness campaign will increase the pressure on the industry to change its way of doing business. Well-informed customers will be important to generate a market for ODS-free equipment and for improved services. Legislation, training and licensing cannot be expected to change the market on their own. To rely on the technicians to promote the new methods and technologies, without assistance, will slow down the phase out process. It is likely that only a limited number of service companies will make the effort to introduce long-term cost-effective solutions to their customers. Many service companies will continue with "business as usual" as long as their customers do not request anything else.

To inform the whole population of Serbia and Montenegro of the ozone issue and all relevant information is a major undertaking. This strategy is proposing a targeted approach together with the industry in addition to general awareness raising campaigns aimed at the general public.

The only time most consumers are interested in and will need to deal with ODS related issues is when they buy or service their car, refrigerator or air-conditioning system. The same will also be true for many professionals that have refrigeration and air-conditioning systems in their buildings, shops, restaurants, hotels, hospitals and industries. General information in the media will raise the general awareness and will play a roll in the phase-out process, but it will be customized information that is targeted for different consumers or

end-users that will be the most important. Information that is targeted towards selected groups can be more specific which should increase the relevance and therefore the audiences' interest in it.

The pressure from a well-planned public awareness campaign directed both at trade companies and end users, coordinated with training of the technicians, will be of key importance. If successful it should generate interest for technicians to participate in training as well as to generate the necessary market for the technicians to implement their new knowledge.

Chapter 10. Monitoring and evaluation

NOU monitors the consumption data of all ODS. Inspections at reconverted companies are foreseen to ensure the non uses of CFCs after project completion. The licensing system will be a tool to monitor and ensure compliance of control measures.

The Government has offered and intends continuing to offer continuity of activities and endorsement for the projects through the institutional support (National Ozone Unit) over the next years. This will guarantee the success of any activity approved for Serbia and Montenegro.

After the establishment of the countrywide system for reuse of ODS, the monitoring activity will be initiated to know whether the project is successfully implemented and the target CFC phase out is achieved.
Monitoring activity will be done by:

(1) Establishing the system to ensure with the counterpart institute, that every recycling/reclaim center and service workshop is encouraged or obliged to report data and give information to the recovery, recycling and reclamation scheme. This may be enabled through forms to be filled by reclaim centers and service workshops.
(2) Setting up adequate office facilities including a computer system to collect and analyze the data.
(3) Regular communication with the counterpart institute.
(4) Occasional visits to workshops and reclaim centers.
(5) Regular communication with customs offices.

Following information will be collected from reclaim centers and workshops.

CFC quantity

number of appliances subjected to refrigerant recovery and type of these appliances at every service workshop,
amount of recovered CFC refrigerants at every workshop,
amount of recovered CFC refrigerants sent to the reclaim centers at every workshop,
amount of recovered CFC refrigerants stored at every workshop,
amount of recovered CFC refrigerants received from service workshops at every rreclaim center,
amount of recycled CFC refrigerants at reclaim centers,
amount of recycled CFC refrigerants returned (sold) to workshops,
amount of recycled CFC refrigerants used in workshops and its application,
amount of CFC refrigerants, which can not be recycled and are subject to further treatment (e.g., decomposition plants abroad)
other data relevant for monitoring the scheme (amount of imported CFC refrigerants etc.).

Cost information

cost of recovery at every service workshop and parties who bear the cost,
cost of reclamation at every reclaim center and parties who bear the cost,
price of reclaimed CFC refrigerants,
other financial information relevant to monitoring the system to reuse ODS

Data and information collected will be analyzed to check the adequate operations of the scheme.

Chapter 11. Performance targets and disbursement schedule

Table 12 gives an overview of the annual performance targets.

Table 12. Performance targets of the national CFC phase out plan, Serbia and Montenegro

Year	Management And technical support	Manufacturing sector	Refrigeration service sector
2004	Project approval Establishment of operational mechanism for management and monitoring of the phase-out plan Initiate review of supportive legislation	Working agreement with enterprise in the manufacturing sector	
	Coordination groups set up	Bidding of foaming equipment and charging units	Coordination office set up and relevant training of staff
	Start of awareness promotion	Initiate research at aerosol enterprise	
	Monitor and evaluation		Selection of training institutes and initiated training of trainers
2005	Monitor and evaluation	Provision of foaming and charging units to enterprises	Initiated bidding for service equipment for workshops
		Bidding for modification of aerosol enterprise	Training of technicians (phase 1)
			Selection of centres for reuse of ODS and initiated bidding of equipment for centers to reuse ODS
			Custom officers trained
2006	Monitor and evaluation	Commissioning of foaming equipment and charging units	Delivery of service equipment (phase 1)
	Workshops e.g., supplementary training	Commissioning of modified Aerosol production facility	Training of staff at centers for reuse of ODS
			Training of technicians (phase 2)
2007	Monitor and evaluation		Delivery of service equipment (phase 2)
	Workshops e.g., supplementary training		Selection of end-users or retrofitting and replacement

			Legislation updated incl. ban on venting, and ban on new installations
2008	Monitor and evaluation		Execution of incentives for retrofitting and replacement
			Licensing system for service technicians in force
2009	Monitor and evaluation		
2010	Monitor and evaluation		

Upon approval of the phase-out plan by the MLF, the Government of Serbia and Montenegro, through UNIDO and Sweden, requests the Executive Committee to authorize disbursement of funding for 2004 in advance, the implementation plan for which, is as following:

1. Establishment of operational mechanism for management and monitoring of the phase-out plan;
2. Formulation of detailed terms of reference and work plans for various activities under the technical support and policy & management support components;
3. Establishment of an operational mechanism for participation in the phase-out plan and for obtaining phase-out commitments from enterprises;
4. Initiating CFC phase-out activities for the … medium-sized enterprises through individual sub-projects;
5. Selection of the small-sized enterprises for group projects;
6. Two workshops under the technical support component for technology assistance to prospective participant enterprises in the sector;
7. One workshop for public awareness and information dissemination under the policy and management support component.

