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EXECUTIVE COMMITTEE OF
THE MULTILATERAL FUND FOR THE
IMPLEMENTATION OF THE MONTREAL PROTOCOL
Forty-first Meeting
Montreal, 17 - 19 December 2003

PROJECT PROPOSAL: LIBYAN ARAB JAMAHIRIYA

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

Phase-out

- National ODS phase-out plan (first tranche) — UNIDO

PROJECT EVALUATION SHEET
LIBYAN ARAB JAMAHIRIYA

SECTOR: Phase-out ODS use in sector (2001): 985.4 ODP tonnes*

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

Project Titles:

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

Project Data	**Multiple**
	National Plan
Enterprise consumption (ODP tonnes)	1,053.60**
Project impact (ODP tonnes)	678.2***
Project duration (months)	72
Initial amount requested (US $)	4,908,907
Final project cost (US $):	
Incremental capital cost (a)	
Contingency cost (b)	
Incremental operating cost (c)	
Total project cost (a+b+c)	4,560,422
Local ownership (%)	
Export component (%)	
Amount requested for first tranche (US $)	1,500,000
Cost effectiveness (US $/kg.)	8.06
Counterpart funding confirmed?	
National coordinating agency	Committee on Climate Change
Implementing agency	UNIDO

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

* 2001 Article 7 consumption of CFCs
** Total 2002 ODS consumption identified by the National Phase-out Plan
*** The total impact of the measures funded in the National Phase-out Plan.

PROJECT DESCRIPTION

Sector background

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

According to Decision 35/37 Libya has selected Option 2 as Starting Point amounting to:	618.0 ODP tonnes
- Remaining consumption of CFCs eligible for funding as at 41st Meeting (per Decision 35/57, proviso B)	618.0 ODP tonnes
- Impact of all CFC projects submitted for funding at the 41st Meeting	678.2 ODP tonnes
- Remaining consumption of CFCs eligible for funding following approval of projects submitted to 41st Meeting	0 ODP tonnes

1. On behalf of the Government of Libya, UNIDO submitted the National Phase-out Plan for consideration at the 41st Meeting of the Executive Committee. The present phase-out plan will be implemented over the period from 2003 – 2009 and enable the Government of Libya to phase out the total remaining ODS consumption by January 1, 2010. A series of investment, non-investment, and technical support activities are proposed to achieve this target in the foam, commercial and transportation refrigeration manufacturing, and refrigeration servicing and halon banking sectors. Given the multi-faceted approach proposed in the Plan the Government of Libya is seeking flexibility to adapt or modify its strategies during implementation of this plan as the need arises. The Plan is attached to this document.

2. The objectives of the NPP are formulated as follows:

- Characterize consumption and uses of the ozone-depleting substances (ODS) in Libya.
- Assess the market structure for CFC supply and consumption in the country;
- Develop documentation on distributors and consumers of CFCs and other ODS;
- Identify and characterize availability and usage of alternatives;
- Identify opportunities for conversions;
- Develop and implement a strong policy action programme for ODS phase out;
- Develop a strategy and an action plan for phasing out remaining ODS consumption; and
- Achieve the phase out of the ODS in 2010, through the implementation of the action plan.

3. Libya does not produce any ozone depleting substances and its total requirement is imported. According to the country programme approved at the 32nd Executive Committee meting, total imports in 1999 were 898.89 ODP tonnes of CFCs, 210.80 ODP tonnes of HCFCs, 5.50 ODP tonnes of halons and 175.00 ODP tonnes of methyl bromide.

4. A national survey was carried out to estimate the consumption of controlled substances in different sectors in the country through questionnaires and interviews with importers and users. Reasonably accurate data were available from users in the formal sector. However, the CFC consumption in informal sectors such as repair and maintenance of domestic refrigerators, air-conditioners and MAC applications has been based on estimates. The 1999 consumption by application sectors and control substances is presented in the table below.

Sector	Sub-sector	ODS	Application	Consumption (metric tones)
Refrigeration & Air-conditioning	Domestic/Commercial/ Industrial	CFC-11	Purging	2.22
	Industrial	CFC-11	Recharge	2.00
	Domestic	CFC-12	Initial	10.50
	Domestic/ Commercial/Industrial	CFC-12	Recharge	135.97
	Industrial	CFC-114	Recharge	0.14
	Commercial/ Industrial	CFC-11 5 (as R-502)	Initial and Recharge	3.00
	MAC	CFC-12	Recharge	3.38
	Domestic/Commercial/ Industrial	HCFC-22	Initial and Recharge	60.95
Foam	Flexible Foam	CFC-11		642.00
	Rigid Foam (including insulation for water heaters and refrigerators)	CFC-1 1		116.45
Halons	Industrial	Halonl211	Fire Protection	0.25
		Halon 1301	Fire Protection	3.37
Methyl Bromide	Soil treatment			175.00

5. The baseline of CFC consumption for Libya is 716.7 ODP tonnes. The Government of Libya has reported CFC consumption to the Ozone Secretariat as follows:

- 1999 - 894 ODP tonnes
- 2000 - 985.4 ODP tonnes
- 2001 – 985.4 ODP tonnes.

6. Libya was recognized to be in non-compliance with the CFC freeze requirements by the Implementation Committee. Pursuant to Decision XIV/25, the Government of Libya submitted to the Implementation Committee at its 30th Meeting a plan of action with time-specific benchmarks to ensure a prompt return to compliance. The Government of Libya committed to prepare a national ODS phase-out plan including development and implementation of control measures, public awareness campaigns and training activities as well as legislation, where necessary, to meet the objectives described in the action plan. Technical monitoring capacity will be improved to ensure effective monitoring of the legal and technical provisions provided for under the Montreal Protocol.

7. The national ODS phase-out plan includes investment projects in flexible and rigid foam, and in the commercial, and transportation refrigeration manufacturing sub-sectors. It also

includes a refrigerant management plan for the servicing sector, a halon management programme and a project to phase-out methyl bromide in horticulture.

8. The estimated incremental costs of proposed components are shown in the table below.

Sector	ODP tonnes 2002	ICC US$	IOC US$	Project cost US$	Support cost US$	Req. grant US$	Cost-effectiveness US$/kg
Flexible PU foams	262.0	1,267,600	51,350	1,318,950	98,921	1,417,871	5.03
Rigid PU foams	52	354,800	-264,037	354,800	26,610	381,410	7.58
Comm./Trans. Refrigeration manufacturing	47.8	439,500	91,909	531,409	39,856	571,265	11.58
RMP	120.0	681,930		681,930	51,145	733,075	5.68
Halons	54.4	25,000		25,000	1,875	26,875	
MeBr	151.0	1,778,520	98,298	1,876,818	140,761	2,017,579	12.43
Sub-total	**687.2**	**4,547,350**	**241,557**	**4,788,907**	**359,168**	**5,148,075**	
Management				**120,000**	**9,000**	**129,000**	
Total				**4,908,907**	**368,168**	**5,277,075**	**7.17**

9. In regard to CFC consumption, the implementation of the proposed activities will result in reductions according to the following schedule.

Year	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Max allowable total consumption of CFC	902.7	667.9	530.9	341.2	114.2	89.2	68.9	14.8

SECRETARIAT'S COMMENTS AND RECOMMENDATIONS

COMMENTS

10. The Secretariat indicated to UNIDO that the CFC phase-out schedule as proposed in the national phase-out plan does not meet the compliance targets or the action plan for a return to compliance prepared by the Government of Libya and adopted by the Parties at their 15th Meeting. Under the action plan, Libya specifically commits itself:

a) To reduce CFC consumption from 985 ODP tonnes in 2001 as follows:
   i) To 710.0 ODP tonnes in 2003;
   ii) To 610.0 ODP tonnes in 2004;
   iii) To 303.0 ODP tonnes in 2005;
   iv) To 107.0 ODP tonnes in 2007;

v) To phase out CFC consumption by 1 January 2010 as required under the Montreal Protocol save for essential uses that might be authorized by the Parties;

b) To establish, by 2004, a system for licensing imports and exports of ODS, including quotas;

c) To maintain its ban on imports of ODS-using equipment introduced in 2003.

11. The Parties noted that the measures listed above <u>should enable Libya to return to compliance by 2003</u> (i.e., consumption below 717 ODP tonnes). Libya was urged to work with the relevant implementing agencies [UNIDO] to implement the plan of action and phase-out CFC consumption.

12. Notwithstanding the commitment of the Government of Libya to return to compliance by 2003, the Fund Secretariat noted that according to the phase-out plan, in 2003, the country would continue to be in non-compliance with the CFC freeze. Likewise, the 2004 and 2005 CFC consumption levels in the action plan would be higher than the levels proposed by the Government to the Implementation Committee and in 2005, the country would not be in compliance with the 50% CFC reduction target. Finally, the 2010 expected total consumption of CFCs proposed in the phase-out plan would be 14.8 ODP tonnes; however, as of 1 January 2010, the maximum allowable consumption of CFCs should be zero.

13. UNIDO subsequently revised the phase-out schedule in the plan so that consumption falls within the limits in the action plan approved by the Parties. UNIDO also indicated that it proposed to use the claimed actual CFC consumption in 2002 of 917.5 ODP tonnes as a starting point to implement the National Phase-out Plan.

14. The Secretariat indicated to UNIDO that irrespective of the starting point for the plan, the maximum CFC consumption eligible for funding for Libya as decided by the Executive Committee is 618 ODP tonnes (Decision 38/66). Additionally, existing Fund guidance related to eligibility of projects must be maintained in all respects (Proviso B). UNIDO was advised that the implication of this decision is that consumption up to the eligible limit cannot be assumed to exist. It must be demonstrated and corroborated as required by relevant Executive Committee decisions.

15. The Secretariat drew UNIDO's attention to the CFC consumption in servicing domestic and commercial refrigeration equipment (120 tonnes), which appears to have been estimated entirely on the basis of assumptions. No surveys were provided to support the claimed consumption. The assumed number of domestic appliances is double the total number of households in the country: this assertion was not supported by statistical data. The number of commercial units was calculated on the basis of the number of shops under the assumption that 20% of the total households each owns a shop. This is not supported by statistical data. The Secretariat proposed to UNIDO to reconsider the servicing sector consumption, on the basis of the levels which could be corroborated through surveys or from relevant published statistics.

16. The cost of recovery and recycling network is US $473,050. It was pointed out to UNIDO that no rationale was provided for the number of machines being requested and the amount of CFCs potentially to be recovered/recycled. Clarification on this issue was requested.

17. The Secretariat compared the claimed CFC-12 consumption in the refrigeration manufacturing and the refrigeration servicing sub-sectors. The average charge of CFC-12 per unit indicated as being used in manufacturing is three-fold higher than the average charge used in servicing. This suggests that the actual consumption in refrigeration manufacturing may not be as high as indicated in the project document. The Secretariat advised UNIDO to reconsider CFC-12 consumption data in the refrigeration manufacturing sector.

18. The Secretariat has also discussed with UNIDO the incremental capital and operating costs in the refrigeration manufacturing sector. Agreement was reached and the budget was adjusted accordingly.

19. In regard to the flexible foam sector, the Secretariat indicated that the grant amounts calculated for four enterprises exceeded the existing cost-effectiveness threshold and were therefore not eligible for funding. The relevant parts of the budget were recalculated accordingly.

20. The Secretariat commented on the halon banking component pointing out the inconsistency in data reported earlier on halon consumption. In particular, it was noted that 2002 halon consumption data are not yet available. In the absence of the reliable halon consumption data the approval of the proposed component would put Libya at risk of non-compliance in the future. UNIDO decided to withdraw the halon component from the national plan. The consumption in the halon sector in Libya will be addressed at a later stage.

21. In regard to methyl bromide, the Secretariat noted that phase-out of methyl bromide consumption in Libya was not part of the 2003-2005 Phase-out Plan. The Secretariat also noted that Government of Libya has not signed the Copenhagen Amendment and its methyl bromide baseline for compliance is zero. Therefore, the Secretariat recommended that UNIDO withdraw the methyl bromide component. UNIDO accepted this proposal.

22. The issues raised above, including the overall level of incremental cost eligible for funding as well as a the draft agreement between the Executive Committee and the Government of Libya are being discussed between UNIDO and the Secretariat. Advice on the outcomes of these discussions will be provided prior to the meeting of the Sub-Committee on Project Review as appropriate.

RECOMMENDATIONS

23. Pending

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PROJECT COVER SHEET

COUNTRY	:	**LIBYA**
IMPLEMENTING AGENCY	:	**UNIDO**
PROJECT TITLE	:	**National phase-out plan**
PROJECT IN CURRENT BUSINESS PLAN	:	**Yes**
SECTOR	:	**Multi-sector**
ODS USE IN ALL SECTORS (2002) :	:	**1053.6 ODP tonnes**
PROJECT IMPACT 2003-2004 (approved projects)	:	**367.4 ODP tonnes**
PROJECT IMPACT (National Phase-out Plan)	:	**678.2 ODP tonnes**
PROJECT DURATION	:	**2003 - 2009**
PROJECT COST	:	**USD 4,560,422 (incl. 120,000 management cost)**
LOCAL OWNERSHIP	:	**100%**
EXPORT COMPONENT	:	**Nil**
REQUESTED GRANT	:	**USD 4,902,453**
COST-EFFECTIVENESS	:	**USD 8.06 per kg ODP**
IMPLEMENTING AGENCY SUPPORT COST	:	**USD 342,031**
TOTAL COST OF PROJECT TO MULTILATERAL FUND	:	**USD 4,902,453**

FINANCING ARRANGEMENT	:	**Project cost**	**Grant with support cost**
2003 tranche	:	**USD 1,500,000**	**USD 1,612,500**
2005 tranche	:	**USD 1,500,000**	**USD 1,612,500**
2006 tranche	:	**USD 1,200,000**	**USD 1,290,000**
2007 tranche	:	**USD 237,000**	**USD 254,775**
2008 tranche	:	**USD 123,422**	**USD 132,678**

STATUS OF COUNTERPART FUNDING	:	**N/A**
PROJECT MONITORING MILESTONES INCLUDED	:	**Yes**
NATIONAL COORDINATING AGENCY	:	**COMMITTEE ON CLIMATE CHANGE**

1 ROJECT SUMMARY

The present national phase-out plan aims at phasing-out all the remaining consumption of ODS in Libya over the period of 2003 – 2009. A series of investment, non-investment, and technical support activities are proposed to achieve this target in the foam, commercial and transportation refrigeration manufacturing, RMP, halon banking and methyl bromide sectors. The present phase-out lan will enable the Government of Libya to totally phase the remaining ODS consumption by January 1, 2010 except the CFC usage in the refrigeration servicing. Considering this multi-faceted approach it is crucial that flexibility be given to the Government of Libya to adapt or modify its strategies during implementation of this plan as the need arises.

The Government of Libya requests about US$ 5.3 million as the total funding from the Multilateral Fund for the total elimination of remaining ODS substances in the country. The funding will be paid out in installments as specified in the Agreement attached. 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 result in the elimination of the remaining ODS consumption in various sectors of Libya and will substantially contribute to the ability of the country to meet its Montreal Protocol obligations.

Prepared by: UNIDO — Date: 5 September 2003
Reviewed by: — Date: 5 September 2003

Contents

Annexes

Annex I – List and status of approved projects for Libya

Annex II - Calculation of incremental costs (ICC and IOC/IOS) for conversion of 8 manufacturers of flexible PU slabstock foam

Annex III – Calculation of incremental costs (ICC and IOC/IOS) for conversion of 4 manufacturers of flexible PU box foam

Annex IV – Calculation of incremental costs (ICC and IOC) for conversion of 4 manufacturers of rigid PU insulation foam.

Annex V – Phasing out CFC-11 by Conversion to HCFC-141b and CFC-12 to HFC-134a Technology in the Manufacture of Commercial and Transport Refrigeration Equipment at the Terminal Umbrella Group of Libyan Commercial and Transport Refrigeration Manufacturers (Project proposal).

Annex VI - Refrigerant management plan (project proposal)

Annex VII – Halon Management Programme for Libya (project proposal)

Annex VIII – Phase-Out of Methyl Bromide in horticulture: tomatoes, cucumbers, peppers and others (project proposal).

Annex IX – NOU report on ODS consumption, 30.09.2002

Annex X – NOU report on ODS consumption 20.06.2003

Annex XI – Appraisal report on of Commercial and Transport Refrigeration project

Annex XII – Appraisal report on RMP

Annex XIII – Appraisal report on Foam sector component

Annex XIV - Appraisal report on Methyl Bromide component

Background

1.1 General information

The Libyan Arab Jamahiriya ratified the 1985 Vienna Convention and the 1987 Montreal Protocol on July 11, 1990 and qualifies as an Article 5 country. In order to comply with the provisions of the Protocol, the National Committee for Climate Change (NCCC) of Libya has carried out a national survey in 2000 and formulated its Country Programme with technical assistance of UNIDO funded by the Multilateral Fund.

The Country Programme was approved by 32nd ExCom in 2002 and provides data on import and use of ODS in Libya and expresses the commitment of the country to phase out consumption of ODS. An Action Plan has been defined, and steps will be taken to implement some or all of the action items, after scrutiny, to ensure a smooth phase out without causing undue economic hardship to the industrial, commercial and the domestic consumers.

Libya does not produce any ODS and all its requirements are met through imports. According to the Country Programme in 1999 CFCs consumption (Annex A) amounted to 947.32 ODP tonnes, resulting in a consumption of 0.18 kg/capita.

Under the Country Programme, Libya is committed to phase out the consumption of CFCs in a controlled and cost effective manner. Following the lifting of the embargo, production in the foam and refrigeration sector has begun picking up, and is yet to reach peak levels. As can be seen from the consumption figures, 1999 CFCs consumption was much higher than earlier years. It will take some or all of the steps outlined in the Action Plan to comply with the phase out schedule required by the Protocol. With timely assistance from the Multilateral Fund to phase out CFCs from the Foam and R&AC manufacturing enterprises, the NCCC was confident of meeting the 2005 compliance requirements of 50% reduction in consumption. However, the NCCC was concerned about availability of a supply of ODS to meet the service requirements of existing ODS based R&AC equipment to enable them operate to the end of their economic life. It is expected that by 2010, most equipment will have been retrofitted or replaced with ODS free technology, with some CFC-12 based equipment remaining. It will strongly encourage recovery and recycling to meet this requirement. Market forces such as rising prices and increasing availability of ozone friendly technology, along with phase-out in the manufacturing sector with assistance from the Multilateral Fund, will play a vital role in the shift by consumers to ODS free technology, particularly in the commercial and industrial sector.

The General Peoples' Committee has nominated the National Committee for Climate Change, which reports to the Secretary of the General Peoples' Committee, for the preparation of the Country Programme. The institutional strengthening project was submitted and approved by the 32nd ExCom (March 2001) for the creation of the National Ozone Unit. However, due to various reasons, the NOU was officially established in year 2002. The NOU is constituted within the Executive Office of the National Committee for Climate Change to coordinate and monitor activities towards a complete phase out of ODS.

1.2 Objectives

With the assistance of UNIDO Libya has prepared a National Phase out Plan (NPP) that will allow Libya to phase out all remaining ODS use by 2010.

The objectives of the NPP are to:

- Characterize consumption and uses of the ozone-depleting substances (ODS) in Libya.
- Assess the market structure for CFC supply and consumption in the country;
- Develop documentation on distributors and consumers of CFCs and other ODS;

- Identify and characterizes availability and usage of alternatives;
- Identify opportunities for conversions;
- Develop and implement a strong policy action program for ODS phase out;
- Develop a strategy, and an action plan for phasing out remaining ODS consumption; and
- Achieve the phase out of the ODS in 2010, through the implementation of the action plan.

Availability of CFC based equipment and remaining equipment inventories are encouraging continued demand on CFC. Consumption remains for servicing of domestic refrigerators, commercial and industrial refrigeration equipment, and for mobile air conditioning. It has been estimated that under the current conditions, consumption of CFC will increase, unless drastic actions are quickly taken through the implementation of investment and other non-investment activities.

2. Impact of the Proposal

2.1 Current consumption

When preparing the Country Programme, a national survey was carried out to estimate consumption of controlled substances in the country through questionnaires and discussions with importers and users. Reasonably accurate data were available from users in the formal sector. However, use in the informal sector (repair and maintenance of domestic refrigerators, air-conditioners and MAC applications) has been estimated, as the informal service sector is quite large.

Upon approval of the Country Programme, the Government of Libya in cooperation with UNDP and UNIDO has initiated formulation of respective investment projects in foam and domestic refrigeration manufacturing sector. During the period between the 32nd and 35th ExComs, 9 investment projects in the PU foam sector (flexible and rigid foam sub-sectors) and 1 project in domestic refrigerators and freezers manufacturing have been approved (see Annex 1).

Upon receipt of the government request by UNIDO to assist in formulation of the National Phase-out Plan (NPP), it was found necessary to conduct a new national survey on the remaining ODS consumption by the country using the relevant preparatory assistance project.

Due to the time constrain, an additional fund for the Country Programme update was not requested.

The historical and current ODS consumption is given in Table 1 below.