Since the average duration required for completion of project components is expected to be 10 – 30 months, the phase-out activities initiated in 2004 will not produce results until mid or end-2005, contributing to the reduction of consumption starting 2006. Therefore, the Government of Serbia and Montenegro through UNIDO, will request the disbursement of the 2004 funding at the second Meeting of the Executive Committee in 2004. The funds for 2005, 2006 and subsequent years will be approved at the first meeting of the Executive Committee in these years, for the amounts listed in Annex VIII, upon approval of the annual implementation plan and upon confirmation by the Government, UNIDO and SWE, that the agreed reduction targets and relevant performance milestones of the respective preceding years have been achieved.

The further detail must be agreed with the Executive Committee and stated in the Agreement.

ANNEX I. MLF Projects in Serbia and Montenegro

CODE	IA	TYPE	SEC	PROJECT TITLE	ODP MT	FUND US$
YUG/SEV/04/PRP/02	IBRD	PRP	SEV	Country programme preparation	0.0	20,302
YUG/SEV/04/PRP/03	IBRD	PRP	SEV	Preparation of investment projects (1991)	0.0	0
YUG/REF/34/INV/13	Italy	INV	REF	Replacement of CFC-11 with cyclopentane foam blowing agent and CFC-12 with HFC-134a refrigerant in the manufacture of domestic refrigerators and freezers at Obod Elektroindustrija	94.9	1,683,135
YUG/FOA/34/PRP/10	UNIDO	PRP	FOA	Preparation of one investment project in the flexible foam sector	0.0	15,000
YUG/FOA/34/PRP/11	UNIDO	PRP	FOA	Preparation of one investment project in the rigid foam sector	0.0	15,000
YUG/FOA/35/INV/14	UNIDO	INV	FOA	Phase-out of CFC-11 by conversion to n-pentane technology in the production of continuous rigid polyurethane foam insulating panels at Prva Iskra-Fim, Co.	75.0	475,728
YUG/FOA/35/INV/15	UNIDO	INV	FOA	Conversion from CFC-11 to methylene chloride in the production of flexible slabstock foam at Prva Iskra-Poliuretani	34.4	100,240
YUG/HAL/33/PRP/09	UNIDO	PRP	HAL	Project preparation in the halon sector	0.0	20,000
YUG/HAL/35/INV/16	UNIDO	INV	HAL	Halon bank management programme	370.0	249,700
YUG/REF/23/PRP/04	UNIDO	PRP	REF	Preparation of an investment project in the refrigeration sector for phasing out ODS at Obod	0.0	9,992
YUG/REF/24/PRP/06	UNIDO	PRP	REF	Preparation of refrigerant management plan	0.0	10,000
YUG/REF/33/PRP/10	UNIDO	PRP	REF	Preparation of 2 projects in the commercial refrigeration sector	0.0	10,000
YUG/REF/34/INV/12	UNIDO	INV	REF	Replacement of refrigerant CFC-12 with HFC-134a and foam blowing agent CFC-11 with HCFC-141b in the manufacture of commercial refrigeration equipment at 7 enterprises	59.6	755,162
YUG/REF/36/PRP/17	UNIDO	PRP	REF	Preparation of an umbrella investment project in the commercial refrigeration sector	0.0	20,000
YUG/REF/37/INV/18	UNIDO	INV	REF	Umbrella refrigeration project 2, replacement of refrigerant CFC-12 with HFC-134a and foam blowing agent CFC-11 with HCFC-141b in the manufacture of commercial refrigeration equipment at three enterprises	10.9	150,109
YUG/SEV/21/CPG/01	UNIDO	CPG	SEV	Country programme preparation	0.0	80,000
YUG/SEV/25/INS/07	UNIDO	INS	SEV	Institutional strengthening	0.0	151,500
YUG/SOL/23/PRP/05	UNIDO	PRP	SOL	Preparation of an investment project in the solvent sector for phasing out ODS at Hemofarm	0.0	7,401
YUG/SOL/26/INV/08	UNIDO	INV	SOL	Replacement of CFC-113 as solvent for dialyses cleaning by water and steam at Hemomed Ltd.	54.6	608,729
YUG/REF/38/INV/xx	UNIDO	INV	REF	Conversion of CFC-12 to HFC-134a in the manufacture of open compressors at Prva Petoletka – Kocna Tehnika Co.	2	223,412
YUG/PHA/40/PRP/20	UNIDO	PRP	PHA	Preparation of project proposal of national phase out plan (manufacturing sector)	0	45,000
YUG/PHA/40/PRP/20	Sweden	PRP	PHA	Preparation of project proposal of national phase out plan (service sector)	0	65,000

ANNEX II. Baseline data of eligible enterprise in the foam sector

Baseline data of Laminat

Company background and products

It is a 100% indigenously owned private company established in 1980 and employs 72 people (9 administrative, 4 technical and 59 operators). The company is producing thermoformed packing products and also laminate cardboard packaging products. The factory is situated in Bajina Bašta 200 km from Belgrade. At present 3-5% is exported to Bosnia & Herzegovina. In 2002, the company produced 404 tonnes of extruded foamed polystyrene split as follows:

15% EPS folia. ("Laminat" boards covered with paper)
50% trays for food packing (54 different type of trays)
35% EPS boards for insulation purposes. (3 different dimensions)

CFC Consumption

The average consumption of the company during the years 2000 to 2002 was 72 tonnes of CFC-11. All chemicals are imported from variety of suppliers including Bayer, Arco Chemicals and ICI.

Manufacturing process and equipment

Production of the company is based on an extrusion line, made by LMP, Italy, Torino: RC 41/E - extruder for production of foamed polystyrene, with installed capacity of 700 MT/year. Manufactured in 1982. Installed in 1982[8]. Extruder capacity is 180 – 220 kg/h.

The extruded polystyrene sheets are processed in the company, producing various plates and trays for food packaging. Extruders operate in three 8 hour shifts a day working cycle, and thermoforming machines in one 10 hour shift/day. Finishing production equipment includes thermo-forming machines, tray production and laminator (paper wrapping). For the normal functioning of the extruder, it is necessary to warm up all working zones at the temperatures higher than the working temperatures for 20- 30 C. There are 10 zones heated from 160 to 310 ^{o}C. Preheating lasts about 2 h . In parallel with heating all other operations are in preparation.

Feeding and discharging is regulated by two timers installed at control board. Vibration intensity is regulated by potentiometer installed in control board and vibration frequency is regulated at the feeder unit. It is recommended that vibration frequency be constant and always 19. At this production line it is possible to produce 4 types of EPS, of following width of the strip 740, 870, 1050, and 1260 mm. Capacity of 220 kg/h could be attained only by producing maximum width of the strip. If the width is less than maximal production capacity varies between 150 –

[8] type, twin-screw, co-rotating; screw diameter, 102 mm; screw length, 21 D; drive, 35 HP, DC electric motor; cylinder heating, electric resistances; die head with oil conditioning unit complete with air cooling ring; dosing of polymer, Engelhardt (mechanical balance loaded through vibrating trough); dosing of solid additives, Engelhardt (mechanical balance loaded through vibrating trough); low and high pressure pump for CFCs; control board for temperature, torque and screw speed control; take-of with two rubber coated cylinders; winding unit.

170 kg/h. Sampling is organized by cutting pieces of EPS strip in size which will enable to make 3 to 4 squared shaped samples with 200x200 mm dimension. Samples are taken from every roll before defined weight and thickness of the strip is secured. After that samples are taken occasionally, only. From the extruder product goes to following production lines, -

I. laminator – paper wrapping (in form of boards),
II. tray production, and
III. thermoforming machines

EPS strips for construction purposes are produced in form of rolls or squared shape boards.

ANNEX II. Detail and the cost breakdown of the foam project

Modifications of foaming system

It is to be done maintaining its current capacity and ability to produce the marketable foam grades that fulfil standard quality demands with the new blowing agent and to comply with the stringent safety requirements. The following conditions are taken into consideration:

- butane/polymer mixture is harder to process than CFC/polymer;
- technological parameters must be controlled accurately;
- flammability of butane requires security in handling with material and perfect technical condition of the equipment.

This project proposes modifications to the extruder, including additional equipment and instrumentation, as follows:

a) Main (driving motor) of the screws, motors for loaders from daily containers, feeders, cutters, and the take-up mandrels must be changed with ex-proof types.
b) Electric heaters of the extruder need at least two changes: different ohmic values to achieve the required temperature profile; and explosion-proof connections, switches, etc.
c) Cooling is done with electric fans and also in this case the motors should be changed to ex-proof types.
d) Barrel and screws with heating and cooling elements renewal and extension.

With the conversion from CFC-11 to butane it should be taken into account, that butane has higher foaming capacity and the dosage is therefore lower (approximately 50 % of the CFC dosage when producing the foam of equivalent quality). The viscosity of the melt is higher. In order to distribute small amount of gas, nucleate and other ancillary chemicals equally so as to produce homogenous, uniform foam, it is necessary to add more mixing (compounding) energy and to keep the foaming process under the control. This can be achieved with the change of geometry and length (extension) of the screws.

To produce perfectly homogenous foam is extremely important in case of thin sheets for further processing using thermoforming technology, especially when manufacturing products that need deeper duct while forming.

Finished products (trays, plates etc.) must exhibit good mechanical properties, so as to withstand further handling in packaging industry.