Table 1: Consumption of ODS (ODP tonnes)

Chemical	Average 1995* 1997	1998	1999 *	2000	2001**	2002***
Annex A Group I						
CFC-11	**531.55**	650.35	769.95	766.0	*857.8*	701.5
CFC-12	**164.43**	8.90	110.90	171.3	157.7	145.7
CFC-11 4	**0.08**	0.13	10.37	10.0	10.9	10.9
CFC-11 5 (as R-502)	**5.77**	0.62	4.60	5.8	4.9	5.0
Annex A Group II						
Halon 1211	**1.50**	1.50	1.50	1.5	1.6	1.6
Halon 1301	**85.50**	140.00	50.00	50.0	52.8	52.8
Total Annex A	**788.83**	**801.50**	**947.32**	**1004.6**	**1074.8**	**917.5**
Annex C Group I						
HCFC-22	**8.88**	11.53	10.54	40.0	60.1	60.0
Annex E Group I						
Methyl Bromide	**60.66**	0	122.50	164.0	113.0	151.0

*Note: * Data taken from the Country Programme*
*** Data reported by NOU to the Ozone Secretariat (letter of 30 September 2002)*
**** Data resulted from the national survey conduced in 2003 for the NPP preparation; the survey shows total CFC-11 consumption in 2001 as of 741 tonnes*

2.2. Forecast Consumption at per Country Programme

Growth in economic performance is expected to continue and will result in continued growth in the industrial sectors, particularly in the oil and gas sector, leading to growth in the commercial sector and strong demands in the consumer sector. Air conditioning is a necessity in Libya, and central air conditioning, split and individual air-conditioning units are all prevalent. Perishable goods need refrigeration for storage and distribution. Manufacture, imports and sales of consumer goods such as refrigerators, air-conditioners, and foam products are expected to continue increasing. Similarly, in the commercial sector, Libya's demand for chillers, freezers and air-conditioning units is expected to increase, particularly with the growth of the oil and gas industry.

The forecast of unconstrained consumption is given below in Table 2. A linear growth rate of 10.0% till the year 2005 and 5.0% from then till 2010 has been assumed for this exercise.

Table 2: Forecast of Unconstrained Consumption (ODP tonnes) *

Substance	1995	1997	1999	2001	2003	2005	2007	2009	2010
CFC-11	474.90	590.65	769.95	931.64	1,127.28	1,364.01	1,503.82	1,657.97	1,740.87
CFC-12	173.60	209.80	110.90	134.19	162. 10	196.47	216.60	238.81	250.75
CFC-114	0.13	0.10	10.37	0.16	0.19	0.23	0.25	0.28	0.29
CFC-1 15	6.74	9.93	4.60	5.57	6.73	8.15	8.98	9.91	10.40
Halon 1211	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
Halon 1301	150.00	56.50	50.00	60.50	73.21	88.58	97.66	107.67	113.05
TOTAL	**806.87**	**868.48**	**947.32**	**1,133.55**	**1,371.28**	**1,658.94**	**1,828.82**	**2,016.13**	**2,116.86**

Note: * The table copied from the original Country Programme

2.3. Assumption of consumption data and reduction schedule

In response to the Decision 35/37, the Option 2 was selected by Libya as a start point for phase-out residual CFCs and the following ODS consumption updated data have been established by the Multilateral Fund Secretariat following the 38th Meeting of the Executive Committee:

Due to the current non-compliance status of the country and its commitment to return to the compliance by 2003, it is suggested to use the ODS consumption data of the year 2002 as the lowest one in order to achieve the ODS phase-out targets (see table 3).

<u>CFCs</u>

-	Latest (year 2002) consumption	863.1 ODP tonnes
-	Baseline consumption	716.7 ODP tonnes
-	Consumption funded since the starting point	367.4 ODP tonnes

<u>Halons</u>

-	Latest (year 2002) installed	54.4 ODP tonnes
-	Baseline installed	633.1 ODP tonnes

<u>HCFCs</u>

-	Latest (year 2002) consumption	3.0 ODP tonnes

<u>Methyl Bromide</u>

-	Latest (year 2002) consumption	151,0 ODP tonnes
-	Baseline data	77.8 ODP tonnes

Bearing in mind the various objective difficulties and constrains that the country was facing during the last several years to meet the commitments under the Montreal Protocol, the Government of Libya took a decision to phase-out the reaming ODS consumption under the NPP using assistance of UNIDO.

Pursuant to Decision XIV/25, the Government of Libya submitted to the Implementation Committee at its 30th Meeting a plan of action with time-specific benchmarks to ensure a prompt return to compliance. As a result, the Implementation Committee noted with appreciation the plan of action submitted by Libya and the fact that it was working with UNIDO to finalize a national phase-out plan. The draft recommendations of the Implementation Committee, (document UNEP/OzL.Pro/ImpCom/30/4), listing the benchmarks and measures taken by the Government to ensure a return to compliance were accepted by the Parties. The highlights of the draft recommendation are as follows:

Under the plan, Libya specifically commits itself:

a) To reduce CFC consumption from 985 ODP tonnes in 2001 as follows:
  i) To 710.0 ODP tonnes in 2003;
  ii) To 610.0 ODP tonnes in 2004
  iii) To 303.0 ODP tonnes in 2005
  iv) To 154.0 ODP tonnes in 2007
  v) To phase out CFC consumption by 1 January 2010 as required under the Montreal Protocol except for essential uses that might be authorized by the Parties;

b) To establish, by (2004), a system for licensing imports and exports of ODS, including quotas;
c) To ban, by (2004), imports of ODS-using equipment.

Regarding ratification of the London and Copenhagen Amendments to the Protocol, the NOU has informed UNIDO that the London Amendment is already ratified and the ratification of the Copenhagen Amendment is in process as it is stated in the endorsement letter to the submitted NPP project document.

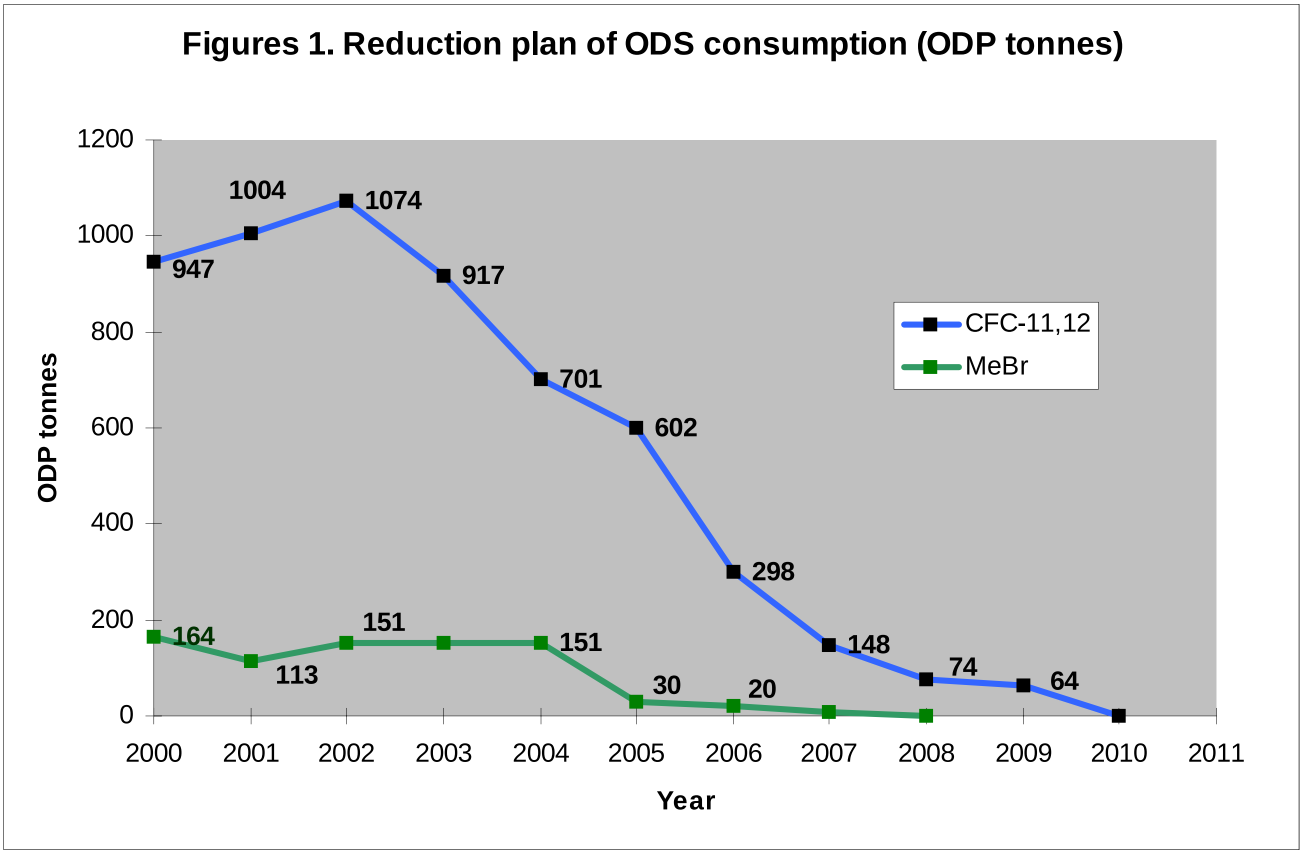
As a result of the survey, the following actual ODS consumption data (including 367.4 ODP tonnes under approved but not completed projects, see Annex 1) have been identified and summarized in the Table 3 below:

Table 3. Summary of ODS consumption by sector and sub-sectors during 1999-2002, (ODP tonnes)

Sector	1999	2000	2001	2002
Flexible foams (CFC-11)	642	623	608	575
Rigid foams (CFC-11)	60.5	58.3	53	52
Domestic refrigeration manufacturing				
CFC-11	44.4	44.4	44.4	44.4
CFC-12	9.0	9.0	9.0	9.9
CFC-114	10.4	10.0	10.9	10.9
CFC-115	4.6	5.8	4.9	5.0
Commerc./transportation refrigeration manufacturing				
CFC-11		40.3	35.5	30.1
CFC-12		22.8	20.5	17.7
Refr. servicing (CFC-12)	141.3	139.5	130.2	120
Halons	3.6	51.5	52	54.4
MeBr	175	164	113	151

Note: With regard to the tendency of CFC consumption in flexible foam sub-sector during 1999-2002, the table 3 above shows that the consumption has dropped from 642 tonnes in 1999 to 575 tonnes in 2003. This phenomenon was caused mainly because many small foam manufacturers are using methylene chloride as a cheaper blowing agent. The bigger manufacturers do not want to follow this practice with understanding that significant technical and safety modification are required to ensure proper operation of the converted facilities specially for flexible slabstock lines.

In order to achieve the relevant ODS phase-out targets, a detailed plan of implementation actions was elaborated and presented in Fig. 1



3. Data collection and validation

As a result of thorough analyses of the Country Programme, discussions with the NOU staff and some project sites visits, it was found that a national survey of the remaining ODS consumption by the different sectors and sub-sectors of the country's economy is required.

For this purpose, a specialized national consulting company (Assalama Bureau) was sub-contracted by UNIDO to provide the required services specified in the respective Terms of Reference jointly prepared by UNIDO and NOU.

Prior to the contract award, the series of substantive meetings took place to interview, instruct and brief the team of national experts on the methodology and practice of the data collection, verification and reporting.

Following the Terms of reference requirements and discussions held with the sub-contractor's team, the following national public and private offices, institutions and companies as the sources of information have been contacted:

General Authority for Documentations and Information
General Authority for Environment
National Oil Corporation
Iron and Steel Complex
General Electricity Co. of Libya
Secretary of Production
Shabia Secretary of Industry

Air Conditioning and Refrigeration Syndicate
Chamber of Industry and Commerce
Sert Oil Co.
Brega Oil Marketing Co.
Veba Oil Co.
Ras Lanuf Chemical Industry Co.
Arabic Gulf Oil Co.
Industrial Research Centre
Agriculture Research Center
Faculty of Agriculture – Efatah University
Ahlia Stores and Cold Stores
General Co. for Chemical Industry

Importers of Chemicals:
Tripoli Gas Company (Public Company)
Ben ghazi Gas Company (Public Company)
Mr. Mostafa Ghannai
Mr. Adel Mariul

Prices of Chemicals:

CFC-11	2.1-2.5$/kg
CFC-12	2.5-2.7$/kg
HCFC-22	3.6-4.1$/kg
HCFC-141b	2.7-3.5$/kg
HCFC-134a	4.7-7.0$/kKg
MeCl	1.1-1.3$/kg
Polyol	1.28-1.40$/kg
TDI	2.10-2.40$/kg
MDI	1.35-1.50$/kg
MeBr	5.0 $/kg

4. Strategy and Plan of Implementation

After a long period of inactivity as a result of the UN sanctions, the key initiative taken by Libya has been to mandate the National Committee for Climate Change (NCCC) to formulate the Country Programme. At that stage, the Libyan Government conducted a thorough analyses of the current situation regarding import and usage of various ODS in order to compare the current ODS consumption, projected future demand and compliance targets and prepare an appropriate implementable strategy and policy taking into account the following conditions:

1. Compliance with freeze, from July 1999 consumption cannot exceed the baseline average of 1995-1997;
2. Compliance with Montreal Protocol requirements: 50% reduction of ODS of Annex A, Group I in January first 2005, 85 % reduction by January first 2007 and 100% reduction by 2010;
3. The projection of future demand was developed using 2000 base year consumption data assuming demand by the end of 2010.
4. The Projection of future demand was developed by the end of 2010, if import of ODS using equipment will be forbiden immediately.

The NCCC, designated by the General Peoples' Committee, is committed to phasing out the consumption of ODS in a controlled and cost effective manner. It will take the steps outlined in the Action Plan to meet the freeze and phase out schedule required by the Protocol. The main thrust is in the conversion of the foam and refrigerator units in the public sector to ozone friendly technologies with funding from the Multilateral Fund in time to meet the 50% phase-out of 2005. For the R&AC service sector, the strategy is based on training, containment, recovery and recycling.

Development and implementation of control measures, public awareness campaigns and training activities are the main components of the action plan. Legislation will be put in place and enactment texts will be defined, where necessary, to meet the objectives described in the action plan. Technical monitoring capacity will be improved to ensure effective monitoring of the legal and technical provisions provided for under the Montreal Protocol.

The General Peoples' Committee has established the National Committee for Climate Change (NCCC), (reporting to the Secretary of the General Peoples' Committee), and entrusted it with duties to develop a strategy and action plan for phasing out Ozone Depleting Substances. In order to implement these duties the NCCC has developed an Action Plan as follows:

- Establish the Executive Office of the NCCC as a focal point for all activities related to the Montreal Protocol.
- Embark on a public awareness program with assistance of UNEP, UNIDO and funding from the Multilateral Fund
- Develop and implement control measures such as:
  - ➢ Prohibit imports of ODS using equipment
  - ➢ Prohibit new enterprises producing and/or assembling equipment, foams, or aerosols using ODS
  - ➢ Establish import quotas into the existing licensing system.
  - ➢ Prohibit investments in building new plants using ODS
- Train Customs Department, National Information Center and NOU in monitoring and collection of data to meet the reporting requirements of the Protocol.
- Seek funding and monitor projects to convert refrigeration and foam manufacturing facilities
- Identify other investment projects not covered in this Country Programme and submit proposals for funding
- Implement a National Recovery and Recycling project.
- Identify key refrigeration installations and submit retrofitting proposals to the Multilateral Fund.

The following regulatory measures are being considered:

- Immediate application of ban of import of ODS-using and ODS-containing equipment (especially second-hand domestic refrigerators using CFC-12), etc.(approved).
- Immediate prohibition of any new activity which aims the production of ODSs or ODS-using equipment;
- Application of strict control of import/export of all ODSs (including licensing, taxation and/or quotas as appropriate);
- Application of control on trade of ODSs (including licensing and taxation policy as appropriate);
- Application of an obligatory certification of technicians. Consideration of ban of illegal service of refrigerators, interlinkage of license on trade with certificate.
- Development of fiscal incentives/disincentives system to encourage the use of ODS alternatives and transitional substances.

Type of action	Specific action	Status
Programming general ODS management	A detailed list of regulatory acts	Done
Reporting of ODS consumption data as a part of environmental reporting system	Reporting system	Done
Consultation of policy makers with all interested parties	Discussion of policy measures in national workshops on ODS phase out	Ongoing
Establish legal framework for ODS phase out.	Incorporate provisions for ODS phasing out into the new law on environmental protection	Ongoing will require further assistance

Once the ODS regulations are finalized and the phasing out management plan is approved, several key results may be anticipated:

1. Import quotas will allow government and industry to ensure compliance with the protocol targets;
2. NCCC will promote phase out actions with all CFC users including MAC sector;
3. CFCs users will be provided with financial support under phase out management plan for recovery & recycling, retrofitting and conversion projects and these actions will lead to a rapid decline in demand for CFCs.

In addition to these initiatives described above, the following additional program will be implemented:

- Education of the main stakeholders and interested parties;
- Public awareness campaign;
- Dissemination of information in Arabic language.

5. Incremental Costs

The incremental conversion costs have been estimated based on the following documents and assumptions:

- Guidance document for preparation of SPP and NPP approved by the 38th ExCom;
- Guidance documents, decisions and recommendations related to the preparation of investment project documents for the particular individual or groups of enterprises of respective ODS consuming sectors;
- Analyses of the current baseline data collected during the recent national survey with regard to the remaining ODS consumption on the country level in light of the content of the Country Programme;
- Methodology, experience and practice of the ICC and IOC/IOS assessment accumulated so far and agreed between Implementing Agencies and the Multilateral

5.1 Sub-sector of flexible PU foam manufacturing

The sub-sector is represented by 20 factories established in the period 1969-1994 and operating in public and private sectors of industry.

Eight public PU slabstock-manufacturing enterprises located in different provinces of the country are being managed by the General Company for Plastic and Foam Industry (GSPFI).

The production programme of this enterprise (slabstock and box foam) is represented by foams with the range of densities of 15-24 kg/m3.

Eight enterprises including four factories of GSPFI are in process of conversion under UNDP projects (see Annex I). Seven enterprises will be converted to the methylene chloride and one to the LCD alternative blowing technologies.

It was expected that some of the remaining 12 enterprises (eight slabstock and four box foam) could also be converted to LCD technology (see table 5). However, in view of the recent decisions of the Executive Committee with regard to the LCD technology, it was decided that all remaining enterprises would be converted to the methylene chloride blowing technology as the most appropriate one for the conditions of the country.

5.1.a <u>Assessment of incremental investment cost (ICC) and operating costs/savings for conversion of PU slabstock manufacturing enterprises.</u>

The list of eligible enterprises and technical services required for the conversion to the methylene chloride blowing technology as well as the methodology for ICC estimation are well established based on the relevant guidelines, documents and practice of such investment project implementation.

The same is also relevant to the estimation (calculation of the potential savings) that could be accumulated due to the lower cost of methylene chloride in comparison to CFC-11.

Cost estimation of conversion for eight slabstock manufacturers, using the year 2002 consumption and production data is attached (see Annex II) and summarized below.

Table 4. List and baseline data for remaining flexible PU foam manufacturing sector

Company Name	Estab. date	Annual Production Mt, Year 2002	Equipment	CFC-11 Consumption, Mt		
				2000	2001	2002
Flexible foam slabstock						
Bayan at Green Square Unit GCPFI	1969	680	Viking Max Foam 500	85	60	40
Derma Unit -GCPFI	1985	540	Viking Max Foam 500	36	35	32
El Wahda Unit - GCPFI	1982	760	Hennecke 1200	82	64	43
Musrata Unit - GCPFI	1987	520	Viking Max Foam 500	50	45	30
Sons of Al Ozzi Foam Company – Tripoli	1970	280	Spaul . 531 B	28	25	15
Tasharoukia EL-Mehwaria	1993	270	CMC - 2C	20	15	13
Tasharoukia El-Tanmia El--Senaeia	1993	300	Tecmac	28	21	15
Tasharoukiate El-Kalij	1994	280	Tecmac	32	28	14

Sub-total		**3630**		**361**	**293**	**202**
Box foams						
Tasharoukiate Elabdali's sons	1988	350	1 LP locally made foaming unit	25	20	18
Tasharoukiate Garmud Janzur	1973	200	1 LP locally made foaming unit	54	32	10
Al Deliui Foam Company Benghazi	1990	210	1 LP locally made foaming unit	26	18	12
Tasharoukiate Ammar's sons	1994	420	1 LP locally made foaming unit	38	30	20
Sub-total		**1180**		**143**	**100**	**60**
Total		**4810**		**504**	**393**	**262**

Summary table

Company name	CFC-11 consumption in 2002 tonnes	ICC budget component US$	IOC/IOS budget comp. US$	Estimated budget US$	Request budget US$	Cost-effectiveness US$/kg
Flexible foam slabstock						
Bayan at Green Square Unit GCPFI	40	134,200	-16,370	117,830	117,830	2.94
Derma Unit -GCPFI	32	134,200	-7,650	126,550	126,550	3.95
El Wahda Unit - GCPFI	43	134,200	-15,830	118,370	118,370	2.75
Musrata Unit - GCPFI	30	134,200	-3,390	130,810	130,810	4.36
Sons of Al Ozzi Foam Company – Tripoli	15	134,200	16,080	150,280	93,450	6.23
Tasharoukia EL-Mehwaria	13	134,200	21,730	155,930	80,990	6.23
Tasharoukia El-Tanmia El--Senaeia	15	134,200	18,860	153,060	93,450	6.23
Tasharoukiate El-Kalij	14	134,200	19,600	153,800	87,220	6.23
Total	**202**	**1,073,600**	**33,030**	**1,106,630**	**848,670**	**5.24**

5.1.b <u>Assessment of incremental operating cost and operating cost/savings for the conversion of PU box foam manufacturing enterprises.</u>

The remaining four box foam manufacturers (see table 5) are equipped with the simple, locally made foaming units. The existing production premises do not have any safety precautions that require operating with methylene chloride.

Therefore, the enterprises should be provided with a package of required equipment and technical assistance to ensure safe operation of the converted units.

Cost estimation of conversion for these four enterprises using year 2002 consumption and production data is attached (see Annex III) and summarized below.

Summary table

Company name	CFC-11 consumption in 2002 tonnes	ICC budget component US$	IOC/IOS budget comp. US$	Project budget US$	Cost effectiveness US$/kg
Flexible PU box foam					
Tasharoukiate Elabdali's sons	18	48,500	1,660	50,160	2.78
Tasharoukiate Garmud Janzur	10	48,500	8,990	57,490	5.75
Al Deliui Foam Company Benghazi	12	48,500	3,340	48,500	4.1
Tasharoukiate Ammar's sons	20	48,500	4,330	51,840	2.6
Total	**60**	**194,000**	**18,320**	**207,990**	**3.8**

5.2 Sub-sector of rigid PU foam manufacturing for insulation of water heaters/boilers and water coolers

Four remaining enterprises of the sub-sector are manufacturing the water heaters/boilers, portable and stationary water coolers and insulated tanks for commercial and food processing industry (see table 6).

Thermo insulation of the products using rigid PU foam is a technological part of the overall production process. In order to operate with HCFC-141b blowing systems, selected as an alternative blowing technology, the existing low-pressure spray units and locally made low-pressure foaming machines are to be replaced by high-pressure units.

In addition, the existing moulds to be also modified or replaced to insure a smooth operation process and quality of foam.

The cost of the moulds modifications to be absorbed by the end-users.

The incremental conversion cost (ICC and IUC) for this group of enterprises were estimated based on similar, recently approved or completed projects (see annex IV).

The summary of the incremental costs estimation is presented below. Due to the cost effectiveness reason, the estimated IUC component will not be requested for funding. It is suggested that eight low-pressure spray units will be replaced with four high-pressure spray machines (one for each factory) with an output of 8-10 kg/min. and four locally made low-pressure foaming units will be replaced by high-pressure machines of 40-60 kg/min. output.

Summary table

Company name	ICC budget component US$	IOC budget comp. US$	Project budget US$
Rigid PU foam			
Brothers Company (boilers/water heaters insulation)	88,700	66,195	154,895
Essourur Company (boilers/water heaters insulation)	88,700	62,476	151,176
Musrata Company (water coolers, cold tanks)	88,700	66,939	155,639
Eshams Company (water coolers, cold tanks)	88,700	68,427	157,127
Total	**354,800**	**264,037**	**618,837**

Table 5. List and baseline data for remaining rigid PU insulation foam manufacturing

Company Name	Establishment date	Annual Production Mt, 2002	Equipment	Consumption, Mt/y CFC-11		
				2000	2001	2002
Brothers Company (boilers/water heaters insulation)	1990	Insulation of boilers/heaters (80-200l) production - 22100 u/y 89 Mt foam	2 LP spray units 1 LP locally made foaming machine 12 moulds	12	14	14
Essourur Company (boilers/water heaters insulation)	1991	Insulation of boilers (40-180l) production - 13500 u/y 84 Mt foam	2 LP spray units 1 LP locally made foaming machine 10 moulds	10	12	11
Musrata Company (water coolers, cold tanks)	1994	Portable cold water containers (5-50 l); production - 11500 u/y Cold tanks (200-500l), production – 850 u/y 90 Mt foam	2 LP spray units 1 LP locally made foaming machine 16 moulds	10	12	12
Eshams Company (water coolers, cold tanks)	1992	Portable cold water containers (5-50 l); production - 15200 u/y 92 Mt foam	2 LP spray units 1 LP locally made foaming machine 20 moulds	13	14	15
Sub-total		**355 Mt**		**45**	**52**	**52**

5.3 Sub-sector of transportation and commercial refrigeration equipment manufacturing

The list and baseline information of the enterprises operating in this sub-sector is provided in the table 6.

It should be noted that this sub-sector is not explicitly reflected in the Country Programme of Libya, and the enterprises were identified during a recent national survey on the remaining ODS consuming sectors.

It was found that these enterprises are mainly involved in the refrigeration servicing and their CFCs consumption for refrigeration manufacturing process is small.

The project document for this group of enterprises is attached as annex V.

The project will phase out 30.0 MT 0f CFC-11 and 17.7 MT of CFC-12 consumption annually in the production of commercial refrigeration equipment at the terminal umbrella group of Commercial and Transport refrigeration manufacturers (Tasharoukiat El-Nakla, Tasharoukiat Marwa, Tasharoukiat El-Jalid, Tasharoukiat El-Shami and Tasharoukiat El-Takadom), Libya by converting to HCFC-141b as a foam blowing agent in the production of polyurethane foam and HFC 134a as the refrigerant in the cooling circuit of equipment in the production of a range of commercial refrigeration equipment. The project will include incremental capital costs covering two low pressure foaming machine (US$ 70,000), two high pressure foaming machines (US$ 160,000), production and portable refrigerant charging units (US$ 105,000), vacuum pumps (US$ 15,000), leak detectors (US$ 3,000), re-design, testing, trials (US$ 15,000), technical assistance (US$ 21,000) and training (US$ 21,000). Eligible incremental operating costs amount to US$ 91,909 resulting from conversion to the new technology.

Project cost summary

CFC consumption	47.8 ODP tonnes
Incremental Capital Cost	US$349,000
Contingency	US$29,900
Incremental Operating Cost	US$66,314
Total Project Cost	US$445,214
Requested grant:	US$445,214
Cost effectiveness:	US$10,10/kg
Agency support cost:	US$33,991
TOTAL COST:	**US$478,605**

Table 6. List and baseline data for remaining enterprises in the commercial and transportation refrigeration-manufacturing sub-sector

Company Name	**Establ. Date**	**Annual Production 2002**	**Equipment**	**Consum., Mt/y CFC-11**			**Consum. Mt/y CFC-12**		
				2000	**2001**	**2002**	**2000**	**2001**	**2002**
Tasharoukiat EL-Nakla	1992	Comm. Chest freezer – 130 u/y Water cooler –3250 u/y Comm. Freezer – 200 u/y Comm. Refrigerator – 300 u/y	2 L.P Foam machines 2 Universal jigs 3 Charging machines 3 Vacuum pumps 1 Leak detector 8 moulds	4.8	4.6	4.5	2.0	2.2	1.8
Tasharoukiat Marwa	1994	Comm. Freezer – 380 u/y Comm. refrigerator – 400 u/y	2 Charging units 2 Vacuum pumps 1 Leak detector	PS Foam	PS Foam	PS Foam	2.6	2.6	2.4
Tasharoukiat EL-Jalid	1993	Comm. Chest freezer – 480 u/y Water cooler - 1600 u/y Comm. Freezer – 700 u/y Upright refrigerator – 250 u/y	3 Charging units 5 Vacuum pumps 2 Leak detectors 10 moulds	PS Foam 5	PS Foam 4.8	3.3	3.9	4.1	3.6
Tasharoukiat EL-shami	1975	Comm. Freezer – 450 u/y Comm. Refrigerator – 680 u/y	1 Universal jig 2 Charging units 3 Vacuum pumps 1 Leak detector	11.5	10.8	6.2	3.8	3.0	2.8
Tasharoukia EL-Takadom	1986	Comm. Freezer – 1,280 u/y Comm. Refrigerators. - 920 u/y Refrigerated trucks – 26 u/y Mobile cold rooms – 32 u/y Prefabricated Houses – 82 u/y	2 locally made L.P Foam units 2 Universal jigs 5 Charging units 5 Vacuum pumps 3 Leak detectors	19	15.1	16.1	10.5	8.6	7.1
Sub-total				**40.3**	**35.3**	**30.1**	**22.8**	**20.5**	**17.7**

5.4 Refrigeration management plan (RMP)

The first draft of RMP project document was prepared in the year 2000 as an integral part of the Country Programme.

The draft was up-dated; incorporating the relevant findings and recommendations of the national survey on the remaining ODS consuming sectors, in particular, in the refrigeration-servicing sector.

The least, technical specification and cost breakdown of required equipment, instrumentation and technical services of recently approved RMP projects were used for the cost estimation of this project (see annex VI).

Through the extensive survey of the refrigeration service sector in Libya followed by the data analysis and a series of discussions with relevant stakeholders, actions required to reduce the CFC consumption in the sector have been identified. These actions are included in four project components of the refrigerant management plan (RMP), i.e., Institutional framework project, Customs offices empowerment project, National project for training service technicians and National recovery and recycling project. Selected workshops and service technicians would be upgraded and trained under the RMP.

The servicing sector in Libya is very complicated and diversified. In total, there are approximately 10,000 workshops distributed in all regions, which provide services of various electrical and electronic households and office equipments. Most of these workshops provide very limited services for refrigeration equipment. Therefore, only approximately 2,500 workshops specialized in refrigeration servicing will be included in the RMP related activities. Through implementation of the proposed project components, the significant amount of CFC consumption in the sector will have to be eliminated in the refrigeration service sector.

Project cost summary	
CFC-12 consumption	120 ODP tonnes
Requested grant:	US$681,930
Cost effectiveness:	US$5.68/kg ODP
Agency support cost:	US$51,145
TOTAL COST	**US$733,075**

5.5 Halon management programme

Libya does not produce halons and the demand on these substances is covered by import. According to the Country Program approved by the 32nd EcCom the total import of halons in 1999 was 5.50 MT. Imported halons are used to maintain fixed fire fighting systems (Halon-1301) and handheld portable extinguishers (Halon-1211) protecting critical installations at oil companies, Libyan Iron and Steel complex and petrochemical companies.

The objective of the project (see annex VII) is to assist the Government of Libya to develop and implement the Halon Management Program aimed at phasing-out the import and net consumption of halons in the Fire Fighting Sector through the establishment of the National Halon Management operation and the progressive promotion of halon alternative technologies. Organizational infrastructure to be set up will ensure effective and environment friendly handling of the available halon stock. The detailed halon inventory database to be established will provide information about availability of halons allowing to maintain the internal halon demand-supply balance. This will facilitate the efficient use of available halons for maintenance/service of critical fire fighting equipment and completely eliminate import/consumption of fresh halons while introduction and enforcement of respective standards and codes of good practice will limit the emissions of halons to a minimum released in essential applications. In addition the project will cover introduction and promotion of Ozone friendly fire fighting technologies, respective training and ensure timely, sustainable and cost-effective phase-out of fresh halon consumption.

In accordance with the decision 18/22, the total eligible incremental costs and the requested grant, including Agency Support Costs amounts to US$ 28,250.

5.6 Phase-out of methyl bromide in horticulture

The horticulture is the only sector where methyl bromide is used in Libya (about 5% is used as QPS). In spite of the 2015 deadline for Article (5) countries, the Libya Government is willing to discontinue the use of MB long before that deadline. However, the farmers and the Government are aware that they cannot do it immediately and earlier than 5 years unless some assistance is provided. After careful consideration of the feasible alternatives discussed to apply in Libya, the farmers have selected: solarization combined with metam sodium, grafting and soilless depending the crop and the type of farmer. The present document describes an investment project to be carried out in conjunction between UNIDO, the farmers associated in different cooperatives and unions and the Faculty of Agriculture and the National Research Institute. The project enjoys support from the National Committee for Climate Change main responsible body for the implementation of the Montreal Protocol. The project is also part of the ODS National Phase Out Plan and is reflected in the country programme.

The project document is attached as annex VIII.

Project cost summary

Methyl bromide consumption	151 ODP tonnes
Incremental Capital Cost	US$1,356,836
Training	US$260,000
Contingency	US$161,684
Incremental Operating Cost	US$98,298
Total Project Cost	US$1,876,818
Requested grant:	US$1,876,818
Cost effectiveness:	US$12.43/kg
Agency support cost:	US$140,761
TOTAL COST:	**US$2,017,579**

5.7 Non-investment activities

These activities include:
Enhancing local capacity through:

- Training of trainers in customs and good practices,
- Training of technicians in good practices regarding refrigeration servicing,
- Training of customers;
- Awareness campaigns through the institutional strengthening project.

In a detailed way, the training activities will be focused on:

1. Implement and monitor training of customs officers to ensure proper control of import and export of ODSs and information collection.
2. Implement and monitor training of refrigeration service technicians in good practices of refrigeration to minimise the use of ODSs and mitigate their emissions into the air during the service of refrigerators
3. Implement and monitor Refrigerant Recovery and Recycling Programm, establish networks for CFC-12 recover, recycling centers and a bank of recycled CFC-12.

4. Develop preventive measures for preservation from re-introduction of use of ODS by sectors concerened.
5. Conduct continuous public awareness campaign on necessity and means for protection of the ozone layer .

At the same time a strong capacity building will be necessary in order to monitor and manage the entire situation and to insure smooth overall implementation of the Plan.

The following actions will ensure that phase out measures will be successful:

1. Implement ODS import registration system and ODS import quota allocation system (2003-2008).
2. Implement annual reductions in allowable ODS imports according to phase out schedule as proposed in the NPP.
3. Develop and implement appropriate reporting requirements for ODS imports monitoring.
4. Develop overall approach to retrofit, recycling and recovery in all refrigeration/ air conditioning sectors, particularly recovery of CFCs when individual users install conversion projects.
5. Organize trainings of customs officers to enforce Import Licensing Regulations.

NOU will serve as the coordinating institution for this project. All local program management and oversight and international coordinating and reporting will be managed by Ministry of Environment, that will be responsible for signing and implementing its agreement with the implementing agencies.

5.8 Implementation Management and Cost

The overall management of the plan will be carried out by the Government of Libya with the assistance of UNIDO.

The NOU will be responsible for monitoring the implementation of the phase-out plan. It will be responsible for tracking the promulgation and enforcement of policy and legislation and will assist UNIDO with the preparation of annual implementation plans and progress reports 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 Libya is taking, to ensure that the implementation is consistent with the Government priorities.

The phase-out plan will be managed by a dedicated implementation team, consisting of at least four national experts. The team leader (coordinator) to be designated by the Government and supported by the implementing agency. The implementation team will assist the NOU in policy and management support components of the phase-out plan in order to synchronize the activities, which are being carried out by the NOU in frame of the institutional strengthening project. However, the implementation team will concentrate its activities on the following subjects:

a) Reassessment and analysis of the relevant sector after the approval of the NPP;
b) Determination of specification of equipment and technical services to be provided under the NPP;
c) Preparation of annual implementation plans including determining the sequence of enterprise participation in planned sub-projects;
d) Development and application of model documents such as:

    - Agreement between NOU and the project beneficiaries on technical, financial and reporting modalities of the conversion process and destruction of ODS related equipment;
    - Individual project documents including specification and cost-estimation of equipment and services to be provided;
    - Bidding document(s) for overseas or local procurement of equipment and services.

e) Verification of ODS phase-out in completed sub-projects within the NPP through plant visits and performance auditing;
f) Establishment and operation of a reporting system of usage of ODS/substitutes by users;
g) RMP related activities:

- Selection of trainers for training of technicians;
- Selection of service workshops to be trained;
- Awareness promotion at the regional level;
- A list of service workshops should be updated in terms of their CFC consumption, necessary recovery equipment, 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 for recovery machine should be determined.

h) Reporting of implementation progress of the plan for the annual performance-based disbursement;

The NPP management implementation budget component estimated US$ 120,000

5.9 Cost of the national phase-out plan

The estimated cost of relevant components of the National Phase-out Plan is summarized in the Table 7 below.

Table 7 Summary of cost estimation of the National Phase-out Plan

Sector	ODP tones*	ICC US$	IOC US$	Project cost US$	Support cost US$	Req. grant US$	Cost effective. US$/kg
Flexible PU foams	262	1,267,600	*-51,350***	1,056,660	79,249	1,135,909	4.52
Rigid PU foams	46.3	354,800	*-264,037***	354,800	26,610	381,410	7.58
Comm./Trans. Refrigeration manufacturing	47.8	378,900	66,314	445,214	33,391	478,605	10.10
RMP	120	681,930	0	681,930	51,145	733,075	5.68
Halons	54.4	25,000	0	25,000	1,875	26,875	
MeBr	151	1,778,520	98,298	1,876,818	140,761	2,017,579	12.43
Sub-total	**678.2**	**4,486,750**	**164,612**	**4,440,422**	**333,031**	**4,773,453**	
Management				**120,000**	**9,000**	**129,000**	
Total				**4,560,422**	**342,031**	**4,902,453**	**8.06**

*Note: * The actual ODP phase-out targets have been taken into account due to the substitution of CFC-11 by HCFC-141b in rigid foam and refrigeration manufacturing sub-sectors.*
*** The IOC for PU foam sub-sector not requested due to the cost effectiveness reason. In addition, the ICC component for 4 flexible foam enterprises was also adjusted to be in frame of threshold for this sector.*

It is suggested that the estimated grand will be requested in five tranches as indicated in the Table 8 below.

Table 8.

Activity	Total cost USD	2003	2005	2006	2007	2008
Technical assistance in accordance with the work programmes of individual project included in the NPP	4,440,422	1,460,000	1,480,000	1,180,000	217,000	103,422
Project management	120,000	40,000	20,000	20,000	20,000	20,000
Total project cost	4,560,422	1,500,000	1,500,000	1,200,000	237,000	123,422
IA support cost	342,031	112,500	112,500	90,000	17,775	9,256
Total Grant	**4,902,453**	**1,612,500**	**1,612,500**	**1,290,000**	**254,775**	**132,678**
Business Plan 2003-2005		1,613,000	1,613,000			

6. Monitoring and evaluation

Monitoring of the implementation and effectiveness of measures described in the National Phase–out Plan (2003 – 2009) to reduce the ODS consumption levels as well as timely design and recommendation of adjustments if any is of crucial importance for speeding up the process of achieving compliance with the Montreal Protocol. As it has happened in many countries the improvements in the collection of data are expected to give a more accurate picture of the needs in the respective sector. The monitoring process will be covered by the Ministry of Environment through the NOU and Implementation team.

The consumption will be monitored through receiving the data from Customs Department and crosschecking it with the data to be permanently collected from the distributors and consumers. At the same time, NOU and Implementation team will also be responsible for preparing the national Monitoring Plan of the NPP implementation.

The reporting process will be responsibility of both NOU and Implementation team. They have to timely collect and analyze all information and regularly submit the following reports:

- Annual reports on ODS consumption to be submitted to the Ozone Secretariat (NOU);
- Annual reports on progress of implementation of NPP to be submitted to the Executive Committee of the Multilateral Fund;
- Project-related reports to UNIDO.

Concerning the evaluation process, the Ministry of Environment and UNIDO will select and hire an independent consultant who will work in close cooperation with the Implementation team to evaluate the progress, quality and performance of implementation of NPP implementation.

The consultant will have full access to all financial and technical data and information concerning the NPP implementation for reliable data collection and cross checking.

The consultant will prepare and submit to UNIDO reports of activities on a quarterly basis and the reports on NPP implementation status and ODS consumption figures on a half – yearly basis. After consideration by UNIDO the reports will be sent to NOU and Implementation team for consideration and follow up.

The responsibilities of the consultant will also include:

- Development of recommendations for improvements/adjustments of the National Phase-out Plan;
- Take into consideration comments from UNIDO and the NOU and Implementation team to the reports and react accordingly;
- Assist in the organization and participate in possible evaluation visits by UNIDO or the Multilateral Fund Secretariat.

On the other hand, UNIDO should:

- Provide the independent consultant with all relevant information;
- Provide the consultant with necessary support and advice;
- Timely consider and comment the submitted reports and issue recommendations to Implementation Plan Unit;
- Control the performance of both the consultant and Implementation Plan Unit in a most suitable manner.

7. Performance targets and disbursement schedule.

Performance targets, indicators of achievements and fund disbursement schedule are presented in the Table 9 below.

Table 9.