The best technical and economical solution is to replace both barrel and screws.

e) An annular foam extrusion head is used. The melt flow through the head has to be adapted to the foaming process and therefore an automatic self-adjusting of the gap must be ensured. This is done by the motor that must be ex-proof.

f) A die head-conditioning unit is necessary so as to keep the foaming under control. The foaming takes place at the end of the barrel (when material is leaving the die head) due to the pressure drop and vaporization of the blowing agent. Equilibrium is reached when

the inner cell pressure balances its structure. An oil thermo-conditioning unit must be used.

g) The homogenizer (static mixer) is used in order to ensure perfect homogeneity and uniform distribution of all the components throughout the polymer melt in the last zone of the process. This unit is placed before the die head. The second role of the homogenizer is to ensure accuracy in the control of melt temperature up to the extrusion head. It is extremely important to avoid over passing the boiling point of the blowing agent and to trigger the premature uncontrolled, expanding process that would provoke series of inconveniences.

h) The high-pressure butane supply pump should preferably be a diaphragm type and should have an ex-proof driving motor and electrical switchgear. It should be designed for liquid gas with a working pressure up to 350 bar. A very accurate and uniform dosing flow is needed.

i) As a safety measure, to cut-off the butane supply in case of a pressure drop indicating loss of material feed or gas leak is required. This can be achieved by installing a pressure sensor in the compression zone of the extruder barrel. It is obvious that the information to be supplied by this transducer should be wired to and processed by the central control panel.

j) As in (h) above, installation of a material feed hopper level indicator can help to shut-off the butane supply if there is an interruption of the material supply.

k) Very accurate dosing and feeding units for solid components are necessary. The satisfactory results are obtained with a gravimetric dozer by weighing system.

Mixer to supply powder additives

Compared to CFC-11, butane leaves the foam cells much faster. Therefore, the new formulation needs nucleation additive to prevent excessive dimensional shrinkage (cells collapse). Due to the higher blowing power of butane the new formulation also needs an additive with cross-linking functions to ensure the required cell structure and hardness of the foam. The different physical, rheological and thermal characteristics of the new formulation require adjustment of temperatures and pressures for extrusion. The existing feeding unit should be replaced by ex-proofed one.

Compressed and ionized air supply

Experience elsewhere shows that about 60% of the hydrocarbon-based foaming agent used in this process is emitted when the foam leaves the die and crosses over to the cutting and take-up mandrel. Therefore, die, crossover and cutter should not only be very-well ventilated but also ionized and compressed air should be blown to this area for cooling and to accelerate the clearing of the gas. Therefore, upgrading of the compressed air supply and the air ring which is used in the cooling phase are needed.

Butane storage and supply

a) One butane storage tank of 25 000 litre capacity and complete with all accessories will be installed.
b) A low-pressure pump with ex-proof motor will be used to supply butane to the high pressure pump.
c) In order to meet the relevant food standard requirements, mercaptan containing in butane as the odorizes must be removed before it is used as foaming agent. Zeolite-based granular filter material, packed into metal cartridges will be installed in the butane supply line. The cartridges will be regenerated or renewed.
d) High pressure butane pumps should be placed in a small, separate room provided with the required safety arrangements.

Building reconstruction and civil works

a) Production plant has to be reconstructed in order to be in compliance with safety standards (separation wall to be erected, water and electricity renewed, etc) Extruder must be separated from other technological operations.

b) New technological storage for fresh products: An estimated 40% of the trapped butane in the cell structure of the foam escapes during the first weeks of storage. Therefore, the fresh products should be stored at least one week in a semi-closed and well-ventilated storage facility, provided with a fire-fighting system, before being transferred to the warehouse.

c) Small separate room provided with required safety arrangements for high-pressure butane pumps, approx 12 m^3.

Approach roads and filling/loading platforms to the butane storage tank must be constructed.

Fire protection and fighting
Due to the limited capacity of the existing water supply system at the project site, it is necessary to install an emergency water tank of minimum 40 m^3, including piping and a low pressure pump, connected to the water sprinkling system of the technological storage place of fresh products. Taking into account the objective reason that butane will always exist in this area increasing the hazard risk, it is absolutely necessary to install a small electrical back-up generator as an integral part of the emergency water tank system.
Measures against fire hazard at the production area will include, among others, placement of 10 mobile/hand-held extinguishers (powder or CO_2 types), 4 trolley-type extinguishers and an automatic foam water sprinkler system.

Electrical system

Emergency back-up electricity generator.
Explosion-proofing of electrical distribution system:
Electrical grounding of workshop, butane storage tank, high-pressure butane pumping room and technological storage facilities.

Ex-proofing of distribution panels, switchgear, other electrical equipment, etc.

Butane detection and alarm system

Centralized alarm system, having, among others, audio and visual warnings and emergency electricity switch-on and butane supply cut-off facilities;
Battery back-up for alarm system and emergency lighting;
Stationary butane gas sensors at ceiling and floor levels (type and placement density depending on the process area covered).
Portable butane sensors.

Ventilation system

Consisting of ex-proof electric fans, air-flow sensors, hoods, tunnels, exhaust ducts, pipes, chimneys, etc. the ventilation system will cover the workshop (with special emphasis on the extruder, the crossover between the extruder and the take-up and cutting mandrel and the electrical control cabinet), and butane pumping room.

The detailed capital cost for conversion of CFC-11 foaming technology to butane technology is given in the Table below.