Year	*Performance target (ODP/tonnes)*	*Consumption allowed under Montreal Protocol*	Indicators of achievement	*Disbursement (in US$)*
2003			▪ Implementation Unit in place ▪ ODS related legislation in place and being reinforced ▪ Licensing system in place and import quotas established ▪ Code on Good practices developed ▪ Monitoring system in place ▪ Completion of 3 UNDP and 1 UNIDO projects ▪ Implementation of sub-sectoral projects in accordance with the respective work programmes ▪ Preparation of Progress Report I	1,612,500
Foam	167.7	641.9		
Refrig.	48.60	101,2		
Service	0	120		
Halon	0	54.4		
CFC	**216.3**	**917.5**		
MeBr	0	**151**		
2004			▪ Completion of 4 UNDP ongoing projects ▪ Implementation of sub-sectoral projects in accordance with the respective work programmes ▪ Monitoring of the NPP implementation ▪ Preparation of Progress Report II	0
Foam	98.3	479.0		
Refrig.	0	47.8		

Year	*Performance target (ODP/tonnes)*	*Consumption allowed under Montreal Protocol*	Indicators of achievement	*Disbursement (in US$)*
Service	0	120		
Halon	0	54.4		
CFC	**98.3**	**701.2**		
MeBr	0	**151**		
2005			▪ Completion of 2 remaining UNDP projects (48 ODP tonnes) ▪ Implementation of sub-sectoral projects in accordance with the respective work programmes; partial phase-out of 162 ODP tonnes from foam sector under NPP ▪ Monitoring of the NPP implementation ▪ Preparation of Progress Report III	1,612,500
Foam	210.0	380.7		
Refrig.	44.5	47.8		
Service	50.0	120.0		
Halon	0	54.4		
CFC	**304.5**	**602.9**		
MeBr	**46**	**151**		
2006			▪ Implementation of sub-sectoral projects in accordance with the respective work programmes ▪ Monitoring of the NPP implementation ▪ Preparation of Progress Report IV	1,290,000
Foam	125.0	175.6		
Refrig.	0	0		
Service	25.0	70		
Halon	0	54.4		
CFC	**150.0**	**298.4**		
MeBr	**35**	**105**		
2007			▪ Implementation of sub-sectoral projects in accordance with the respective work programmes ▪ Monitoring of the NPP implementation ▪ Preparation of Progress Report V	254,775
Foam	50.6	50.6		
Refrig.	0	0		
Service	25	45		
Halon	0	54.4		
CFC	**75.6**	**148.4**		

Year	*Performance target (ODP/tonnes)*	*Consumption allowed under Montreal Protocol*	Indicators of achievement	*Disbursement (in US$)*
MeBr	**35**	**70**		
2008 Foam Refrig. Service Halon **CFC** **MeBr**	 0 0 10 0 **10** **35**	 0 0 20 54.4 **74.4** **35**	▪ Implementation of sub-sectoral projects in accordance with the respective work programmes ▪ Monitoring of the NPP implementation ▪ Preparation of Progress Report VI	132,678
2009 Foam Refrig. Service Halon **CFC**	 0 0 0 54.4 **54.4**	 0 0 10.0 54.4 **64.4**	▪ Implementation of sub-sectoral projects in accordance with the respective work programmes ▪ Monitoring of the NPP implementation ▪ Preparation of Progress Report VI	
2010 Foam Refrig. Service Halon **CFC**	 0 0 10 0 **10**	 0 0 10 0 **10**	▪ Implementation of sub-sectoral projects in accordance with the respective work programmes ▪ Monitoring of the NPP implementation ▪ Preparation of Completion Report	

Annex I

CODE	AGENCY	TYPE	SEC	PROJECT_TITLE	ODS 1	ODP1	ODS REPL.	ODS 2	ODP2	ODS REPL.2	IMPACT	DATE APPR.	TOTAL GRANT	COST EFF.	DATE COMPL.
LIB/SEV/27/CPG/01	UNIDO	CPG	SEV	Preparation of country programme		0.0			0.0		0.0	Mar-1999	$86,376		Dec-1999
		CPG Total											**$86,376**		
LIB/SEV/32/INS/04	UNIDO	INS	SEV	Creation of the National Ozone Unit		0.0			0.0		0.0	Dec-2000	$177,410		Jan-2004
		INS Total											**$177,410**		
LIB/FOA/32/INV/05	UNDP	INV	FOA	Phaseout of CFC-11 by conversion to methylene chloride in the manufacture of flexible polyurethane foam at Sebha Unit	CFC-11	26.0	Methylene chloride		0.0		26.0	Dec-2000	$144,750	4.93	Jan-2004
LIB/FOA/32/INV/06	UNDP	INV	FOA	Phaseout of CFC-11 by conversion to methylene chloride in the manufacture of flexible polyurethane foam at Garabouli Unit	CFC-11	40.3	Methylene chloride		0.0		40.3	Dec-2000	$124,085	2.72	Jan-2004
LIB/FOA/32/INV/07	UNDP	INV	FOA	Phasing out of CFC-11 in the manufacture of rigid polyurethane foam at Electrical Household Appliance-Tajura by conversion to a combination of water and HCFC-141b based systems	CFC-11	11.0	HCFC-141b	CFC-11	4.3	Water CO2	15.3	Dec-2000	$135,376	7.83	Jan-2004
LIB/FOA/32/INV/08	UNDP	INV	FOA	Phaseout of CFC-11 by conversion to methylene chloride in the manufacture of flexible polyurethane foam at Ben Ghazi Unit	CFC-11	31.4	Methylene chloride		0.0		31.4	Dec-2000	$141,092	3.98	Jan-2004

LIB/FOA/34/INV/12	UNDP	INV	FOA	Phase out of CFC-11 by conversion to methylene chloride in the manufacture of flexible polyurethane foam at Tasharoukiate Essadek	CFC-11	32.0	Methylene chloride		0.0		32.0	Jul-2001	$145,893	4.03	Aug-2004
LIB/FOA/34/INV/13	UNDP	INV	FOA	Phase out of CFC-11 by conversion to methylene chloride in the manufacture of flexible polyurethane foam at Hilal Africa	CFC-11	22.0	Methylene chloride		0.0		22.0	Jul-2001	$128,512	5.17	Aug-2004
LIB/FOA/35/INV/14	UNDP	INV	FOA	Phase out of CFC-11 by conversion to methylene chloride in the manufacture of flexible polyurethane foam at Tasharoukiate El Hani	CFC-11	28.0	Methylene chloride		0.0		28.0	Dec-2001	$127,057	4.02	Jan-2005
LIB/FOA/35/INV/15	UNDP	INV	FOA	Phase out of CFC-11 by conversion to liquid carbon dioxide (LCD) in the manufacture of flexible polyurethane foam at El Houria Unit Plant	CFC-11	96.0	Liquide carbone dioxydes		0.0		96.0	Dec-2001	$587,650	5.42	Jan-2005
LIB/FOA/35/INV/16	UNDP	INV	FOA	Phase out of CFC-11 by conversion to methylene chloride in the manufacture of flexible polyurethane foam at Tasharoukiate Ali Sannoga	CFC-11	23.0	Methylene chloride		0.0		23.0	Dec-2001	$141,973	5.46	Jan-2005
LIB/REF/32/INV/03	UNIDO	INV	REF	Phasing out ODS in the production of refrigerators and freezers at Electrical Household Appliances Manufacturing	CFC-11	44.4	HCFC-141b	CFC-12	9.0	HFC-134a	53.4	Dec-2000	$629,505	10.45	Jun-2003
		INV Total											**$2,305,893**		
LIB/FOA/32/PRP/09	UNDP	PRP	FOA	Project preparation in the foam sector		0.0			0.0		0.0	Dec-2000	$33,900		Dec-2001
LIB/FOA/33/PRP/10	UNDP	PRP	FOA	Project preparation in the flexible polyurethane foam sector		0.0			0.0		0.0	Mar-2001	$28,250		Apr-2002

LIB/FOA/36/PRP/17	UNDP	PRP	FOA	Project preparation for 4 projects in the rigid foam sector		0.0			0.0		0.0	Mar-2002	$14,125		Apr-2003
LIB/FOA/36/PRP/18	UNDP	PRP	FOA	Project preparation for 6 projects in the flexible slabstock foam sector		0.0			0.0		0.0	Mar-2002	$14,125		Apr-2003
LIB/FOA/36/PRP/19	UNDP	PRP	FOA	Project preparation for 3 projects in the flexible slabstock foam sector		0.0			0.0		0.0	Mar-2002	$22,600		Apr-2003
LIB/REF/30/PRP/02	UNIDO	PRP	REF	Preparation of investment project in the refrigeration sector		0.0			0.0		0.0	Mar-2000	$22,600		Apr-2001
LIB/REF/33/PRP/11	UNIDO	PRP	REF	Project preparation in the commercial refrigeration sector		0.0			0.0		0.0	Mar-2001	$16,950		Apr-2002
LIB/REF/36/PRP/20	UNIDO	PRP	REF	Preparation of an investment project in the commercial refrigeration sector		0.0			0.0		0.0	Mar-2002	$22,600		Apr-2003
LIB/SEV/38/PRP/21	UNIDO	PRP	SEV	Preparation of a national ODS phase-out plan		0.0			0.0		0.0	Nov-2002	$45,200		Dec-2003
		PRP Total									**367.4**		**$220,350**		
		Grand Total											**$2,790,029**		

Annex II - Calculation of incremental costs (ICC and IOC/IOS) for conversion of 8 manufacturers of flexible PU slabstock foam

Incremental capital cost was estimated based on the list of required equipment and services as well as the cost breakdown for similar ongoing and recently completed projects.

Investment cost summary

	Item	**US$**
1	Methylene chloride storage tank (1000l)*	10,000
2	Methylene chloride pumping system	15,000
3	Process ventilation	50,000
4	Cure area ventilation system	20,000
5	Electrical control system modification	5,000
6	Safety devices	7,000
7	Trials/Commissioning/Start-up/Training	15,000
8	Contingencies (10%)	12,200
	Total	**134,200**

* - *Currently the enterprises are not using pressurized CFC-11 storage tanks.*

In view of the specific features of a national execution and implementation modalities of the Plan, it is suggested that the above estimated ICC budget component will be the same for all 8 enterprises.

Incremental operating costs/savings have been calculated in accordance with the relevant guidelines documents using the actual production parameters of year 2002 and the current costs of chemicals.

The relevant calculations for the individual enterprises are attached.

Summary table

Company name	**ICC budget component US$**	**IOC/IOS budget comp. US$**	**Project budget US$**
Flexible foam slabstock			
Bayan at Green Square Unit GCPFI	134,200	-16,370	117,830
Derma Unit -GCPFI	134,200	-7,650	126,550
El Wahda Unit - GCPFI	134,200	-15,830	118,370
Musrata Unit - GCPFI	134,200	-3,390	130,810
Sons of Al Ozzi Foam Company – Tripoli	134,200	16,080	150,280
Tasharoukia EL-Mehwaria	134,200	21,730	155,930
Tasharoukia El-Tanmia El--Senaeia	134,200	18,860	153,060
Tasharoukiate El-Kalij	134,200	19,600	153,800
Total	**1,073,600**	**33,030**	**1,106,630**

Bayan at Green Square

Item	Price US$/ton	Consumption ton/year	
		Before	After
CFC-11	2100	40	0
MC	1100		36
Amines	7500	1	1.1
Tin	8000	1	1.25
Production	2700	680	680
Energy (kWh)	0.1		50

CFC/MC ratio	1.00 : 0.9			
Yield loss		3/2/1/0 %year on	100 %production	
Maintenance	US$	5 % of new mechanical equipment		134,200

CALCULATIONS

COST ITEM	2002	2003	2004	2005
US$X1000				
BASELINE				
CFC-11	84.00	84.00	84.00	84.00
Amines	7.50	7.50	7.50	7.50
Other additives	8.00	8.00	8.00	8.00
TOTAL	99.50	99.50	99.50	99.50
POST PROJECT				
MC	39.60	39.60	39.60	39.60
Amines	8.25	8.25	8.25	8.25
Other additives	10.00	10.00	10.00	10.00
Incr.yield loss	55.08	36.72	18.36	0.00
Incr.energy	0.01	0.01	0.01	0.01
Incr. maintenance	6.71	6.71	6.71	6.71
TOTAL	119.65	101.29	82.93	64.57
Incr.Oper.Costs	20.15	1.78	-16.58	-34.94
Discount factor	0.91	0.83	0.75	0.68
N.P.V.*	18.33	1.48	-12.43	-23.76
Incremental Operational Costs			**-16.37**	

Derma

Item	**Price US$/ton**		**Consumption ton/year**	
			Before	After
CFC-11	2100		32	0
MC	1100			28.8
Amines	7500		1	1.1
Tin	8000		1	1.25
Production	2700		540	540
Energy (kWh)	0.1			50
CFC/MC ratio	1.00 : 0.9			
Yield loss		3/2/1/0 %year on	100 %production	
Maintenance	US$	5 % of new mechanical equipment		134,200

CALCULATIONS

COST ITEM	2002	2003	2004	2005
US$X1000				
BASELINE				
CFC-11	67.20	67.20	67.20	67.20
Amines	7.50	7.50	7.50	7.50
Other additives	8.00	8.00	8.00	8.00
TOTAL	82.70	82.70	82.70	82.70
POST PROJECT				
MC	31.68	31.68	31.68	31.68
Amines	8.25	8.25	8.25	8.25
Other additives	10.00	10.00	10.00	10.00
Incr.yield loss	43.74	29.16	14.58	0.00
Incr.energy	0.01	0.01	0.01	0.01
Incr. maintenance	6.71	6.71	6.71	6.71
TOTAL	100.39	85.81	71.23	56.65
Incr.Oper.Costs	17.69	3.10	-11.48	-26.06
Discount factor	0.91	0.83	0.75	0.68
N.P.V.*	16.09	2.58	-8.61	-17.72
Incremental Operational Costs			**-7.65**	

El Wahda

Item	**Price US$/ton**		**Consumption ton/year**	
			Before	After
CFC-11	2100		43	0
MC	1100			38.7
Amines	7500		1	1.1
Tin	8000		1	1.25
Production	2700		760	760
Energy (kWh)	0.1			50
CFC/MC ratio	1.00 : 0.9			
Yield loss		3/2/1/0 %year on	100 %production	
Maintenance	US$	5 % of new mechanical equipment		134,200

CALCULATIONS

COST ITEM	2002	2003	2004	2005
US$X1000				
BASELINE				
CFC-11	90.30	90.30	90.30	90.30
Amines	7.50	7.50	7.50	7.50
Other additives	8.00	8.00	8.00	8.00
TOTAL	105.80	105.80	105.80	105.80
POST PROJECT				
MC	42.57	42.57	42.57	42.57
Amines	8.25	8.25	8.25	8.25
Other additives	10.00	10.00	10.00	10.00
Incr.yield loss	61.56	41.04	20.52	0.00
Incr.energy	0.01	0.01	0.01	0.01
Incr. maintenance	6.71	6.71	6.71	6.71
TOTAL	129.10	108.58	88.06	67.54
Incr.Oper.Costs	23.30	2.77	-17.75	-38.27
Discount factor	0.91	0.83	0.75	0.68
N.P.V.*	21.20	2.30	-13.31	-26.02
Incremental Operational Costs			**-15.83**	

Musrata Unit

Item	**Price US$/ton**		**Consumption ton/year**	
			Before	After
CFC-11	2100		30	0
MC	1100			27
Amines	7500		1	1.1
Tin	8000		1	1.25
Production	2700		520	520
Energy (kWh)	0.1			50
CFC/MC ratio	1.00 : 0.9			
Yield loss		3/2/1/0 %year on	100 %production	
Maintenance	US$	5 % of new mechanical equipment		134,200

CALCULATIONS

COST ITEM	2002	2003	2004	2005
US$X1000				
BASELINE				
CFC-11	63.00	63.00	63.00	63.00
Amines	7.50	7.50	7.50	7.50
Other additives	8.00	8.00	8.00	8.00
TOTAL	78.50	78.50	78.50	78.50
POST PROJECT				
MC	29.70	29.70	29.70	29.70
Amines	8.25	8.25	8.25	8.25
Other additives	10.00	10.00	10.00	10.00
Incr.yield loss	42.12	28.08	14.04	0.00
Incr.energy	0.01	0.01	0.01	0.01
Incr. maintenance	6.71	6.71	6.71	6.71
TOTAL	96.79	82.75	68.71	54.67
Incr.Oper.Costs	18.29	4.24	-9.80	-23.84
Discount factor	0.91	0.83	0.75	0.68
N.P.V.*	16.64	3.52	-7.35	-16.21
Incremental Operational Costs			**-3.39**	

Sons of Al Ozzi

Item	**Price US$/ton**	**Consumption ton/year**	
		Before	After
CFC-11	2100	15	0
MC	1100		13.5
Amines	7500	1	1.1
Tin	8000	1	1.25
Production	2700	280	280
Energy (kWh)	0.1		50

CFC/MC ratio	1.00 : 0.9			
Yield loss		3/2/1/0 %year on	100 %production	
Maintenance	US$	5 % of new mechanical equipment		134,200

CALCULATIONS

COST ITEM	2002	2003	2004	2005
US$X1000				
BASELINE				
CFC-11	31.50	31.50	31.50	31.50
Amines	7.50	7.50	7.50	7.50
Other additives	8.00	8.00	8.00	8.00
TOTAL	47.00	47.00	47.00	47.00
POST PROJECT				
MC	14.85	14.85	14.85	14.85
Amines	8.25	8.25	8.25	8.25
Other additives	10.00	10.00	10.00	10.00
Incr.yield loss	22.68	15.12	7.56	0.00
Incr.energy	0.01	0.01	0.01	0.01
Incr. maintenance	6.71	6.71	6.71	6.71
TOTAL	62.50	54.94	47.38	39.82
Incr.Oper.Costs	15.50	7.94	0.38	-7.19
Discount factor	0.91	0.83	0.75	0.68
N.P.V.*	14.10	6.59	0.28	-4.89
Incremental Operational Costs			**16.08**	

Tasharoukia El-Mehwaria

Item	**Price US$/ton**		**Consumption ton/year**	
			Before	After
CFC-11	2100		13	0
MC	1100			11.7
Amines	7500		1	1.1
Tin	8000		1	1.25
Production	2700		270	270
Energy (kWh)	0.1			50
CFC/MC ratio	1.00 : 0.9			
Yield loss		3/2/1/0 %year on	100 %production	
Maintenance	US$	5 % of new mechanical equipment		134,200

CALCULATIONS

COST ITEM	2002	2003	2004	2005
US$X1000				
BASELINE				
CFC-11	27.30	27.30	27.30	27.30
Amines	7.50	7.50	7.50	7.50
Other additives	8.00	8.00	8.00	8.00
TOTAL	42.80	42.80	42.80	42.80
POST PROJECT				
MC	12.87	12.87	12.87	12.87
Amines	8.25	8.25	8.25	8.25
Other additives	10.00	10.00	10.00	10.00
Incr.yield loss	21.87	14.58	7.29	0.00
Incr.energy	0.01	0.01	0.01	0.01
Incr. maintenance	6.71	6.71	6.71	6.71
TOTAL	59.71	52.42	45.13	37.84
Incr.Oper.Costs	16.91	9.62	2.33	-4.97
Discount factor	0.91	0.83	0.75	0.68
N.P.V.*	15.38	7.98	1.74	-3.38
Incremental Operational Costs			**21.73**	

Tasharoukia El-Tanmia

Item	Price US$/ton		Consumption ton/year	
			Before	After
CFC-11	2100		15	0
MC	1100			13.5
Amines	7500		1	1.1
Tin	8000		1	1.25
Production	2700		300	300
Energy (kWh)	0.1			50
CFC/MC ratio	1.00 : 0.9			
Yield loss		3/2/1/0 %year on	100 %production	
Maintenance	US$	5 % of new mechanical equipment		134,200

CALCULATIONS

COST ITEM	2002	2003	2004	2005
US$X1000				
BASELINE				
CFC-11	31.50	31.50	31.50	31.50
Amines	7.50	7.50	7.50	7.50
Other additives	8.00	8.00	8.00	8.00
TOTAL	47.00	47.00	47.00	47.00
POST PROJECT				
MC	14.85	14.85	14.85	14.85
Amines	8.25	8.25	8.25	8.25
Other additives	10.00	10.00	10.00	10.00
Incr.yield loss	24.30	16.20	8.10	0.00
Incr.energy	0.01	0.01	0.01	0.01
Incr. maintenance	6.71	6.71	6.71	6.71
TOTAL	64.12	56.02	47.92	39.82
Incr.Oper.Costs	17.12	9.02	0.92	-7.19
Discount factor	0.91	0.83	0.75	0.68
N.P.V.*	15.57	7.48	0.69	-4.89
Incremental Operational Costs			**18.86**	

Tasharoukia El-Kalij

Item	**Price US$/ton**		**Consumption ton/year**	
			Before	After
CFC-11	2100		14	0
MC	1100			12.6
Amines	7500		1	1.1
Tin	8000		1	1.25
Production	2700		280	280
Energy (kWh)	0.1			50
CFC/MC ratio	1.00 : 0.9			
Yield loss		3/2/1/0 %year on	100 %production	
Maintenance	US$	5 % of new mechanical equipment		134,200

CALCULATIONS

COST ITEM	2002	2003	2004	2005
US$X1000				
BASELINE				
CFC-11	29.40	29.40	29.40	29.40
Amines	7.50	7.50	7.50	7.50
Other additives	8.00	8.00	8.00	8.00
TOTAL	44.90	44.90	44.90	44.90
POST PROJECT				
MC	13.86	13.86	13.86	13.86
Amines	8.25	8.25	8.25	8.25
Other additives	10.00	10.00	10.00	10.00
Incr.yield loss	22.68	15.12	7.56	0.00
Incr.energy	0.01	0.01	0.01	0.01
Incr. maintenance	6.71	6.71	6.71	6.71
TOTAL	61.51	53.95	46.39	38.83
Incr.Oper.Costs	16.61	9.05	1.49	-6.08
Discount factor	0.91	0.83	0.75	0.68
N.P.V.*	15.11	7.51	1.11	-4.13
Incremental Operational Costs			**19.60**	

Annex III - Calculation of incremental costs (ICC and IOC/IOS) for conversion of 4 manufacturers of flexible PU box foam

Incremental capital cost was estimated based on the list of required equipment and services as well as the cost breakdown for similar ongoing and recently completed projects.

Investment cost summary

	Item	US$
1	Methylene chloride pumping system	10,000
2	Process ventilation	20,000
3	Electrical control system modification	2,000
4	Safety devices	3,000
5	Trials/Commissioning/Start-up/Training	10,000
6	Contingencies (10%)	3,500
	Total	**48,500**

In view of the specific features of a national execution and implementation modalities of the Plan, it is suggested that the above estimated ICC budget component will be the same for all 4 enterprises.

Incremental operating costs/savings have been calculated in accordance with the relevant guidelines documents using the actual production parameters of year 2002 and the current costs of chemicals.

The relevant calculations for the individual enterprises are attached.