Table Incremental capital cost break down for the project at Laminat

	ITEM	Unit	Unit price [US$]	Qty	Total [US$]
	Extruder retrofitting				
1	Explosion-proof main motor	each	20,000	1	20,000
2	Explosion-proof driving motor for metering and dosing unit (polymer pellets)	each	1,200	1	1,200
3	Explosion-proof motor for loader from daily container	each	1,200	3	3,600
4	Extrusion screw	set	30,000	1	30,000
5	Barrel with heating and cooling elements renewal and extension	set	15,500	1	15,500
6	Extrusion head with adjustable gap	each	30,000	1	30,000
7	Homogenizer	each	30,000	1	30,000
8	Gas injector into extruder	each	10,000	1	10,000
9	Die head conditioning unit	each	18,000	1	18,000
10	Pressure transducer with connection and display (Dynisco)	each	2,500	1	2,500
11	Changing of cooling air fans of heaters	set	1,500	1	1,500
12	Metering and dosing unit for nucleant	each	10,000	1	10,000
13	Mixer to prepare powder additives	each	1,500	1	1,500
14	Explosion-proof die motor	each	2,600	1	2,600
15	Explosion-proof cutter and take-up mandrel motor	each	2,000	2	4,000
16	Ionized air blowers	each	1,700	2	3,400
17	Electric control cabinet ventilation	each	35,000	1	35,000
	Total cost of extruder retrofitting				218,800
	Foaming agent supply				
18	Butane tank, 5 m^3	set	10,000	1	10,000
19	Low pressure system including tank accessories	set	15,800	1	15,800
20	Molecular sieve system	each	15,000	1	15,000
21	High pressure system	set	49,000	1	49,000
22	Piping (LP and HP)	set	12,000	1	12,000
	Total cost for foaming agent supply system				101,800

	ITEM	Unit	Unit price [US$]	Qty	Total [US$]
	Safety-related modifications/retrofitting				
23	Civil construction for adaptation of old building	each	22,000	1	22,000
24	Water sprinklers for technological storage facility	set	11,000	1	11,000
25	Portable fire extinguisher	set	200	2	400
26	Emergency water supply: 2 water tanks (40 m^3 each), pumps and other hydraulic components	set	12,000	1	12,000
27	Stand-by electric power generator for ventilation, alarm and water supply system: 100kW	each	16,500	1	16,500
28	Automatic CO_2 system over die	set	6,700	1	6,700
29	Gas detection system with associated wiring and electronics	each	20,000	1	20,000
30	Electric control cabinet	each	20,000	1	20,000
31	Ex-proof ventilation fans (2 for gas house containing high pressure pump, 4 for extruder line, 4 for storage/cure area)	each	2,600	6	15,600
32	Ventilation ducting, including hoods and sucks around and above the extruder. (Drawings and critical components are from MF)	set	28,000	1	28,000
33	Audio/visual alarm system	set	3,000	1	3,000
34	Emergency lighting	each	200	6	1,200
35	Portable gas detectors	each	400	1	400
36	Electrical grounding for the entire building	set	5,100	1	5,100
37	Antistatic paint, clothing, shoes, etc	set	3,500	1	3,500
	Total safety-related modifications/retrofitting				165,400
	TOTAL EQUIPMENT COST				486,000
	Certification according to intern. and local standards	each	17,000	1	17,000
	General consulting services and training, icl. safety training	w/m	8,000	3	24,000
	Contingency 10%				36,090
	TOTAL INCREMTNAL CAPITAL COST				563,090

ANNEX IV. Detail of the aerosol sector phase-out project

Baseline data of Galenika

Enterprise NAME: Galenika
No. OF EMPLOYEES: 2,700
YEAR OF ESTABLISHMENT: 1945 (spray production started in 1978)
BASELINE EQUIPMENT:

EQUIPMENT	MAKE/MODEL	SERIAL No.	CAPACITY, CANS/MIN	YEAR	Proposed Modification	DISPOSAL PLAN
Double head crimper and gasser	Rotamat Pamasol Tip 2038	3315/5977	4 cans/min	1977	To be connected to the new gassing unit	Gassing head to be rendered unusable
Water bath for ceiling test	Pamasol, 2032RH	3316-5974	N/A	1977	To be modified	N/A

BASELINE PRODUCTION DATA: 2000 – 2003

Year	Products	Production Volume
2000	Enbecin aeropsip/Pantenl pena	45,580/0
2001	Enbecin aeropsip/Pantenl pena	31,875/6,390
2002	Enbecin aeropsip/Pantenl pena	94,170/7,065
2003	Enbecin aeropsip/Pantenl pena	130,358/8,831

BASELINE ODS CONSUMPTION DATA: 2000 - 2002

Year	Activity	R-11/R-12 (80/20)	R-114/R-12 (60/40)	CFC total
2000	Production of aerosols	10.0	-	10.0
2001	Production of aerosols	6.8	0.13	9.9
2002	Production of aerosols	20.66	0.14	20.8
2003	Production of aerosols	28.6	0.18	28.8

Project detail

Process implications of replacing CFC with HAP

The use of HAP technology will require substantial changes to the perfume / 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 UNIDO implemented projects as well as conformance with the statutory safety requirements or recommendations of the Local, State, or Federal 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 Zone1. 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, ionising blowers, static dissipaters, 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 Serbia and Montenegro, safety is a serious problem in the closed filling rooms. Every millilitre of liquid propellant that leaks is converted to approximately 230 ml of gas, and this is flammable at even less than 2 % concentration[9]. Therefore, it is proposed, in this project that existing propellant gassing units of the beneficiaries will be replaced with new automatic (semi-automatic) indexing units with gassers and the new units will be placed in the separate open air filling rooms, which will be constructed for this purpose next to the existing production areas.

The project will supply an automatic (semi-automatic) indexing unit with gasser. The production capacity of the new unit will be similar to that of the existing manual crimping/gassing units.

[9] 1.4% - 8% depending on propellant mixture, for instance for propane-butane 25% / 75% mixture

The new unit will be placed in the Open Air Filling Room (OAFR). The production area and the OAFR will be separated by the reinforced concrete wall.