Summary table

Company name	ICC budget component US$	IOC/IOS budget comp. US$	Project budget US$
Flexible PU box foam			
Tasharoukiate Elabdali's sons	48,500	1,660	50,160
Tasharoukiate Garmud Janzur	48,500	8,990	57,490
Al Deliui Foam Company Benghazi	48,500	3,340	48,500
Tasharoukiate Ammar's sons	48,500	4,330	51,840
Total	**194,000**	**18,320**	**207,990**

Tasharoukaite

Item	**Price US$/ton**		**Consumption ton/year**	
			Before	After
CFC-11	2100		18	0
MC	1100			16.2
Amines	7500		1	1.1
Tin	8000		1	1.25
Production	2700		350	350
Energy (kWh)	0.1			50
CFC/MC ratio	1.00 : 0.9			
Yield loss		3/2/1/0 %year on	100 %production	
Maintenance	US$	5 % of new mechanical equipment		48,500

CALCULATIONS

COST ITEM	2002	2003	2004	2005
US$X1000				
BASELINE				
CFC-11	37.80	37.80	37.80	37.80
Amines	7.50	7.50	7.50	7.50
Other additives	8.00	8.00	8.00	8.00
TOTAL	53.30	53.30	53.30	53.30
POST PROJECT				
MC	17.82	17.82	17.82	17.82
Amines	8.25	8.25	8.25	8.25
Other additives	10.00	10.00	10.00	10.00
Incr.yield loss	28.35	18.90	9.45	0.00
Incr.energy	0.01	0.01	0.01	0.01
Incr. maintenance	2.43	2.43	2.43	2.43
TOTAL	66.85	57.40	47.95	38.50
Incr.Oper.Costs	13.55	4.10	-5.35	-14.80
Discount factor	0.91	0.83	0.75	0.68
N.P.V.*	12.33	3.40	-4.01	-10.06
Incremental Operational Costs			**1.66**	

Garmud

Item	Price US$/ton		Consumption ton/year	
			Before	After
CFC-11	2100		10	0
MC	1100			9
Amines	7500		1	1.1
Tin	8000		1	1.25
Production	2700		200	200
Energy (kWh)	0.1			50
CFC/MC ratio	1.00 : 0.9			
Yield loss		3/2/1/0 %year on	100 %production	
Maintenance	US$	5 % of new mechanical equipment		48,500

CALCULATIONS

COST ITEM	2002	2003	2004	2005
US$X1000				
BASELINE				
CFC-11	21.00	21.00	21.00	21.00
Amines	7.50	7.50	7.50	7.50
Other additives	8.00	8.00	8.00	8.00
TOTAL	36.50	36.50	36.50	36.50
POST PROJECT				
MC	9.90	9.90	9.90	9.90
Amines	8.25	8.25	8.25	8.25
Other additives	10.00	10.00	10.00	10.00
Incr.yield loss	16.20	10.80	5.40	0.00
Incr.energy	0.01	0.01	0.01	0.01
Incr. maintenance	2.43	2.43	2.43	2.43
TOTAL	46.78	41.38	35.98	30.58
Incr.Oper.Costs	10.28	4.88	-0.52	-5.92
Discount factor	0.91	0.83	0.75	0.68
N.P.V.*	9.35	4.05	-0.39	-4.03
Incremental Operational Costs			**8.99**	

Al Deliui

Ítem	**Price US$/ton**		**Consumption ton/year**	
			Before	After
CFC-11	2100		12	0
MC	1100			10.8
Amines	7500		1	1.1
Tin	8000		1	1.25
Production	2700		210	210
Energy (kWh)	0.1			50
CFC/MC ratio	1.00 : 0.9			
Yield loss		3/2/1/0 %year on	100 %production	
Maintenance	US$	5 % of new mechanical equipment		48,500

CALCULATIONS

COST ITEM	2002	2003	2004	2005
US$X1000				
BASELINE				
CFC-11	25.20	25.20	25.20	25.20
Amines	7.50	7.50	7.50	7.50
Other additives	8.00	8.00	8.00	8.00
TOTAL	40.70	40.70	40.70	40.70
POST PROJECT				
MC	11.88	11.88	11.88	11.88
Amines	8.25	8.25	8.25	8.25
Other additives	10.00	10.00	10.00	10.00
Incr.yield loss	17.01	11.34	5.67	0.00
Incr.energy	0.01	0.01	0.01	0.01
Incr. maintenance	2.43	2.43	2.43	2.43
TOTAL	49.57	43.90	38.23	32.56
Incr.Oper.Costs	8.87	3.20	-2.47	-8.14
Discount factor	0.91	0.83	0.75	0.68
N.P.V.*	8.07	2.66	-1.85	-5.54
Incremental Operational Costs			**3.34**	

Ammar`s

Item	**Price US$/ton**		**Consumption ton/year**	
			Before	After
CFC-11	2100		20	0
MC	1100			18
Amines	7500		1	1.1
Tin	8000		1	1.25
Production	2700		420	420
Energy (kWh)	0.1			50
CFC/MC ratio	1.00 : 0.9			
Yield loss		3/2/1/0 %year on	100 %production	
Maintenance	US$	5 % of new mechanical equipment		48,500

CALCULATIONS

COST ITEM	2002	2003	2004	2005
US$X1000				
BASELINE				
CFC-11	42.00	42.00	42.00	42.00
Amines	7.50	7.50	7.50	7.50
Other additives	8.00	8.00	8.00	8.00
TOTAL	57.50	57.50	57.50	57.50
POST PROJECT				
MC	19.80	19.80	19.80	19.80
Amines	8.25	8.25	8.25	8.25
Other additives	10.00	10.00	10.00	10.00
Incr.yield loss	34.02	22.68	11.34	0.00
Incr.energy	0.01	0.01	0.01	0.01
Incr. maintenance	2.43	2.43	2.43	2.43
TOTAL	74.50	63.16	51.82	40.48
Incr.Oper.Costs	17.00	5.66	-5.68	-17.02
Discount factor	0.91	0.83	0.75	0.68
N.P.V.*	15.47	4.70	-4.26	-11.57
Incremental Operational Costs			**4.33**	

Annex IV - Calculation of incremental costs (ICC and IOC) for conversion of 4 manufacturers of rigid PU insulation foam.

Incremental capital cost was estimated based on the list of required equipment and services as well as the cost breakdown for similar ongoing and recently completed projects using the following data.

Investment cost summary

	Item	US$
1	Spray foam machine unit 8-10 kg/min	12,000
2	High Pressure Foam Machine 40-60 kg/min	65,000
3	Trials	2,000
4	Technology transfer and training	2,000
5	Contingencies (10%)	7,700
	Total	**88,700**

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In view of the specific features of a national execution and implementation modalities of the Plan, it is suggested that the above estimated ICC budget component will be the same for all 4 enterprises.

Incremental operating costs have been calculated in accordance with the relevant guidelines documents using the actual production parameters of year 2002 and the current costs of chemicals and calculation methodology for similar project.

The relevant calculations for the individual enterprises are attached.

Summary table

Company name	ICC budget component US$	IOC budget comp. US$	Project budget US$
Rigid PU foam			
Brothers Company (boilers/water heaters insulation)	88,700	66,195	154,895
Essourur Company (boilers/water heaters insulation)	88,700	62,476	151,176
Musrata Company (water coolers, cold tanks)	88,700	66,939	155,639
Eshams Company (water coolers, cold tanks)	88,700	68,427	157,127
Total	**354,800**	**264,037**	**618,837**

INCREMENTAL OPERATING COSTS

Brothers Company

Before Conversion				After Conversion			
Chemicals	Ratio	Price ($/kg)	Cost	Chemicals	Ratio	Price($/kg)	Cost
Polyol*	100	1.32	0.47	Polyol	100	2.15	0.73
CFC-11	40	2.10	0.30	HCFC-141b	34	3.50	0.40
MDI	140	1.45	0.73	MDI	160.8	1.45	0.79
Unit Cost ($/kg)			1.50	Unit Cost ($/kg)			1.92
Foam Production (kg)			89,000				89,000
Foam Cost ($)			133,182				171,225
Cost Difference Between CFC-11 Foam and HCFC-141b Foam Per Year							38,043
Net Present Value of Incremental Operating Cost for Two Years (10%/yr.)							66,195

Essourur Company

Before Conversion				After Conversion			
Chemicals	Ratio	Price ($/kg)	Cost	Chemicals	Ratio	Price($/kg)	Cost
Polyol*	100	1.32	0.47	Polyol	100	2.15	0.73
CFC-11	40	2.10	0.30	HCFC-141b	34	3.50	0.40
MDI	140	1.45	0.73	MDI	160.8	1.45	0.79
Unit Cost ($/kg)			1.50	Unit Cost ($/kg)			1.92
Foam Production (kg)			84,000				84,000
Foam Cost ($)			125,700				161,606
Cost Difference Between CFC-11 Foam and HCFC-141b Foam Per Year							35,906
Net Present Value of Incremental Operating Cost for Two Years (10%/yr.)							62,476

Musrata Company

Before Conversion				After Conversion			
Chemicals	Ratio	Price ($/kg)	Cost	Chemicals	Ratio	Price($/kg)	Cost
Polyol*	100	1.32	0.47	Polyol	100	2.15	0.73
CFC-11	40	2.10	0.30	HCFC-141b	34	3.50	0.40
MDI	140	1.45	0.73	MDI	160.8	1.45	0.79
Unit Cost ($/kg)			1.50	Unit Cost ($/kg)			1.92
Foam Production (kg)			90,000				90,000
Foam Cost ($)			134,679				173,149
Cost Difference Between CFC-11 Foam and HCFC-141b Foam Per Year							38,471
Net Present Value of Incremental Operating Cost for Two Years (10%/yr.)							66,939

Eshams Company

Before Conversion				After Conversion			
Chemicals	Ratio	Price ($/kg)	Cost	Chemicals	Ratio	Price($/kg)	Cost
Polyol*	100	1.32	0.47	Polyol	100	2.15	0.73
CFC-11	40	2.10	0.30	HCFC-141b	34	3.50	0.40
MDI	140	1.45	0.73	MDI	160.8	1.45	0.79
Unit Cost ($/kg)			1.50	Unit Cost ($/kg)			1.92
Foam Production (kg)			92,000				92,000
Foam Cost ($)			137,671				176,997
Cost Difference Between CFC-11 Foam and HCFC-141b Foam Per Year							39,326
Net Present Value of Incremental Operating Cost for Two Years (10%/yr.)							68,427

ANNEX V

PROJECT COVER SHEET

COUNTRY: Libya **IMPLEMENTING AGENCY:** UNIDO

PROJECT TITLE: Phasing out CFC-11 by Conversion to HCFC-141b and CFC-12 to HFC-134a Technology in the Manufacture of Commercial and Transport Refrigeration Equipment at the Terminal Umbrella Group of Libyan Commercial and Transport Refrigeration Manufacturers

PROJECT IN CURRENT BUSINESS PLAN:		Yes
SECTOR:		Refrigeration
SUB-SECTOR:		Commercial/Transport Refrigeration
ODS USE IN COUNTRY		
	Baseline (1999)	900.8 ODP tonnes
	Current (2002)	902.6 ODP tonnes
ODS USE AT ENTERPRISE (Average of 2002):		30.062 MT CFC-11 and 17.671 MT CFC-12
PROJECT IMPACT (ODP TO BE ELIMINATED):		44.042 MT
PROJECT DURATION:		30 months
PROJECT COSTS:	Incremental Capital Cost	US$ 349,000
	Contingency (10% of equipment cost)	US$ 29,900
	Incremental Operating Cost	US$ 66,314
	Total Project Cost	US$ 445,214
LOCAL OWNERSHIP:		100 % Libyan
EXPORT COMPONENT:		None
REQUESTED GRANT:		US$ 445,214
COST EFFECTIVENESS:		**10.02** US$/kg
IMPLEMENTING AGENCY SUPPORT COST:		US$ 33,391
TOTAL COST OF PROJECT TO MULTILATERAL FUND:		US$ 478,605
STATUS OF COUNTERPART FUNDING:		
PROJECT MONITORING MILESTONES INCLUDED:		Yes
NATIONAL COORDINATING AGENCY:		Ministry of Environment and Climate Changes

PROJECT SUMMARY

The project will phase out 30.1 MT 0f CFC-11 and 17.7 MT of CFC-12 consumption annually in the production of commercial refrigeration equipment at the terminal umbrella group of Commercial and Transport refrigeration manufacturers (Tasharoukiat El-Nakla, Tasharoukiat Marwa, Tasharoukiat El-Jalid, Tasharoukiat El-Shami and Tasharoukiat El-Takadom), Libya by converting to HCFC-141b as a foam blowing agent in the production of polyurethane foam and HFC 134a as the refrigerant in the cooling circuit of equipment in the production of a range of commercial refrigeration equipment. The project will include incremental capital costs covering three low pressure foaming machine (US$ 105,000), one high pressure foaming machine (US$ 80,000), production and portable refrigerant charging units (US$ 81,000), vacuum pumps (US$ 15,000), leak detectors (US$ 3,000), re-design, testing, trials (US$ 15,000), technical assistance (US$ 25,000) and training (US$ 25,000). Eligible incremental operating costs amount to US$ 66,314 resulting from conversion to the new technology.

Impact of project on country's Montreal Protocol obligations:

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

Prepared by: A.Malayeri Date: Aug.2003
Reviewed by: C. Murdoch Date:7.Sept.2003

1. BACKGROUND

1.1. Enterprise Baseline Data

The baseline data for the companies covered by this project contains:

- baseline production data
- baseline ODS consumption data
- baseline production equipment data

All of the companies covered by this project are similar in nature and operate using similar manufacturing techniques. All of the companies covered by this project are similar in nature and operate using similar manufacturing techniques. Similar to commercial refrigeration companies in Article 5 countries, production is generally on a batch and on order basis. Most companies manufacture a range of equipment, which can be tailored to suit the needs of the customer.
Production lines are generally in open plan factory units or workshops and consist of a series of workstations at which particular task can be carried out such as assembly, brazing, charging etc. Work in progress is moved from one station to another using trolleys or conveyors. In the majority of cases production lines can be reconfigured to suit the particular production and market requirements. A brief overview of each of the companies is given in Annex1.

A brief overview of each of the companies is given below:

Name	Location	Set up year	No. of Employees
Tasharoukiat El-Nakla	Tripoli	1992	32
Tasharoukiat Marwa	Tripoli	1994	18
Tasharoukiat El-Jalid	Tripoli	1993	36
Tasharoukiat El-Shami	Tripoli	1975	42
Tasharoukiat El-Takadom	Tripoli	1986	83

All companies except Tasharoukiat Marwa are using CFC-11 as foam blowing agent. Tasharoukiat Marwa is using polystyrene for insulation.

1.2 The Terminal Umbrella Project; Ownership and licenses

Since the remaining companies in the commercial refrigeration sector are all small and medium scale enterprises, and therefore generally too small in terms of CFC usage to warrant individual project preparation, the umbrella project approach has been sanctioned by the Government of Ibya to phase out ODS usage in the commercial sector in Libya. All of the companies in this umbrella project have a number of common factors.

a) The choice of CFC replacement technology is the same in all cases.
b) All companies are 100% Libyaian owned. No licensing from other companies exists.
c) The production facilities are similar and in the majority of cases consist of simple production and fabrication facilities.

All companies involved in this project have formally been committed to scrapping equipment made redundant by the conversion to non-CFC technology. As an Article 5 country, Libya is entitled to import CFCs until 2006. CFC consumption was carefully checked against the specifications of refrigerated models actually produced by each of the companies.

These companies are 100% indigenously owned. No licensing from other companies exists.

1.3. Project Impact

The project will phase out 30.1 MT of CFC-11 and 17.7 MT of CFC-12. The total project impact, which will be eliminated, is 44.04 ODP tonnes, which will assist the Libyan Arab Jamahiriya in meeting its Montreal Protocol Obligations**.**

2. PROJECT OBJECTIVE

The objective of this project is to eliminate the use of CFC-11 and CFC-12 in the production of commercial refrigeration equipment at the Terminal Umbrella Group of Libyan commercial and transport refrigeration manufacturers through conversion to the use of HFC-134a refrigerant for the cooling system and HCFC-141b as blowing agent for the polyurethane insulation foam.

The same operating parameters and the same quality level must be guaranteed on completion of the conversion process, but no increase in production capacity will be brought about by the project. The companies involved are aware of the financial limitations of the funding process and are prepared to use its own funds to share some of the cost of the conversion process.

3. PROJECT DESCRIPTION

The companies included in this terminal umbrella project have recognized the need to be in compliance with the Montreal Protocol and have agreed to participate in Libya's ODS phase-out programme. The companies are committed to phase out CFCs by converting their foaming equipment to HCFC-141b and adopting HFC-134a as refrigerant. This project document describes the activities needed to carry out the phase out process.

3.1. Justification for Selection of Alternative Technologies

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

- Proven and reasonably mature technology;
- Cost effective conversion;
- Availability of the systems at favorable pricing;
- Critical properties that have to be obtained in the end product (in this project – thermal Conductivity, dimensional stability, closed cell content, surface properties and strength);
- Compliance with established (local and international) standards on safety and environment;

a) Refrigerant

The technological options currently available to replace CFC-12 refrigerant are presented in the table below:

Refrigerant	**Assessment**	**Consequences**
Iso-butane (R-600a)	• Inflammable and explosive in certain limits of mixture with air • ODP=0 • High coefficient of performance (COP) which means lower energy consumption • GWP near zero	Special safety infrastructure is needed. Technology and specific know-how are available, which guarantees safe conditions during manufacture repair and service. Special service technology must be applied. Changes in refrigerator design are necessary (special compressor, capillary tube etc)
HFC-134a	• ODP=0 • GWP=1,300	Product design can largely stay the same. Increased operation requirements. Especially high cleanliness necessary. Components affected by the refrigerant must be dry and free of mineral oil. Special compressor (lubricating oil), filter-dryer and different length capillary tube will be needed. Refrigerant is not flammable.

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

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

Hydrocarbon technologies are environmentally friendly (no ODP/GWP or health hazards) but require elaborate safety/monitoring provisions and investments due to their flammability and will not be suitable for viable transfer to enterprises of this size and organization.

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

HFC-134a technology as a replacement for CFC-12 based refrigeration systems, is universally accepted, especially in small hermetic or semi-hermetic systems. HFC-134a is a zero ODP option. The technology is commercially available and relatively cheap to implement. Hermetic compressors optimized for HFC-134a are commercially available. The enterprise has therefore chosen HFC-134a technology.

b) FOAM

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

Blowing agent	**Assessment**	**Consequences**
HCFC-141b	ODP = 0.11 GWP = 630	Almost drop-in replacement. Some adjustments in production process and product design required
Cyclopentane	ODP = 0 GWP = 3	Special technology and infrastructure is needed (high pressure PU dispenser). Additional equipment to ensure safe operation has to be installed.

Interim Technologies

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

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

Long term Technologies

Pentane (n-, iso-, cyclo) based systems require extensive safety related provisions/investments due to their flammability. Due to safety considerations, the use of pre-blended systems is not viable and additional investments for in-house pre-mixing are required. Cyclopentane has miscibility limitations with polyols. The molded densities and insulation values are still inferior to those obtained with HCFC-141b. The advantages are their relatively lower unit costs; they are environmentally friendly (no ODP/GWP or health hazards) and constitute a permanent technology. Hydrocarbons are therefore the preferred conversion technology for large and organized users, where the safety requirements can be complied with and investments can be economically justified. In case of this enterprise, implementation of hydrocarbon based technology will require enormous investments for changing the plant layout completely (as the current layout is not suitable for handling hazardous substances consistent with local regulations), which are not justified by the level of their production.

Gaseous HFCs have been used successfully in some cases but have not been applied widely due to cost, technical and/or availability factors.

For water-based systems, the insulation values, density and commercial availability are unsatisfactory at present. However, these systems have acceptable processing characteristics and are expected to be mature and commercially viable in the near future, especially for applications where insulation values are not critical. They are environmentally friendly and safe (zero ODP/GWP, no health or safety hazards) and constitute a permanent technology.

Chemical and systems suppliers and the appliance industry are extensively evaluating liquid HFC-based systems. Preliminary trials with non-optimized formulations indicate lower molded foam densities, insulation values comparable to HCFC-141b and no solvent action. However, issues such as the time frame for commercial availability of liquid HFCs, their costs and their impact on climate change, need to be addressed satisfactorily. On the whole, liquid HFCs are considered to be the only potential zero-ODP alternatives to hydrocarbons.

Based on the above, cost, safety and technical considerations as well as due to the lack of expertise and well trained personnel, the enterprise will convert to CFC-free systems for their rigid polyurethane foam operations. Until the commercial introduction of mature CFC-free and national laws limiting use of HCFCs. HCFC-141b based systems will be selected as an interim technology, to maintain product standards and acceptability.

The companies are fully aware that HCFC-141b is a transitional substance and there is no possibility to apply for any further assistance in the future in case it becomes necessary to phase out the presently selected alternative (s).

3.2.1 Conversion

The conversion technology and expertise will be acquired from equipment, component and chemical suppliers and external foam and refrigeration experts. The impact on the plant/process due to the use of HCFC-141b as the blowing agent and HFC-134a as the refrigerant, would need to be addressed by implementing plant modifications and through the introduction of new equipment, components and processes, as below:

A. Refrigeration Operation

The conversion to HFC-134a as the replacement for CFC-12 will involve the following changes:

a) Compressors suitable for HFC-134a will be required. These will be available from existing suppliers.

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

- The vacuum pumps are not suitable for use with HFC134a. 6 of the existing vacuum pumps will be replaced.
- The existing refrigerant charging units are not suitable for use with HFC -134a and cannot be retrofitted, and will therefore be replaced with 4 production-charging units and 7 portable charging units.
- The design/sizing of the refrigeration system will need to be suitably changed, to ensure the viability of the process and to maintain the product standards for performance, such as:
- Up sizing the condensers and re-engineering evaporators and condensers, so as to ensure the levels of cleanliness and contamination that can be tolerated with HFC-134a
- Lengthening of the capillary tubes.
- Use of filter-dryers with finer pores, suitable for use with HFC-134a

d) The existing leak detectors are suitable for detecting CFC-12 only and will therefore need to be replaced with leak detectors suitable for detecting HFC-134a.

e) Provision for technical assistance from external international refrigeration experts and also from compressor suppliers will be required to be made to ensure smooth transition to the new technology and the successful implementation of the project.

f) In-house and field trials on prototypes of each model will be needed to be carried out, to establish performance and reliability with the HFC-134a based refrigeration systems.

g) The system dryness/cleanliness with the use of HFC-134a being of crucial nature, careful re-assessment of the production program, re-training/orientation of the staff for the new technology would be required.

Investments will need to be made and provisions thereof are included in the project budget, to cover the incremental costs of these changes. These changes will also result in incremental operating costs in the refrigeration operation originating from the following:

a) Increased costs of the compressors suitable for HFC-134a.
b) Increased costs of HFC-134a in relation to CFC-12.

c) Increased costs due to up sizing of the condensers.
d) Increased costs due to the lengthening of the capillary.
e) Increased costs of the filter/drier due to the finer pores required in relation to those presently used.

B. Refrigeration Service

h) No equipment or training is being requested in respect of service work. It is anticipated that training will be handled via a nationwide training program that has yet to be organized.

The servicing of new HFC-134a equipment as well as the recovery and recycling of the used refrigerant will have to be addressed on national level in line with the recommendation of the Fund Secretariat for the service sector.

C. Foam Operation

The use of HCFC-141b as an alternative-blowing agent for the foaming operation will result in the following:

a) New formulations suitable for CFC-141b will be required. These will be available from existing chemical suppliers. No investments are foreseen for handling chemicals.

b) In cases when the low pressure foaming machine will be replaced with a high pressure one, the use of new formulations will lead to a change in mixing ratios ad increased viscosity, leading to reduced flow characteristics of the chemical mixture. The foaming reaction parameters will change. HCFC-141b based foam will have an increased thermal conductivity compared to foam produced with CFC-11. The existing low-pressure foam dispensers with mechanical missing will not be able to process new formulations without adversely affecting the cell structure and thereby the thermal conductivity of the foam. These dispensers will therefore be replaced by one high-pressure foam dispensers of equivalent effective capacity for each company, which will provide a finer cell structure and help minimize the deterioration of thermal conductivity of the foam.

c) In cases when low pressure foaming machine will be replaced with a low pressure one, the new PU formulation, with HCFC-141b, it is necessary to use a slightly higher foam density in order to compensate for the lower insulation value of foam. Also, to guarantee a good foam structure, it is necessary to heat the foaming moulds. In some cases this can be accomplished by passing the moulds through an oven, in other cases electric heating of the moulds would resolve the question. In the PU system using HCFC-141b as the blowing agent must also guarantee thorough mixing of the higher viscosity chemicals.

It was noted by various technical for a that in the refrigeration sector with the use of low-pressure foaming machines, one can not meet the quality requirements in the manufacture of insulating polyurethane foam based on HCFC-141b formulations and it would therefore be optimal to apply high pressure foaming machines for use with HCFC-141b. Since the Montreal Protocol supports the concept of phase out of CFCs without either upgrading or downgrading existing production facilities, and in the light of the above considerations, the replacement of low pressure machines with high pressure ones has been the accepted procedure in the refrigeration sector projects.

However, in those cases, where the scale of production cannot allow purchase of a high pressure foaming machine within the applicable cost effectiveness threshold and the counterpart has no financial means to substantially supplement the project cost, we are proposing purchase of new low pressure foaming machine to replace the existing conventional ones. The implementation of the projects through upgrading of the existing foam dispensers would be impractical since the existing equipment is locally made, very simple and rather unique. It is clear furthermore, that the use of HCFC-141b formulations with the existing machines would result in a net degradation of foam quality.

The design of low pressure foaming machines has improved over the last years as a result of research with the use of sophisticated simulations and mathematical models for the prediction of chemical behavior in real conditions, application of CAD systems in the design process, production of machine parts on numerical control machines and the use of the sophisticated surface treatments. The mixing head of the newer foaming machine have a control board with basic functions like emergency push button, pouring, washing, air shot, set and reset timers, mixing head forced lubrication and emergency cleaning facility. The metering group (for polyol premix and isocyanate components) has better precision to ensure accurate dosing and constant optimal conditions for the chemical reaction of the components. Nevertheless, the replacement of low pressure foaming machines with new low pressure foaming machines will not completely solve the issue of degradation of physical properties when using the HCFC-141b but it will compensate the quality problems to some extent, as the equipment will be inherently more accurate and more efficient.

Replacement of old for new will therefore have a positive impact on the foam quality, even if not completely counterbalancing the negative impact of HCFC-141b.

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

e) Technical assistance from external process experts and from chemical and equipment suppliers will need to be acquired, to implement the new formulations and to ensure smooth transition to the new technology.

f) Trials will be needed for the new equipment, process and products. This will cover the cost of chemicals, raw materials, consumables & utilities required during trials/commissioning.

g) The production personnel in the enterprise need to be trained to be able to work with the new formulations and process.

Costs are included in the project budget, to cover the incremental costs of these changes. These changes will also result in incremental operating costs, for which provision has been made in the project budget. These incremental costs originate from the Increased cost of the formulations and increased foam density resulting in increased consumption of polyurethane chemicals.

4. INPUTS

4.1. Capital Goods Replacement, disposal of replaced CFC-related equipment

Annex A gives the detailed list of the required services, equipment to be modified, equipment to be replaced, and additional equipment to be provided for the conversion. The scope of supply is based on maintaining the present production capacity and the quality of products.

4.2. Conversion/Training

Within the scope of the project, technicians from the recipient enterprise will be trained in the following areas:
- redesign of refrigeration equipment and appliances;
- quality control in relation to conversion;
- operation and maintenance of the new machinery and equipment;
    - testing of refrigeration systems;
    - materials' specifications and selection;

- refrigerator servicing techniques.

4.3. Model Redesign

It is foreseen that all models will have to be redesigned; this will be followed by the manufacture of prototypes and refrigeration performance tests. In this regard cooperation with well-qualified consultants would minimize the risk related to the conversion of the manufacturing technology and of the products.

5. IMPLEMENTATION

The project will be implemented according to the rules and procedures of UNIDO, under the management of the backstopping officer of UNIDO, in close cooperation with the counterpart company. The Ozone Unit of the Department of the Environment of Libya will do all necessary local coordination and control.

Suitably qualified and experienced consultants will be appointed and fielded by UNIDO, to substantively assist and supervise the technical aspects of the conversion process, to perform troubleshooting and to provide assistance in specialized product redesign work. The respective job description(s) will be prepared on approval of the project.

The detailed Terms of Reference for the supplies and services to be provided under the project will be elaborated after project approval and sent to the company for his review. After competitive bidding, performed by UNIDO in accordance with UNIDO's financial rules and procedures, a General Contractor will be appointed by UNIDO for the supply of the project equipment (production equipment, etc.). Training and production expertise is likely to be provided by individuals who will be separately contracted by UNIDO.

The final equipment specification and work plan can only be elaborated after approval of the basic approach for project implementation by the MFMP.

Permission from local authorities for the introduction of the new technologies under this project will be obtained by the counterpart, who will also be responsible for the compliance of the new technologies with the established national standards.

Having accepted the conversion of its plants to the application of non-ODS technologies under this project, the counterpart, shall be committed to provide the following inputs:

- All activities and costs related to the construction work needed (including the provision of technical infrastructure) to accommodate the new technologies introduced under this project;
- Technical staff, local labor as required by the General Contractor;
- Provision of tools, transportation and lifting equipment as required;
- Provision of materials, utilities, services, manpower, etc. related to commissioning, start-up, trial runs, prototyping and testing;
- Local transport, communication and secretarial facilities for the General Contractor's and UNIDO's staff involved in the project's implementation;
- All other expenses not included in this Project Document and not covered by the budget approved by the Multilateral Fund for the Implementation of the Montreal Protocol.

The General Contractor will elaborate the specification of these works after project approval and the necessary site inspection. Thus, the costs of construction work can be specified only after appointment of the General Contractor and finalization of the equipment list. The relevant construction work shall be arranged by the counterpart under the supervision of the General Contractor and in line with the established milestones for this project

UNIDO as Implementing Agency has the necessary experience and capabilities for the successful implementation of projects at enterprise level. Upon approval of the project by the MFMP the whole budget will be transferred to UNIDO. Any substantive or financial deviation from the approved project is subject to approval by the MFMP and UNIDO.

All of the equipment replaced during the conversion process through the project should be dismantled by the counterpart and rendered unusable for use with CFC (Low pressure Foaming Machines and Charging boards).

The Government of Socialist People's Libyan Arab Jamahiriya has already obtained the counterpart's commitment for cost sharing for this project and took note of the decision no. 27/13 taken during the 27th Session of the Ex.Com. The project document was technically appraised by an independent expert and his comments have been incorporated in the project document.

6. PROJECT COSTS

The total project cost is estimated at US$ **445,214** and is set out in Annex 4 along with the calculation of the cost effectiveness of the project.
The Incremental Capital Costs of US$ **349,000** include capital investments required for refrigerant charging/evacuation equipment, trials, technical assistance and training. The breakdown of these is provided separately for the foaming and refrigeration operations in annex 2.
The Incremental Operating Costs of US$ **66,314** represent the incremental operating cost calculated in Annex 3. Incremental operating costs are claimed within the limits of cost effectiveness for each enterprise.
A contingency of US$ **29,900** equal to 10% of the capital equipment cost is included to cover unforeseen expenditure within the limits of cost effectiveness for each enterprise.
Implementing agency support costs of US$ **33,391** are 7.5% of the of the total grant requested.

PROJECT MONITORING MILESTONES

Milestone	Month, after approval	Results			Remarks
		Achieved	Not achieved	Delay	
Implementation Agreement submitted to beneficiary	2				
Implementation Agreement signed	3				
TOR for equipment (Refrigerant equipment and foaming machines)	3				
TOR for equipment cleared by beneficiary	4				
Bids requested	5				
Bids received, evaluated	6				
Contract for equipment supply signed	7				
Equipment delivered	15				
Commissioning and trial runs	18				
Decommissioning and destruction of replaced equipment	24				
Submission of project completion report	30				

Annexes

Annex 1: Baseline Production and ODS Consumption Data
Annex 2: Incremental capital Costs
Annex 3: Incremental Operating Costs
Annex 4: Project Budget and Cost Effectiveness
Annex 5: Baseline production equipment data and disposal

Annex1 - Baseline production and ODS consumption Data

Model / Description	Annual Production	Foam		CFC-11		Comp.	CFC-12		Total ODS kg
		per unit (kg)	Total (kg)	per unit (kg)	Total (kg)		per unit (kg)	Total (Kg)	
Tasharoukiat El-Nakla									
Comm. Freezers	200	17	3,400	2.20	440	1/3 – 1 HP	0.90	180	620
Comm. Refrigerators	300	21.5	6,450	2.80	840	1/3 – 1 HP	0.80	240	1,080
Water Coolers	3,250	7.2	23,400	0.95	3,090	¼ –1/3 HP	0.40	1,300	4,390
Chest freezers	130	7.7	1,001	1	130	¼ - ½ HP	0.60	80	210
Total / average	**3,880**	**8.83**	**34,251**	**1.16**	**4,500**	**------**		**1,800**	**6,300**
Tasharoukiat Marwa									
Comm. Freezer	380	0	0	0	0	½ – 3 HP	2.30	880	880
Comm. Refrigerator	400	0	0	0	0	½ – 3 HP	3.80	1,520	1,520
Total / average	**780**	**0**	**0**	**0**	**0**	**-----**		**2,400**	**2,400**
Tasharoukiat El-Jalid									
Chest Freezers	700	7.8	5,460	1	700	1/3–1.5 HP	1.8	1,260	1,960
Water cooler	1,600	0	0	0	0	¼ - ½ HP	0.38	608	608
Commercial Freezer	480	35	16,800	4.5	2,160	¾ - 3 HP	3	1,440	3,600
Upright Refrigerator	250	14	3,500	1.80	450	¾ - 1 HP	1.2	300	750
Total / average	**3,030**	**8,5**	**25,760**	**2.3**	**3,310**	**---**		**3,608**	**6,918**
Tasharoukiat El-Shami									
Comm. Freezer	450	37	16,650	4.8	2,160	¾ – 3HP	2.85	1,283	3,443
Comm. Ref,	680	45	30,600	5.9	4,012	¾ - 3 HP	2.2	1,496	5,508
Total / average	**1,130**	**41.80**	**47,250**	**5.46**	**6,172**	**---**		**2,779**	**8,951**
Tasharoukiat El-Takadom									
Comm. Freezers	1,280	35	44,800	4.9	6,272	¾ -3 HP	3.2	4,096	10,368
Comm. Refrigerators	920	42	38,640	5.9	5,482	¾ - 3 HP	2.8	2,576	8,058
Refrigerated Trucks	26	130	3,380	18.2	473	1 – 3 HP	6	156	629
Mobile cold rooms	32	40	1,280	5.6	179	3 – 5 HP	8	256	435
Panels for Prefabricated Houses	82	320	26,240	44.8	3,674	----	0	0	3,674
Total / average	**2,340**	**48.86**	**114,340**	**6.87**	**16,080**	**----**	3.02	**7,084**	**23,164**

Annex 2 - INCREMENTAL CAPITAL COSTS

Description	Cost	Tasharoukiat El-Nakla		Tasharoukiat Marwa		Tasharoukiat El-Jalid		Tasharoukiat El-Shami		Tasharoukiat El-Takadom		Total	
		Qty	**Total Cost**	**Qty**	**Total Cost**	**Qty**	**Total Cost**	**Qty**	**Total Cost**	**Qty**	**Total Cost**	**Qty**	**Total Cost**
Low pressure foam dispenser	35,000	1	35,000	0	0	1	35,000	1	35,000	0	0	3	105,000
High pressure foam dispenser	80,000	0	0	0	0	0	0	0	0	1	80,000	1	80,000
Total Foaming Equipment			***35,000***		***0***		***35,000***		***35,000***		***80,000***		***185,000***
Production charging units suitable for HFC-134a duty	15,000	1	15,000	0	0	1	15,000	0	0	2	30,000	4	60,000
Portable charging units suitable for HFC-134a duty	3,000	1	3,000	1	3,000	1	3,000	2	6,000	2	6,000	7	21,000
Vacuum pumps	2,500	1	2,500	1	2,500	1	2,500	1	2,500	2	5,000	6	15,000
Hand-held leak detectors for HFC-134a	500	1	500	1	500	1	500	1	500	2	1,000	6	3,000
Redesign of main models	1,000	1	1,000	1	1,000	1	1,000	1	1,000	1	1,000	5	5,000
Manufacture of prototypes	1,000	1	1,000	1	1,000	1	1,000	1	1,000	1	1,000	5	5,000
Laboratory and field test	1,000	1	1,000	1	1,000	1	1,000	1	1,000	1	1,000	5	5,000
Total Refrigeration Equipment			***24,000***		***9,000***		***24,000***		***12,000***		***45,000***		***114,000***
Total Equipment			**59,000**		**9,000**		**59,000**		**47,000**		**125,000**		**299,000**

Annex 3: Incremental Operating Costs

Refrigerant:

The prices of HFC-134a and CFC-12 used in this document have been calculated by average the prices given by a range of Libyan refrigeration companies; these prices are US$ 7/kg and US$ 2.50/kg respectively (without considering customs duties). The incremental cost column of refrigerant is calculated as follows:
(Total CFC-12 Consumption kg x US$5.85 x 0.9) - (Total CFC-12 Consumption kg x US$2.50)

The factor of 0.9 is applied, as average the charge of HFC-134a used is 90% of the mass of the original CFC-12 charge.

Foam:

When HCFC-141b is used as a blowing agent in polyurethane foam, approximately 5% more of the overall material mixture is needed to achieve the higher foam density required to compensate for slightly higher thermal conductivity and ensure mechanical strength. The prices of HCFC-141b and CFC-11 are currently US$ 3.5/kg and US$2.1/kg respectively, as supplied in 250 liters barrels.

Calculation of Incremental Cost per kg of Foam

	CFC-11 Foam			HCFC-141b Foam		
	wt%	Price$/kg	Cost US$/kg	wt%	Price $/kg	Cost US$/kg
Polyol + MDI	87	2.0	1.74	93	2.0	1.86
CFC-11 or HCFC 141b	13	2.1	0.273	7	3.50	0.245
PU-cost			**2.013**			**2.105**

The incremental cost of foam production is therefore 2.105 - 2.013 = US$ 0.092 per kg

The total incremental operating cost associated with the foam is calculated below in the following way:
Total Production x Average kg of Foam per unit x 1.05 x US$0.092

Where the factor of 1.05 applied as 5 more polyurethane foam is used, the density of the foam is in the range 30-32 kg/m^3.

Breakdown of IOC calculation

	IOC foam	IOC Ref.	Total IOC
Tasharoukiat El-Nakla	**2,342**	**4,977**	**7,319**
Tasharoukiat Marwa	**0**	**6,636**	**6,636**
Tasharoukiat El-Jalid	**2,488**	**9,976**	**12,464**
Tasharoukiat El-Shami	**4,564**	**7,684**	**12,248**
Tasharoukiat El-Takadom	**8,060**	**19,587**	**27,647**
Total	**17,454**	**48,860**	**66,314**

Annex 4: TOTAL PROJECT BUDGET AND COST EFFECTIVENESS

Project Budget	Cost	Cost	Cost	Cost	Cost	Cost
	Tasharoukiat El-Nakla	Tasharoukiat Marwa	Tasharoukiat El-Jalid	Tasharoukiat El-Shami	Tasharoukiat El-Takadom*	Total
International experts	5,000	5,000	5,000	5,000	5,000	25,000
Training of personnel	5,000	5,000	5,000	5,000	5,000	25,000
Equipment	59,000	9,000	59,000	47,000	125,000	299,000
Incremental Capital Cost	69,000	19,000	69,000	57,000	135,000	349,000
Contingency Cost (10% of capital equipment)	5,900	900	5,900	4,700	12,500	29,900
Incremental operating cost (IOC)	7,319	6,636	12,464	12,248	27,647	66,314
Total Project Cost	82,219	26,536	87,364	73,948	175,147	445,214
Implementing Agency Support Cost						33,391
Total Cost to Multilateral Fund						478,605
Cost Effectiveness	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**
ODP phase out CFC-11	4,500	0	3,310	6,172	16,080	30,062
ODP phase out CFC-12	1,800	2,400	3,608	2,779	7,084	17,671
ODP of HCFC-141 b	495	0	364	679	2,153	3,307
Total ODP impact	6,034	2,400	6,723	8,586	21,011	44,426
Total Project Cost US $	82,219	26,536	87,364	73,948	175,147	445,214
Total Cost Effectiveness of Project US$/Kg	**13.62**	**11.06**	**13.00**	**8.61**	**8.33**	**10.02**

*** The foam operations in the production of insulation panels for the refrigeration units, refrigerated trucks and prefabricated houses are treated according to the rigid foam sub-sector. The cost effectiveness for the 2 components is calculated as follows:**

Cost effectiveness	**Tasharoukiat El-Takadom**
Refrigeration Component	
ODP phase out CFC-12	7,084
Total cost of refrigeration component	79,087
Cost Effectiveness refrigeration component US$/Kg	11.16
Foam Component	
ODP phase out CFC-11	16,080
ODP of HCFC-141 b	2,153
Total ODP impact	13,927
Total cost of foam component	96,060
Cost Effectiveness foam component US$/Kg	**6.90**

Annex 5: Baseline Production Equipment

DESCRIPTION	Nr.	INSTALLED (Year)	Specification	Disposal Plan
Tasharoukiat El-Nakla				
Foaming Machine	2	**1993**	**Low pressure, Locally made**	**Scrap**
Foaming jigs	2	**1993**	**Locally made**	**N/A**
Vacuum Pumps (for CFC-12)	3	**1993**	**Robinair**	**2 x Retrofit**
Production charging machine	3	**1993**	Galileo	**Scrap**
Leak Detector (for CFC-12)	1	**1994**	**Robinair**	**Use for service**
Tasharoukiat Marwa				
Vacuum Pumps (for CFC-12)	2	**1994**	**Robinair**	**1 x retrofit**
Production charging machine	2	**1994**	Galileo	**Scrap**
Leak Detector (for CFC-12)	1	**1994**	**Leybold**	**Use for service**
Tasharoukiat El-Jalid				
Vacuum Pumps (for CFC-12)	5	**1994**	Galileo	**4 x retrofit**
Production charging machine	3	**1994**	Galileo	**Scrap**
Leak Detector (for CFC-12)	2	**1994**	**Leybold**	**Use for service**
Moulds	10	**1994**	**Locally made**	**N/A**
Tasharoukiat El-Shami				
Foaming jigs	1	**1978**	**Locally made**	**N/A**
Vacuum Pumps (for CFC-12)	3	**1993**	Galileo	**2 x retrofit**
Production charging machine	2	**1990**	Galileo	**Scrap**
Leak Detector (for CFC-12)	1	**1990**	**Leybold**	**Use for service**
Tasharoukiat El-Takadom				
Foaming Machine	2	**1993**	**Low pressure**	**Scrap**
Foaming jigs	5	**1988**	**Locally made**	**N/A**
Vacuum Pumps (for CFC-12)	5	**1991**	Galileo	**3 x retrofit**
Production charging machine	5	**1991**	Galileo	**Scrap**
Leak Detector (for CFC-12)	3	**1992**	**Robinair**	**Use for service**

PROJECT COVER SHEET

COUNTRY	:	**Libya**
IMPLEMENTING AGENCY	:	**UNIDO**
PROJECT TITLE	:	**Refrigerant management plan**
PROJECT IN CURRENT BUSINESS PLAN	:	**Yes**
SECTOR	:	**Refrigeration**
SUB SECTOR	:	**Service sector**
ODS USE IN SERVICE SECTOR (2002)	:	**120 MT**
PROJECT IMPACT	:	**120 MT**
PROJECT DURATION	:	**2003 – 2007**
PROJECT COST	:	**US$ 681,930**
LOCAL OWNERSHIP	:	**Nil**
EXPORT COMPONENT	:	**Nil**
REQUESTED GRANT	:	**US$ 681,930**
COST-EFFECTIVENESS	:	**US$ 5.68/kg ODP**
IMPLEMENTING AGENCY SUPPORT COST	:	**US$ 51,145**
TOTAL COST OF PROJECT TO MLF	:	**US$ 733,075**
STATUS OF COUNTERPART FUNDING	:	**N/A**
PROJECT MONITORING MILESTONES INCLUDED	:	**Yes**
NATIONAL COORDINATING AGENCY	:	**Ministry of Environment and Climate Change**

PROJECT SUMMARY

Through the extensive survey of the refrigeration service sector in Libya followed by the data analysis and a series of discussions with relevant stakeholders, actions required to reduce the CFC consumption in the sector have been identified. These actions are included in four project components of the refrigerant management plan (RMP), i.e., Institutional framework project, Customs offices empowerment project, National project for training service technicians and National recovery and recycling project. Selected workshops and service technicians are upgraded and trained under the RMP. As the sector structure is complicated with about 10,000 workshops distributed in all regions, the first two non-investment project components are started this year in order to make the country be prepared for following project components. The latter two project components are started in following years. Accordingly, the funding is requested in five years from 2003 to 2007, thereby the funds are effectively used. Through implementation of these project components, the significant amount of CFC consumption in the sector will have to be eliminated in the refrigeration service sector.