The hydrocarbon cylinder rack, destenching column system, the replacement of existing process pump, the installation of emergency shut-off valve, the automatic (semi-automatic) indexing hydrocarbon gassing unit, u-type conveyor, manual water bath, ex-proofed lighting, fire fighting equipment and flammable gas monitoring (hand held) will be required to accommodate the conversion.

The existing manual crimping and gassing units will be repositioned so that they can be easily connected by means of additional conveyors through the reinforced concrete wall with the hydrocarbon indexing gasser in the OAFR to be located outside the production hall.

Assistance is requested for:

a) the propellant storage, destenching column system and transfer system to the gassing unit:

"Hydrocarbon Cylinder Storage Rack" for three cylinders, manifold and piping, "Destenching Column System", "The replacement of existing process pump", "Emergency Shut-off Valve".

b) the filling line:

"Construction of OAFR", "Conveyor System for connecting the existing crimping units with the OAFR and back to the production area (6 m loop incl. drive unit and two 90 degrees bent)", "indexing HAP gassing unit", Hand held gas detector", Manual water bath", "Ex-proofed lighting", Grounding and lightning conductor", "Fire fighting equipment".

Technical assistance in designing, installation, commissioning and training:

Technical assistance will be required to ensure smooth transition to the selected replacement technology and its sustainable application after the project completion.

Funds are requested for:

Training in plant safety, safety audit, technical assistance and research and testing, all associated with the new HAP gassing technology. The services required for the proper project implementation 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 20 days;
- assistance in training-on-the-job of the personnel of Galenika in production, quality control, safety and safe operation procedures for about 20 days;
- a safety audit after the installation and before the commissioning by an internationally recognized safety certification body.

All other costs, which are related to the relocation of the production lines to the safer areas will be borne by the enterprise themselves.

Incremental cost

ITMES	Project cost in US$
HAP Cylinder Storage Rack, manifold and piping	3,000
Destenching Column System	10,000
Process pump	4,000
Emergency shut-off valve	3,000
Construction of Open Air Filling Room	8,000
U-type conveyor (2 + 2 + 2 m)	14,000
Indexing propellant gasser	22,000
Gas detector (hand held)	1,000
Manual water bath	0
Ex-proofed lighting	2,000
Grounding and lightning conductor	1,000
Fire fighting equipment	2,000
Sub-total	70,000
Contingency (10%)	7,000
Equipment cost total	**77,000**
Training in Plant Safety	**3,000**
Safety Audit	**5,000**
Technology Transfer/Technical Advisory Services (**)	**10,000**
Research, clinical test, registration	**30,000**
Total Incremental Capital Costs	**125,000**

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.

ANNEX V. Baseline data of eligible manufacturers in the refrigeration sector.

	Enterprise	Location	CFC-11 foaming	CFC-12	R-502	CFC Total	Year established	Number of Employees	Product	Baseline foaming equipment	Baseline charging equipment	vacuum pump
1	AS Frigo	Horgos	500	1,500	150	2,050	1977	6	cold storage room	Low pressure dispenser	Refko RMV 2 1988	Refco RD4 1990, RefcoRD6 1995
2	Duta	Svilanjnac	0	700	0	700	1986	7	freezing cabinet, refrigerating show case	N/A	Fisher,Refko Vigam, x5, 1984-2000	Fisher,Vigam, x5, Refco1984
3	Frigotehnika	Nis	0	120	20	127	1989	10	freezing cabinet, refrigerating show case, cooling box	N/A		
4	Jugoklima	Krusevac	0	220	0	220	1991	12	freezing cabinet, condensing unit,cold storage room, low temperature refrigerator	N/A	Frigovak, x2, 1987	Frigovak, x2, 1987
5	Freshness	Belgrade	0	235	42	130	1992	5	cold storage room, condensing unit	N/A	x1	Refco,x2, Rakijas
6	Frigosystem 2000	Mladenovac	780	2,100	0	2,880	1992	15	milk cooler, display refrigerator,cold storage room, water cooler	Low pressure machine x2 locally made and Cannon	Robiner, x5	Robiner, x6
7	Frigomex	Belgrade	300	5,400	500	5,865	1992	6	cold storage room, low temperature refrigerator, condensing unit	Low pressure dispenser	Refco 12505, Refco 10.705 1994	Refco RD8 I RL4, x4 1996
8	Frigo elektro	Podgorica Crna Gora	0	1,360	0	1,360	1989		freezing cabinet, refrigerating show case	N/A	WIGAM, REFCO, x7	Refco, x5
9	Filterfrigo	Beograd	0	970	0	970	1991	11	condensing unit, cooling cabinet, low temperature refrigerator	N/A	x1	x2

10	Arktik	Belgrade	0	700	350	816	1994	10	display case, refrigeration cabinet, milk cooler, low temp. equipment, condensing unit, cold water	N/A	x1	x2

ANNEX VI. Project cost of the refrigeration sector phase-out program, in US$.

#	Enterprise	CFC-11	CFC-12	R-502	CFC Total	Redesign	R134a charging unit	no	renovation of vacuum pump	no	hand held leak detector	no	modification of low pressure dispensing unit	no	Incremental cost total	CE
	unit cost					2,000	2,000		300		300					
1	AS Frigo	500	1,500	150	2,050	12,000	8,000	2	600	2	300	3	10,000	1	30,900	15.08
2	Duta	0	700	0	700	2,000	6,000	5	1,500	5	600	2	0	1	10,100	14.43
3	Frigotehnika	0	120	20	127	0	1,000		300		300	1	0		1,600	12.64
4	Jugoklima	0	220	0	220	500	2,000	2	300	2	300	1	0	2	3,100	14.09
5	Freshness	0	235	42	130	0	1,000		600	3	300	1	0		1,900	14.62
6	Frigo 2000	780	2,100	0	2,880	2,000	2,000	5	1,800	6	900	3	35,000	1	41,700	14.48
7	Frigomex	300	5,400	500	5,865	30,000	30,000	2	1,200	4	1,800	6	10,000	0	73,000	12.45
8	Frigo elektro	0	1,360	0	1,360	3,000	15,000	7	1,500	5	300	1	0		19,800	14.56
9	Filterfriog	0	970	0	970	4,000	8,000		900		900		0		13,800	14.23
10	Arktic	0	700	350	816	4,000	6,000		900		900		0		11,800	14.47
	Contingency														20,000	
	TOTAL				15,117										227,700	15.06

ANNEX VII. End-users and cost estimation of retrofitting in the incentive program

End users are grouped in several sectors.

Sweetmeat and chocolate production; Information and data were collected from the largest producers in this sector such as PIONIR, Subotica, JAFFA, Crvenka, BANAT, Vrsac, and SOKO Stark, Belgrade. Generally, end users in this group are using mostly HCFC–22, small quantity of CFC-12, and less amount of R-502. R-11 is not used. HCFC-22 is mostly used for chillers for preparation of cold water to be used in process and for air conditioning of production areas. Direct expansion is used only tunnels for chocolate products and for air conditioning of specific areas like store rooms, laboratories and some production areas.

End-users of CFCs, chocolate and sweat food manufacturers

Producers of chocolate		R-12		R-502		R-22	
		Charging	Service	Charging	Service	Charging	Service
1	Soko Stark	258*	136	1,5	0,5	890	408
2	Pionir	49	30	40	10	910	400
3	Banat	14	5	-	-	537	180
4	Yaffa	68**	24	-	-	230	50

* In mid 2003 company made partial change substituting R-12 with R-22.
** By the end of 2002 company changed production line and introduced R-404a, and not using R-12 any more

Administrative and other public buildings; Larger administration offices and public buildings use CFCs. They include airport Belgrade, Government buildings, oil company business centre, insurance company, headquarters of PTT, Newspaper and publishing companies, House of Justice, and some others. CFC-11 and CFC-12 are used for air conditioning in turbo chillers (manufactured in most cases by Carrier, York and Westinghouse). Cumulative quantity of the refrigerant for 11 major public buildings and objects is as follows; for R-11 is 2.500 kg and for R-12 is 900 kg.

Hospitals; The most important and largest clinical centers are, -

- Complex of Belgrade clinical centre having 3 turbo chillers charged with CFC-12, each one 280 kg, i.e. 780 kg in total and many water chillers charged with HCFC-22.
- Complex of Military hospitals, Belgrade having four turbo chillers (Carrier) charged with CFC-12, each one 1,361 kg, i.e. 5,444 kg in total.

Super markets and fast food restaurants; C Market Co. in Serbia consumed 3,264 kg of CFC-12 in 2002 for its refrigeration needs (mostly for cold stores and display refrigeration). McDonalds fast food restaurants in its installations use following quantities of refrigerants; CFC-12 50 kg, R-502 30 kg, HCFC-22 300 kg and R-404 a 50 kg.

Two supermarkets from Montenegro gave us information on their consumption data:

End-uses of CFCs, supermarkets

	Company	R-12	R-22	R-502	R-134 a
1	PKB Zelenika	100	100	10	20
2	Institute SM - 2000	200	100	25	30

Hotels; Two largest hotels in Belgrade (Hyatt and Intercontinental) and 12 largest hotels at the Montenegrin coast have small refrigeration equipment with annual consumption of refrigerant for service purposes as seen below.

End-users of CFCs, hotels

	Hotel name – bed number	R-12	R-22	R-502	R-134 a
1	HTP Boka – 2,500	150	200	25	30
2	Institute SM – 2,000	100	600	30	50
3	RVI Igalo - 600	40	200	20	20
4	Military hospital	100	200	20	20
5	H. Vojvodina -300	80	100	15	20
6	H. Metalurg – 400	50	50	10	10
7	H. Delfin - 500	80	100	20	20
8	Enterprise Hotels - 500	100	50	20	20
9	Private pensions in He4rceg Novi area – 500	50	100	30	20
10	H. Slovenska Plaza Budva-800	70	280	-	-
11	H. Hyatt, Belgarde				
12	H. Intercontinental - 1000	120	** till 2002 R-11 200 kg, from 2003 R-123 290		

The cost of retrofitting of CFC equipment is estimated, which compose the cost of new refrigerant, synthetic lubricant and engineering fee.