IMPACT OF PROJECT ON COUNTRY'S MONTREAL PROTOCOL OBLIGATIONS

When implemented as scheduled, 120-MT CFC consumption will have been eliminated from the refrigeration service sector, whose CFC consumption is significant for the country's total CFC consumption. The project is essential to ensure Libya to meet the country's obligation with the Montreal Protocol to reduce 50% CFC consumption in 2005 and 85% in 2007.

Prepared by: A. Malayeri — Date: August 2003
Reviewed by: C. Murdoch — Date: September 2003

Refrigerant Management Plan (RMP), Libya

CONTENTS[1]

[1] Prepared according to the basic format for the RMP in "Guidelines for Development of Refrigerant Management Plans" (Policies, procedure, guideline and criteria, Annex XIII 18, Multilateral Fund for the Implementation of the Montreal Protocol).

1. Current Situation

The population in 2002 is taken to be 6,166,993 persons, including non-Libyans. This is based on the actual population in 1999 and the population growth rate of 2.8% given for the year 2002. The average family consists of 6 persons, and the gross domestic product (UDP) per capita in 2002 is given as 2520 Libyan Dinar (US$ 1938 approximately).

1.1 Consumption of CFC-12 in the Domestic Refrigeration Sector

The number of families in Libya is calculated from the information given above to be 1,027,832 families. On the average, a Libyan family usually has one refrigerator and one freezer. Therefore, the total number of units amounts to 2,055,664 units. Assuming that 10% of these units require service annually, the number, which goes for service, is then *205,566* units. If each unit consumes about 200 grains of CFC-12 in The process of recharging, therefore the consumption of *CFC-12* in the domestic sector becomes 41.11 tonnes.

1.2 Consumption of CFC-12 in the Commercial Refrigeration Sector

It *is* estimated *that* 20% *of the Libyan families own one shop* each. Therefore the *total* number of shops in Libya is 205,566 shops. Of this total, the number of food stores and grocery shops amounts to 75%, that is the number of food stores and grocery shops is estimated to be 154,175 shops. These shops usually install various refrigerating equipment, such as; chest freezers, display cabinets, ice cream machines, cold rooms, upright refrigerators and freezers, etc. Normally, a shop may have one or more of these refrigerating units. We may say, on the average, that there are two units in each shop. This will result in a total number of 308,350 refrigerating units in the commercial sector.

Assuming 20% of the total to be serviced annually, each requiring 800 grams of CFC-12 in the process of recharging, the total amount of CFC-12 consumed annually in the commercial sector is 49.336 tonnes.

The usage of CFC-11 and CFC-12 in the manufacture of commercial refrigeration sub sector will be addressed in detail by separate requests for funding, however the consumption and phase out targets have been fully taken into consideration as part of the RMP in line with Decision 31/48.

1.3 Consumption of CFC-12 in the Industrial Refrigeration Sector

The data in this sector are collected from questionnaires and reports. It is found that the annual consumption of CFC-12 in the industrial sector is 22.3 13 tonnes.

1.4 Consumption of CFC-12 in the Mobile Air-Conditioning *(MAC)* Sector

A round figure of the registered vehicles is found to be 600,000 vehicles in 1999. It is estimated that 5% of this number is air-conditioned using CFC-12 and need annual service. That is the number of vehicles' air conditioners using (7FC-12 which need annual service is 30.000 units. Taking that each unit requires 100 grams for topping up; therefore the annual consumption of CFC-12 in this sector is 3 tonnes. All vehicles imported after 1999 mostly air-conditioned using HCFCI34a.

1.5 CFC Consumption in Service Sector

Table 1 shows the overall consumption of ODS by sector in Libya for in the period 1999 – 2002.

The grand total of CFC-12 consumption in the refrigeration service sector is currently estimated to be 115.759 tonnes per year as detailed above.

The refrigeration used in hotels, restaurants and public buildings will be part of the commercial and industrial refrigeration and will be covered under the RMP project.

Table 1: Summary of ODS Consumption by sector (ODP MT) in Libya during 1999 - 2002

Sector	**1999**	**2000**	**2001**	**2002**
Flexible foams (CFC-11)	642	623	608	575
Rigid foams (CFC-11)	60.5	58.3	53	52
Domestic refrigeration manufacturing				
CFC-11	44.4	44.4	44.4	44.4
CFC-12	9.0	9.0	9.0	9.0
Commerc/transportation refrigeration manufacturing				
CFC-11		40.3	35.5	30.1
CFC-12		22.8	20.5	17.7
Refr. Servicing (CFC-12)	141.3	139.5	130.2	120
Halons	3.6	51.5	52	54.4
MeBr	175	164	113	151
Total	**1,075.8**	**1,152.8**	**1,065.6**	**1,053.6**

Table 2: Estimated Use of Refrigerants in 2002 by Use and Application (ODS MT)

Sub-Sector	**ODS**	**Application**	**Consumption**
Domestic/Commercial/Industrial	CFC-11	Purging and recharge	4.50
Domestic/Commercial/Industrial	CFC-12	Recharge	113.29
Industrial	CFC-114	Recharge	0.231
Commercial/Industrial	CFC-115 (as R-502)	Recharge	8.343
MAC	CFC-12	Recharge	3.73
Domestic/Commercial/Industrial	HCFC-22	Recharge	86.12
		Total	**216.214**

Table 3: Total Import of ODS (ODP MT) 2000 - 2002

Substance	**2000**	**2001**	**2002**
Annex A Group 1			
CFC-11	852	853.943	836.54
CFC-12	120	118.00	117.02
CFC-114	9	10.98	0
CFC-115 (as R-502)	3.5	4.89	2.837
Annex A Group II			
Halon 1211	1.50	1.58	0
Halon 1301	50	52.80	0
Total Annex A	**1,036**	**1,042.193**	**956.40**
Annex C Group I			
HCFC22	10.7	11.21	86.12
Annex E Group I			
Methyl Bromide	153	153.72	150.84

The difference between imports and actual consumption can be attributed to stocks.

1.4 Estimate of Number of refrigeration Technicians

Two methods are used in estimating the number of technicians. The first method is as follows: -

Method 1

The number of the registered workshops at the Refrigeration and *Air-Conditioning* Syndicate in Tripoli is 555 workshops. We have been informed that about 20% workshops are not registered. 'Therefore, the total number of workshops in Tripoli is 611 workshops. 'This *number* is believed to constitute about one third of the total number in the country. Therefore, the total number in the country is about 1833 workshops. On the average, there are three technicians in each workshop, one of whom is non-qualified Libyan Technicians. Thus, the number of Libyan technicians to be trained in the domestic and commercial sectors is about 1 833 technicians.

There are about 200 public factories and other public enterprises in the country using refrigeration equipment. These establishments require on the average about 3 technicians for operation and maintenance. 'Thus the total number required in this sector is about 600 technicians, giving a total of technicians in the three sectors is 2432 technicians.

Method 2

Based on the average consumption of refrigerant CFC-12 in the workshops. The total annual consumption of CFC-12 in the domestic and commercial sectors is (41.11 + 49.336) = 90.446 tonnes. It is found from the survey that each workshop uses about 0.04 Tonnes per year. Therefore, the total number of workshops is estimated to be round 2261 workshops. Once again there are, on the average, three technicians in each workshop, one of whom is non qualified technicians Libyan. Thus, the number of Libyan technicians to be trained in the domestic and commercial sectors is about 2261 technicians. Since it is found that the industrial sector requires about 600 technicians, therefore the total number is 2861 technicians.
In addition, there are also about 50 technicians in the mobile air conditioning sector.

Therefore, it may he concluded, from this number and the results of the above two methods used in estimating the number of Libyan technicians, that the total number of Libyan technicians need to he trained ranges from 2,500 to 3,000 technicians.

1.5 Current Legal and regulatory Framework of the Refrigeration Sector

The General Peoples' Committee of Libya has established the National Committee for Climate Change (NCCC), (reporting to the Secretary of the General Peoples' Committee), and entrusted it with duties to develop a strategy and action plan for phasing out Ozone Depleting Substances. In order to implement these duties the NCCC has developed an Action Plan as follows:

- Establish the Executive Office of the NCCC as a focal point for all activities related to the Montreal Protocol.
- Embark on a public awareness program with assistance of UNEP, UNIDO and funding from the Multilateral Fund
- Develop and implement control measures such as:

  - Prohibit imports of ODS using equipment

  - Prohibit new enterprises producing and/or assembling equipment, foams, or aerosols using ODS
  - Establish import quotas into the existing licensing system.
  - Prohibit investments in building new plants using ODS

- Train Customs Department, National Information Center and NOU in monitoring and collection of data to meet the reporting requirements of the Protocol.
- Seek funding and monitor projects to convert refrigeration and foam manufacturing facilities
- Identify other investment projects not covered in this Country Programme and submit proposals for funding
- Implement a National Recovery and Recycling project.
- Identify key refrigeration installations and submit retrofitting proposals to the Multilateral Fund.

In addition to these objectives a number of institutional and regulatory measures will be developed as part of the RMP project as detailed in section 6.

2. Actions Required to Achieve Phase out in the Service Sub-sector

Based on the survey of the situation of the refrigeration service industry, training institutions and related regulatory framework followed by the analysis of the data collected through the extensive survey, a series of needs has been identified as measures to reduce CFC consumption in the refrigeration service sector in Libya. They are classified into several categories and listed below.

Enforcement of the legal and regulatory framework

- Customs training and provision of refrigerant identifiers to customs points;
- Awareness promotion of the Ozone issues and the RMP program to industry as well as consumers.

Improvement of service practice

- Establishment of training centers by upgrading the facility existing training institutes;
- Preparation of mobile training vehicles for training technicians in remote areas;
- Training of service technicians and certification;
- Development of a licensing system;
- Upgrading of service facilities at service workshops.

Use of recovered and recycled refrigerant

- Establishment of recycling centers;
- Provision of recovery machines to workshops;
- Consultation for recycling business.

Coordination and monitoring of the whole project

- Set up of regional function for coordination of the activities in provinces or regions.

4. JUSTIFICATION FOR REFRIGERANT MANAGEMENT PLAN

4.1 Country compliance

Under the initiative of the strategic planning of the Multilateral Fund and in order to ensure for Article 5 countries to be in compliance with the Montreal Protocol control measures for the consumption of Annex A Group I substances (CFCs), "updated data in the 2003 – 2005 phase-out plan for the Multilateral Fund" have been compiled by the Multilateral Fund Secretariat in November 2002 after the 38th Meeting of the Executive Committee, Decision 38/66. Libya is classified into non-LVC that might require further assistance to achieve the 2007 phase out target, and amount of CFCs to be phased out in 2003 – 2005 through new assistance have been determined. The 2003 – 2005 strategic rolling business plan was prepared by implementing agencies in line with this Decision, and approved at the 39th Meeting of the Executive Committee held in April 2003. In the business plan, implementing agencies reported CFCs phase out plan due to the on-going projects as well.

In Table 9, the total CFC consumption trend is shown under scenarios with phase-out plan in the 2003 – 2005 rolling business plan, which includes both the phase-out amount due to completion of on-going investment projects under the Multilateral Fund and that due to new activities. Under this phase-out scenario, Libya would be close to in compliance with the control measure in 2005, if the business plans for CFC phase out would be fully implemented. It is certain that without the present RMP program the country would be non-compliance with the 2007 control measure for the CFC consumption.

4.2. Government commitment for CFC phase out

The Government of Libya is extremely concerned about the consequences of non-availability of refrigerants for the industry in Libya. Abrupt change will affect the ability of the facilities (industry, houses, hotels, restaurants, hospitals etc.) to perform, and will decrease the earnings of the country. In addition, there will be a severe and unnecessary economic burden on the domestic and commercial refrigeration sector to replace systems that have not yet reached the end of their economic life.

Despite the above concerns, the Government is committed to meet their obligations as a Party to the Montreal Protocol. They realize that, in spite of possible hardships in the immediate time frame, regulatory instruments have to be enacted and implemented to ensure, that environmentally friendly technology is available and implemented at an early stage.

The Government has already taken several legislative measures to ensure the country's obligations, even by considering advanced phase out.

The RMP reflects the Government's commitment to comply with its obligations as a Party to the Montreal Protocol on Substances that Deplete the Ozone Layer. It provides a catalyst to the industry and service organizations to allow them to develop sustainable business. Further, it also gives the necessary information and tools to the Libya Customs Department to enforce the relevant legislation.

5. ASSISTANCE RECEIVED

At the 27th Meeting of the Executive Committee of the Multilateral Fund held in March 1999, the preparatory assistant fund was approved for the preparation of the Refrigerant Management Plan, Libya. The Government of Libya, in close collaboration with UNIDO, started the preparatory work for the RMP based on the fund.

In order to conduct the extensive survey of the situation of the refrigeration service sub-sector in Libya, the Committee consisting of the Ministry of Environment, Local Government and Rural Development, UNIDO and UNDP representatives selected Libya as a survey-consulting firm. UNIDO contracted with this company for the survey, including:

- District wide distribution of service workshops,
- Estimation of total number of workshops,
- Current service practices,
- Assessment of training needs,
- Potential service providers,
- Industrial statistics of production and import of refrigeration and air conditioning equipment,
- Technical institutions and vocational training centers,
- Industrial associations,
- Customs organization and training facilities.

The survey was done for service workshops spread in Libya and information was collected from about 600 shops.

Various Government authorities, original equipment manufacturers, industrial associations, service workshops, importers and consumers of ODS and other relevant stakeholders were consulted in the preparation of the RMP. Among them are:

Government: Chamber of Commerce and Industry
Ministry of Industry and Production
Ministry of Environment, Local Government and Rural Development
Central Board of Revenue, Customs Tariff Section

Industry: Libya HVACR Society
OEMs:

6. ACTION PLAN

6.1 Objectives

The strategic objective of RMP is to ensure, that the Libya's obligation is met in terms of the Montreal Protocol's control measure by reducing CFC consumption in the refrigeration service sector. The RMP definitely contributes to the country's obligation of the 50% reduction of CFC consumption in 2005, and provides a base for the country's obligation of the 85% reduction in 2007 and the total phase out in 2010.

The conditions and constraints for RMP in Libya are described below.

- The industry related to CFC must be developed in a sustainable manner.
- Employment must be kept in all related industries, particularly in SMEs, which play a major role in the refrigeration service sector. Even more employment may be created as a result of successful RMP implementation.
- The requirements of CFC refrigerants for servicing and maintenance of existing CFC refrigeration and air-conditioning equipment must be satisfied.
- The grant from the MFMP may be limited.
- The service sector in Libya is not well coordinated due to the number of SMEs involved.
- Availability of CFC may be limited in the near future.
- Legislation framework in Libya is to be modified.

External constraints for the RMP include the availability of CFCs at low prices and the disposal of CFC. These issues are under the consideration of Task Forces of the Multilateral Fund. Under these circumstances, the present RMP must serve as a seed to initiate a sustainable national system for refrigerant recovery and recycling and the responsible use of CFC (and non-CFC[2]) refrigerant in the refrigeration industry and the consumer sector.

In order to achieve the strategic objective of the RMP, activities identified are classified into four inter-related project components:

1. Institutional framework project,
2. Customs offices empowerment project,
3. National project for training service technicians, and
4. National recovery and recycling project.

The last project directly aims at phasing out CFCs in the sector, while other three projects facilitate to achieve the target of the national recovery and recycling project.

6.2 Institutional Framework

The following regulatory and instituational measures will be considered and developed by the coordinating bodies as part of the the RMP Implemenetation

Legal Instruments

- Immediate application of ban of import of ODS-using and ODS-containing equipment (especially second-hand domestic refrigerators using CFC-12), etc.(approved).

- Immediate prohibition of any new activity which aims the production of ODSs or ODS-using equipment;

- Application of strict control of import/export of all ODSs (including licensing, taxation and/or quotas as appropriate);

- Application of control on trade of ODSs (including licensing and taxation policy as appropriate);

- Application of an obligatory certification of technicians. Consideration of ban of illegal service of refrigerators, interlinkage of license on trade with certificate.

- Development of fiscal incentives/disincentives system to encourage the use of ODS alternatives and transitional substances.

Awareness promotion

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 RMP activities in Libya. Target audience of the awareness activity is not only industries but also consumers who use refrigeration

[2] Responsible use of alternative refrigerant may be considered in the program. This is because the climate change issue will be the next global environment requirement, and HFC refrigerants are of high global warming potential in the "basket gas" in Kyoto Protocol.

and air-conditioning equipment. This activity encourages more workshops to be involved in the RMP program.

Development of licensing system

A system and criteria for licensing service workshops and recycling centers will be developed. Provincial authorities or Federal authorities will issue licenses for qualified service workshops and recycling centres based on the established licensing criteria and the system. The detail of the system will be decided during the implementation of the project after the approval

6.3 Customs offices empowerment project

The training of 200 customs officers (inspectors, controllers and customs policemen) will be executed by three existing customs training centres in Libya, 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.[3] The experience obtained at customs authorities in non-A5 countries will be shared at training courses.

CFC detection equipment will be provided to 10 major customs points in the country. In addition, the project allows the customs department to create a database on imported ODS. The 10 major entry points will be selected during the project implementation.

6.4 National project for training service technicians

Establishment of Training Centres

Training centres will be established or upgraded at cities given below, so that service workshops can easily access to one of the centres. Training centres principally function also as refrigerant recycling centres.

Although the optimum number of “centres” is 22 to 28, twenty (20) centres are planned to be established by the present RMP program due to budget constraints.

In order to enable training of service workshops in remote areas, two mobile training vehicles will be made in addition to the stationary training centres.

Training workshops

The training programme includes both theoretical and hands-on sessions, and covers the following items.[4]

- elements of Ozone depletion and their effects,
- the relation with Montreal Protocol controlled refrigerants,
- methods for appropriate servicing and maintenance practices for ODS-containing refrigerant equipment,
- equipment working with new replacement refrigerants,

[3] “Training manual for customs officers” published by UNEP is a basis of training manual in the RMP Libya.
[4] “Training Manual of good practices in refrigeration” published by UNEP is a base for the training manual of the RMP Libya.

- leak detection,
- general concepts of refrigerant recovery and recycling,
- correct handling of refrigerants,
- Government regulations which affect the refrigeration sector.

This training programme ensures the permanent use of good refrigeration service and maintenance practices for systems using Ozone-friendly substances, and the correct handling of new replacement refrigerants. The training programme is coordinated with the recovery and recycling project component. The long-range objective is to enhance the refrigeration related courses at all training centres

There are more than 3,000 service technicians and 600 workshops estimated in Libya. The present RMP aims at giving training on good service practice for 600 selected technicians and workshops. The rest of the technicians will be trained by those trained by the RMP or through the national training system to be established by the project.

6.5 National recovery and recycling project

Approach:

As long as the supply of CFC exceeds the demand and CFCs are easily available at low prices, releasing refrigerants at servicing would be common practice. However, when the import of virgin CFC is declining, recovered or recycled refrigerants are the only source to keep existing equipment in operation. Recovered refrigerant is an asset, though it is currently only marginally used by service workshops due lack of infrastructure for recovery and recycling. The re-use of CFC will be important for all sectors in order to avoid the economic loss when perishable goods are ruined or premature scrapping of equipment when CFC imports decrease. The reuse of the CFC stock will play an important role in the phase-out of CFC in Libya.

Another problem encountered in RMPs in other countries is the no credibility of the quality of the recovered and recycled CFC. In order to create credibility for recovered and recycled CFCs, the legal requirements such as a ban on venting and compulsory recovery may be considered in addition to establishing the infrastructure to deal with the recovered refrigerant. This kind of activity is handled in the first component of the RMP.

To achieve a fully functioning and sustainable recovery and recycling scheme, it is important to establish a system that allows the recycling centres to operate long term on commercial basis. Therefore it is essential to train the staff of recycling centres on the commercial matter in addition to technical matters.[5]

Recycling Centres

Five recycling centres will be established at major cities, principally at the training centres. Each recycling centre will receive fundamental equipment required for refrigerant recycling. The central recycling centre in each of the five provinces/regions will be equipped with a recycling machine with the facility to remove non-condensable gas. They also need a cylinder to keep un-recyclable refrigerants until further treatment will be done. Equipment to be provided is a recovery machine, a recycling machine (chamber type), a recycling machine with function to remove non-condensable gas (for 4 major recycling centres), several small recovery cylinders, vacuum pumps, a refrigerant identifier (infrared type), a

[5] There are several ideas for this including (i) an environmental tax or fee - moving the cost for the handling of recovered material from the time when it is recovered to when new material is supplied to the market, and (ii) a fee on new refrigerant serving the dual purpose of increasing the price on new CFC and discouraging the intension for the service technician to release the refrigerant. The fee should also cover the potential cost of destruction of non-reclaimable material.

storage cylinder, service tools (piercing valve, gauge manifold etc.), and a hand-held leak detector. The location of the centres will be decided during the project implementation.

Service equipment and recovery machines

Essential service equipment for good servicing practice and refrigerant recovery will be provided to 600 g valves and other service tools. Recovery machines will be sourced locally, so that the cost would be reduced and machines will be better maintained. There are several potential manufacturers of recovery machines in Libya, though they need to develop the machine, which must be qualified to the international standard and adequate for use in the local condition.