Cost of retrofitting

Company	No. with CFC	Application	CFC-12 Service use kg	CFC-12 installed amount kg	Lubiricnat amount kg	R-134a kg	Cost of POE	Cost of R-134a	Minor capital	Labor man-day	Labor cost	TOTAL US$
unit cost, $							4.00	8.90			100.00	
Hospital and clinic	7	turbo chillers		6,224	12,448	5,602	49,792	49,854	44,869	2	1,400	146,000
Supermarket chains	20	cold storage, display case	3,640	30,000	60,000	27,000	240,000	240,300	216,270	10	20,000	717,000
Hotels	11	refrigerators	940	9,400	18,800	8,460	75,200	75,294	67,765	2	200,000	418,000
Public buildings	10	Public buildings	3,400	30,000	60,000	27,000	240,000	240,300	216,270	2	2,000	699,000
Restaurant	1350	cold chamber freezer	80	800	1,600	720	6,400	6,408	5,767	1	135,000	154,000
TOTAL COST			8,060	76,424							0	2,133,000

ANNEX VIII. Project cost of the National CFC Phase-out Plan for Serbia and Montenegro

Description	Total Cost	2004		2005		2006	
	US$	UNIDO	SWE	UNIDO	SWE	UNIDO	SWE
1. Foam sector program	**209,000**	100,000		109,000			
2. Aerosol sector program	**125,000**	35,000		90,000			
3. Refrigeration manufacturing sector program	**227,700**	177,700		50,000			
4. Refrigeration servicing sector program	**1,951,550**	102,000	73,000	500,000	48,000	1,218,050	10,500
(1) Training of existing workforce							
Training of Trainers	15,000	15,000	0				
Development of training material	15,000		15,000				
3 - 4 day training course	190,000		0	100,000		90,000	0
Contingency	21,500					21,500	
Technical assistance to develop the training material	8,000		8,000				
Sub-Total	**249,500**	15,000	23,000	100,000	0	111,500	0
(2) Strengthening of Vocational Schools							
Update and production of training materials	15,000		15,000				
Procurement of equipment (10 schools)	150,000			150,000			
Training of Trainers	20,000		20,000				
Contingency	18,500					18,500	
Technical assistance to develop the training material and upgrade the equipment	8,000				8,000		
Sub-Total	**211,500**	0	35,000	150,000	8,000	18,500	0
(3) Equipment to service technicians							
Equipment for service shops	915,000			150,000		765,000	
Contingency	91,500					91,500	
Tecnical assistance to develop incentive scheme for voucher/partial grant system	10,000		0		10,000		
Sub-Total	**1,016,500**	0	0	150,000	10,000	856,500	0
(4) Code of Practice							
Code of practice	25,000		7,000		10,000		8,000
Contingency	2,500						2,500

Technical assistance to develop af Code of Practice	8,000		8,000				0
Sub-Total	**35,500**	0	15,000	0	10,000	0	10,500
(5) Establishment of infrastructure to reuse ODS							
Equipment to initiate infrastructure	210,500			100,000		110,500	
Coningency	21,050					21,050	
Technical assistance to establish infrastructure to reuse ODS (incl. financial scheme)	20,000				20,000		
Sub-Total	**251,550**	0	0	100,000	20,000	131,550	0
(6) Customs training							
Customs training and provision of identifier	72,000	72,000					
Technical assistance	15,000	15,000					
Sub-Total	**87,000**	87,000					
(7) Demonstration project for Incentive program for retrofitting	**100,000**					100,000	
5. Project management and technical assistance							
Targeted information	30,000		20,000		10,000		
Management and coordination of implementation	300,000		50,000		50,000	150,000	50,000
Auditing and Monitoring	100,000					100,000	
Technical assistance for industry, workshop on alternative technology, ODS issues.	100,000	50,000		50,000		0	
Technical assistance to authorities to update legislation	15,000		15,000				
Technical assistance to design licensing system for service technicians	10,000		10,000				
Sub-Total	**555,000**	50,000	95,000	50,000	60,000	250,000	50,000
Total Project cost	**3,068,250**	464,700	168,000	799,000	108,000	1,468,050	60,500
Total for tranche		632,700		907,000		1,528,550	
Support Cost UNIDO (7,5%)	**204,881**	34,853		59,925		110,104	
Support Cost SWE (13%)	**43,745**		21,840		14,040		7,865
Support Cost total	**248,626**	56,693		73,965		117,969	
Total Grant	**3,316,876**	499,553	189,840	858,925	122,040	1,578,154	68,365
Total Grant for tranche		689,393		980,965		1,646,519	

ANNEX IX. Equipment Costs for the recovery, recycling and reclamation project

The following costs are applied to the national CFC phase out plan for the national re-use and reclamation project and the equipment to service shops.

National re-use and reclamation project				
Items	Description	unit cost	Q'ty	Sub total
Establishment of reclamation capability	Total 6 reclamation centers			
Training of reclamation centre staff		500	10	5 000
Equipment	reclaimer with air purge function	15 000	6	90 000
	Gas chromatograph	12 000	6	72 000
	Moisture meter	6 000	6	36 000
	recovery cylinders	30	100	3 000
	storage cylinders	150	10	1 500
	leak detector	300	10	3 000
Total Equipment				210 500
Contingency				21 050
Technical Assistance to establish infrastructure to re-use ODS (Including financial scheme)				20 000
Total for infrastructure to re-use ODS				*251 550*

Equipment for service shops	for 1000 shops			
	Vacuum pump	400	1 000	400 000
	Vacuum meter	45	1 000	45 000
	Recovery cylinder	30	0	0
	Leak detector	300	1 000	300 000
	Nitrogen gauges	170	1 000	170 000
	Cost per shop	1 095		
Total Equipment				915 000
Contingency				91 500
Technical Assistance to develop incentive/partial grant scheme				10 000
Total for workshops				1 016 500
Element Total				1 268 050