7. PROJECT MANAGEMENT

7.1 Overall Coordination

The Ministries of the Federal Government of Libya are responsible for the national coordination of the project. The National Ozone Unit is the core institution for the national coordination.

The Federal Ministries with the NOU will be responsible for the national coordination and project management of the whole RMP programme. They will consider further legislation as and when required, for the successful implementation of the RMP and implement rigorous monitoring and reporting of performance.

The Federal Ministries with the NOU will be responsible for managing the following activities:

- 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 centres 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 refrigerant recovery and recycle machines, which will be procured through UNIDO bidding procedure and delivered to the country, should be executed.

7.2 Regional Coordination

Executive Teams in the four provinces/regions of Libya will coordinate the project implementation in each region including following activities:

- Reassessment and analysis of the sector after the approval of the RMP.
- Determination of the specification of equipment to be provided by the RMP.

- Selection of trainers for training of technicians.
- Selection of service workshops to be trained.
- Awareness promotion.
- Development of licensing system.
- Monitoring and report.

7.3 Monitoring and reporting:

After the establishment of the countrywide scheme of refrigerant recovery and recycling, 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 include:

- Establishing the system to ensure with the counterpart institute, that every recycling centre and service workshop is encouraged or obliged to report data and give information to the recovery and recycling scheme. This may be enabled through forms to be filled by recycling centres and service workshops.
- Setting up adequate office facilities including a computer system to collect and analyze the data.
- Regular communication with the counterpart institute.
- Occasional visits to workshops and recycling centers.
- Regular communication with customs offices.

Following information will be collected from recycling centres 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 recycling centres at every workshop,
- amount of recovered CFC refrigerants stored at every workshop,
- amount of recovered CFC refrigerants received from service workshops at every recycling centre,
- amount of recycled CFC refrigerants at recycling centres,
- 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., sent to reclaiming plants, or 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 recycling at every recycling centre and parties who bear the cost,
- price of recycled CFC refrigerants,
- other financial information relevant to monitoring the recovery and recycling scheme.

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

7.4 Timetable for implementation

Annex 2 shows the timeframe for the implementation of each activity in each project component. It was developed so as to cope with the phase out amount described in the 2003 – 2005 rolling business plan that would ensure the country compliance with the Montreal Protocol control measures in 2005 and 2007. After these activities having completed, the Project Completion Report will be prepared by Second Quarter of 2006. Therefore, the total duration of the RMP project is 4 years.

8. IMPACT and ODS phase out target

Most of CFC consumption (770 MT reported in 1999 and 563 MT surveyed in 2001) is to be phased out in the refrigeration service sector in Libya through the present RMP. Obviously, all project components contribute to achieve the targets in addition to the recovery and recycling project. The projected CFC phase-out amount by the RMP components is shown in Table 10.

Table 10. Impact of RMP components, MT

Year	Reduction	Consumption
2001	**0**	**120**
2002	**0**	**120**
2003	**0**	**120**
2004	**15**	**105**
2005	**25**	**80**
2006	**30**	**50**
2007	**30**	**20**
2008	**10**	**10**
2009	**5**	**5**
2010	**5**	**0**

Provisional direct impacts of CFC usage reduction in each category of service shops are given in Table 12. The target value of reduction of CFC emission through refrigerant leakage from installed equipment is 10% for all categories of shops. It will be achieved by the training of service technicians on good service practices followed by certification combined with the provision of essential service equipment to elected shops. Awareness promotion would help the achievement. Relatively high target reduction was set for “large” shops and “medium” shops for MAC and split systems services, which can be achieved as facility and human resources are well organized in these shops. In addition to the direct impact by the present programme, the RMP would achieve the total phase-out in the service sub-sector through indirect influences (legislation, awareness promotion and others) and the possible national scheme in addition to the MF assisted plan.

Meeting the Montreal Protocol control measures

The RMP provides a concrete basis for Libya's obligations of 50% reduction of the CFC consumption in 2005, 85% reduction in 2007 and the total ban in 2010.

Reduction of ODS consumption

The RMP aims at phasing out 120 ODP MT of CFCs in the refrigerant service sector.

Strengthening national capacity and expertise

The institutional framework project gives the opportunity to local personnel involved in the RMP implementation to get acquainted with the advanced systems and technologies with respect to the refrigerant management in industrialized countries.

This project requests the Executive Teams in four provinces/regions to take the responsibility for the regional coordination of the wide spread activities in the RMP, thereby they acquire expertise for managing the project. This is the basis for further execution of the regional system after the completion of the RMP project under the MFMP.

The customs-training program provides essential technical and financial support necessary for the enforcement of the national legislation to customs offices in Libya under the Central Board of Revenue. It plans to share experiences obtained in industrialized countries with customs officers in Libya in terms of inspection of ODS and ODS containing equipment including illegal trades. Major customs check points are equipped with refrigerant identifiers, so that imported CFC refrigerants, refrigeration and air conditioning equipment can be inspected.

Education facilities at selected institutions are updated, and satisfactory training can be executed for profound service practice, alternative technologies, Ozone issues, recovery and recycling technology, and other related matters.

It is planned to procure refrigerant recovery machines designed and manufactured locally, in order to reduce the costs of equipment and to ensure reliable maintenance of the machines. This would provide an opportunity to the industry to develop technology and production processes of the recovery machines, which are not only qualified by the international standard but also satisfy specific requirements due to specific local conditions in terms of climate, business practice, capability and experience of service technicians.
Selected service workshops are provided with essential service equipment for prevention of leak of CFC refrigerants from installations at operation and at disposal, and refrigerant recovery equipment. Recycling facilities are provided to recycling centers. Under the recovery and recycling scheme, service industries are able to obtain and use recycled refrigerants when the CFC import will be reduced, thereby the service business can be sustainable.

9. Financial assistance

Financial assistance required for each activity is summarized in Table 11 for the consideration by the Multilateral Fund. The grant is requested in phasing mode for three years, so that an effective use of the allocated fund is ensured. The administration costs of the implementing agency are 7.5 % of the project cost. The funding would be disbursed into 5 tranches. The first tranche is important to initiate the program to achieve the objective of the whole project by establishing the national institutional framework, training centres and customs training. The full effect of the measures will appear as reduced demand only after a lead period of 1 year or more after the activities are being introduced. The cost breakdown of activities in the project components is given in Annex 2

Table 13.Costs of the RMP, Libya

Project components and activity	**Cost, US$**
Institutional framework project	**66,000**
Project coordination	
Awareness promotion	
Monitoring	
Customs empowerment project	**35,800**
Training of customs officers	
Provision of refrigerant identifiers	
National project for training service technicians	**107,080**
Establishment of training centers	
Training workshops	
Certification of service technicians	
National recovery and recycling project	**473,050**
Establishment of recycling centers	
Provision of service equipment and recovery units	
Total Project cost	**681,930**
IA Cost	**51,145**
Grant from MFMP	**733,075**

Cost effectiveness

TOTAL Cost	681,930
IA Cost	51,145
Grant from MFMP	733,075
IMPACT (ODP tonnes)	**120**
CE	**5.68**

Annex 1. Cost breakdown of project components of RMP Libya, in US$

Project component and activities	Description	Unit cost	Q'ty	Sub total	Total for element
Project management					
International consultant		5,000	1		5,000
Training of national experts		2,000	10		20,000
Awareness promotion		3,000	5		40,000
Development of licensing system					
Monitoring					
	Coordination office set up	15,000	1	60,000	
	Office equipment	2,000	1	2,000	
	Travel	50	100	5,000	
	Sundries			5,000	
	Reports	100	10		1,000
Element Total					**66,000**

Project component and activities	Description	Unit cost	Q'ty	Sub total	Total for element
Customs empowerment project					
Custom training	2 x 2 days-workshops with 10 - 15 trainees				
Workshops	Travel and accommodation for outstation trainees	50	2	100	
	Workshop arrangement, certification	200	2	400	
	Martial, draft and translation, printing			15,000	
	International consultant	5,000	1	5,000	
	Fee for trainers	150	2	300	
Identifiers		1,000	10	10,000	
Contingency				5,000	
Element Total					**35,800**

Project component and activities	**Description**	**Unit cost**	**Q'ty**	**Sub total**	**Total for element**
National project for training service technicians					
Establishment of 3 training centres					
Training of trainers		500	3	1,500	
Training equipment	Teaching aids	400	3	1,200	
	Training rigs	1,000	3	3,000	
	Recovery machine	500	3	1,500	
	Recycling machine to be used for both training and recycling in R&R project	6,000	3	18,000	
	Cylinders, 13 kg	30	6	180	
	Vacuum pumps	150	6	900	
	Refrigerant identifier	1,000	3	3,000	
	Service tools, piercing valve, gauge manifold etc.	300	3	900	
	Leak detector	300	3	900	
Contingency				20,000	
					51,080
Training workshops: 60 x 4-days workshops with 10 trainees					
	Support for outstation trainees	50	300	15,000	
	Material – preparation drafting, translation, printing 10,000 copies			20,000	
	Fee for teachers	150	60	9,000	
	certification, arrangement	200	60	12,000	
					56,000
Element Total					**107,080**

Project component and activities	**Description**	**Unit cost**	**Q'ty**	**Sub total**	**Total for element**
National recovery and recycling project: Establishment of recycling centre Total 5 recycling centres at 20 training centres					
Trainers	Training of recovery centre staff	500	5	2,500	
Training equipment	Recycling machine with air purge function	8,000	5	40,000	
	Recovery cylinders	30	10	300	
	Storage cylinders	150	5	750	
	Service tools (piercing valve, gauge manifold etc.)	300	10	3,000	
	Leak detector	300	5	1,500	
				Subtotal	48,050
Equipment for service shops	For 3,000 shops				
	Recovery machine	700	400	280,000	
	Recovery bag	30	200	6,000	
	Vacuum pump	150	300	45,000	
	Recovery cylinder	30	300	9,000	
	Service tools (piercing valve, gauge manifold etc.)	150	300	45,000	
				Subtotal	**385,000**
Contingency					40,000
Element Total					**473,050**

The specifications of the equipment jointly with NOU will be reviewed during the implementation of the project.

Annex 2 Timetable for implementation of the RMP Libya

Year	2003		2004		2005		2006		2007		2008		2009		2010	
	H1	H2	H1	H2	H1	H2	H1	H2	H1	H2	H1	H2	H1	H2	H1	H2
ACTIVITY																
Approval																
Institutional framework																
Coordination group set up																
Training of national experts																
Awareness promotion																
Development of licensing system																
Monitoring																
Customs training																
Martial, draft and translation, printing																
Workshops																
Identifiers delivery																
Technician training																
Establishment of training centers																
Training equipment delivery																
Mobile training wagon																
Trainers training																
Material – preparation drafting, translation, printing																
Training courses for technicians																
Recovery and recycling scheme																
Equipment delivery to centres																
Training of centre staff																
Equipment for service shops																

ANNEX VII

PROJECT COVER SHEET

COUNTRY: Libya **IMPLEMENTING AGENCY:** UNIDO

PROJECT TITLE: Halon Management Program for Libya

PROJECT IN CURRENT BUSINESS PLAN: Yes

SECTOR:		Halon, Fire Fighting
ODS USE IN SECTOR:	Net consumption of Halons:	54.40 ODP tons
	(baseline consumption, 1999):	34.45 ODP tons
	Installed Halon capacity (baseline):	633.10 ODP tons
	Latest installed Halon capacity (in 2000):	983.40 ODP tons
PROJECT IMPACT:	Phase-out of net Halon consumption	54.40 ODP ton/year
PROJECT DURATION:		1 year
PROJECT COSTS:	Total Project Costs	US$ 25,000

LOCAL OWNERSHIP:		100%
EXPORT COMPONENT:		0%
REQUESTED GRANT:	US$	25,000
COSTEFFECTIVENESS:	US$/kg/y	N/A
IMPLEMENTING AGENCY SUPPORT COSTS:	US$	3,250
TOTAL COST OF PROJECT TO MULTILATERAL FUND:	US$	28,250
STATUS OF COUNTERPART FUNDING:		TBD
PROJECT MONITORING MILESTONES:		Included
NATIONAL COORDINATING BODY:		NOU

PROJECT SUMMARY

The objective of this project is to assist the Government of Libya to develop and implement the Halon Management Program aimed at phasing-out the import and net consumption of Halons in the Fire Fighting Sector through the establishment of the National Halon Management operation and the progressive promotion of Halon alternative technologies. Organizational infrastructure to be set up will ensure effective and environment friendly handling of the available Halon stock. The detailed Halon inventory database to be established will provide information about availability of Halons allowing to maintain the internal Halon demand-supply balance. This will facilitate the efficient use of available Halons for maintenance/service of critical fire fighting equipment and completely eliminate import/consumption of fresh Halons while introduction and enforcement of respective standards and codes of good practice will limit the emissions of Halons to a minimum released in essential applications. In addition the project will cover introduction and promotion of Ozone friendly fire fighting technologies, respective training and ensure timely, sustainable and cost-effective phase-out of fresh Halon consumption. The total eligible incremental costs and the requested grant, including Agency Support Costs amounts to US$ 28,250

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

The approval and implementation of this project will help Libya to meet its Montreal Protocol obligations regarding the phased reduction and complete elimination of Halon consumption.

PREPARED BY: UNIDO **DATE:** 7 August 2003
REVISED: **DATE:** 21 October 2003

PROJECT OBJECTIVE

The objective of this project is to provide assistance to the Government of Libya to develop and implement the Halon Management programme aimed at phasing-out the import and net consumption of Halons in the Fire fighting Sector through the establishment of the National Halon Management operation and the progressive promotion of Halon alternative fire fighting technologies.

The project will specifically address the issues related to regulatory, institutional and technological awareness strengthening as well as proper training of the staff concerned.

1. SECTOR BACKGROUND

Libya does not produce Halons and the demand on these substances is covered by import. According to the Country Program approved by the 32nd EcCom the total import of Halons in 1999 was 5.50 MT. Imported Halons are used to maintain fixed fire fighting systems (Halon-1301) and handheld portable extinguishers (Halon-1211) protecting critical installations at oil companies, Libyan Iron and Steel complex and petrochemical companies.

The data on Halons obtained through a national survey carried out to estimate import and consumption of ODS in Libya are reflected in Table 1 and Table 2.

Table 1: Import of Halons (ODP tons) 1995-1999

Chemical	**1995**	**1996**	**1997**	**Average 1995-1997**	**1998**	**1999**
Halon-1211	1.50	1.50	1.50	1.50	1.50	1.50
Halon-1301	150.00	50.00	56.50	85.50	140.00	50.00
Total	**151.50**	**51.50**	**57.50**	**86.50**	**141.50**	**51.50**

Table 2: Estimated Halon consumption in 1999 by use and application

Sector	**Sub-sector**	**ODS**	**Application**	**Consumption, MT**
Halons	Industrial	Halon-1211	Fire Protection	0.25
		Halon-1301	Fire Protection	3.37

The difference between imports and actual consumption can be attributed to stocks from earlier years.

Growth in economic performance is expected to continue and will result in continued growth in the industrial sector, particularly in the oil and gas sub-sectors, leading to growth in the commercial sector and strong demands in the consumer sector.

The following data on the installed Halon capacity have been established by the Multilateral Fund Secretariat following the 38th Meeting of the ExCom:

Halon-1211 and Halon 1301 installed capacity (year 2000)	985.4 ODP tons
Halon-1211 and Halon-1301 installed capacity (baseline)	633.1 ODP tons

Bearing in mind the various objective difficulties and constrains that the country was facing during the last several years to meet the commitments under the Montreal Protocol, the Government of Libya took a decision to phase-out the remaining ODS consumption under the NPP using assistance of UNIDO.

Upon receipt of the Government request and approval of the preparatory assistance project by the 38th EcCom Meeting, a national survey was conducted in order to collect and verify the current ODS consumption in various sectors and sub-sectors of the country. As one of the survey results the following actual Halon consumption has been identified:

Halon-1211 and Halon-1301 annual consumption 54.40 ODP tons or 5.8 ODS tons.
Imported Halon-1211 and Halon-1301 are consumed in the refilling operations of leaked or discharged hand held extinguishers and cylinders of fixed systems during their maintenance and service. There are no local manufacturers of Halon-1211 hand held extinguishers in Libya. Therefore, funds for conversion of extinguisher manufacturing sector to Halon alternatives are not requested.

2. PROJECT DESCRIPTION

Libya does not have any facility for recovery and recycling of Halons from existing portable extinguishers and fixed fire fighting systems. With respect to the current total installed Halon capacity of 985.4 ODP tons, the establishment of such a facility could hardly be economically reasonable. On the other hand it is expected that the use of the available Halon fire protection equipment for essential applications will continue till the end of its service life or the economic life of the protected installation.

The existing poor awareness on the available Halon alternative fire protection technologies and the lack of incentives and/or funds for their introduction as well as absence of respective regulations and standards do not stimulate the early replacement of Halons by commercially available alternatives.

Under these conditions and with account to inadequate procedures of Halon stock management the risk of leakages and accidental emissions of Halons into the atmosphere during maintenance or dismantling operations of the fire protection equipment will remain high.

With respect to the above this project will provide the relevant expertise and consultancy services to the Government of Libya in developing the National Halon Management Program and the Plan of Action for its implementation. This will be done by recruitment of an international consultant and/or national expert(s), who, in cooperation with Government authorities, representatives of the fire protection industry and the main fire equipment end users will review and analyze data on the installed Halon capacity and consumption requirements, verify qualification and competence of the staff involved in and procedures (standards and codes) applied for Halon equipment installation, inspection and maintenance, identify respective training/re-training requirements and adjustments, provide advice and recommendations on the design of and activities to be implemented under Halon Management Program including the relevant rules and regulations to be introduced.

In addition to the above the project will address the following issues:

- establishment of a detailed halon inventory database maintaining the records on the quantities of halons installed in the fire protection equipment in various sectors and serving as a clearing house estimating inter alia the future demand on halons, participating in the regional halon bank cooperation and liaison with UNEP clearing house,
- establishment of the Halon Management Advisory Panel/Steering Committee composed of the Government authorities concerned, representatives of the fire protection industry and the main halon end-users, which will provide independent advice and recommendations related to halon stock management, selection of halon fire protection alternative technologies, standards and codes requirements etc.,
- halon alternative fire protection technologies awareness and training workshop(s).

3. PROJECT COSTS

3.1 International and/or national consultancy services comprising:

- Review of data on the consumption and installed halon capacity in various sectors and preparation of the detailed halon inventory.

- Review of the existing procedures, regulations, codes of practise for halon equipment installation, inspection, certification and maintenance.
- Evaluation of competence and qualification of staff carrying out maintenance and service of the halon fire protection equipment.
- Analyses of the obtained data and information and preparation of the detailed Halon Management Program, Plan of Action and recommendations on the organizational structure to be established for implementation of the Plan.
- Presentation to and discussions of the proposed Halon Management Program, Plan of Action and the recommended organizational structure with the Government Authorities concerned, representatives of the fire protection and business communities at the awareness workshop.
- Submission of the final report.

Cost of cunsultancy services: US$ 15,000

3.2. Awareness and training workshops for the Government, fire protection industry and main Halon end users including the following topics:

- Key elements of the proposed Halon Management Program and the Plan of Action
- Organizational structure for Halon Management and responsibilities of the parties concerned.
- Environmentally safe maintenance, servicing, transportation and decommissioning of halon fire fighting equipment.
- Sources of supply of and access to recycled halon.
- Halon alternative fire protection technologies.

The awareness and training activities will include publication and distribution of respective brochures to be followed by workshops presenting to the public the main activities to be implemented under the Halon Consumption Phase-out Action Plan.

Cost of awareness and training workshops: US$ 10,000 (two workshops at US$ 5,000 each)

Total project costs (3.1 + 3.2): US$ 25,000

4. PROJECT IMPLEMENTATION MILESTONES

Activities	Dec. 2003	2004			
		1 qtr	2 qtr	3 qtr	4 qtr
Project approved	x				
Consultant/national expert(s) reqruited		x			
Consultancy services provided			x	x	
Halon Management Program developed				x	
Halon awarenes and training workshops arranged and carried out			x	x	
Organizational structure for Halon Management established				x	x
Implementation of Halon Management Program started					x

Annex VIII

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

PROJECT COVER SHEET

COUNTRY:		Libya
IMPLEMENTING AGENCY:		UNIDO
PROJECT TITLE:	Phase-Out of Methyl Bromide in horticulture: tomatoes, cucumbers, peppers and others.	
PROJECT IN CURRENT BUSINESS PLAN:		Yes
SECTOR:		Methyl Bromide
SUB-SECTOR:		Soil Fumigation
ODS USE IN SECTOR:		
	Baseline (*Average 1995-1998*)	**105** tonnes (*175 ODS*)
	Current (2002)	**151** tonnes (*251 ODS*)
ODS USE AT ENTERPRISE (2002)		**151** tonnes (*251 ODS*)
PROJECT IMPACT (*ODS TO BE ELIMINATED*):		100 % of the ODS
PROJECT DURATION:		5.0 years
PROJECT COST:		
	Incremental Capital Costs	US$ 1,356,836
	Training Costs	US$ 260,000
	Contingency (*10 %*)	US$ 161,684
	Incremental Operating Cost	US$ 98,298
	Total Project Cost	**US$ 1,876,818**
LOCAL OWNERSHIP:		100%
EXPORT COMPONENT:		Nil
REQUESTED GRANT:		**US$ 1,876,818**
COST-EFFECTIVENESS:		**US$/kg 12.43**
IMPLEMENTING AGENCY SUPPORT COST:		US$ 140,761
TOTAL COST OF PROJECT TO MULTILATERAL FUND:		**US$ 2,017,579**
STATUS OF COUNTERPART FUNDING:		N.R
PROJECT MONITORING MILESTONES INCLUDED:		Yes
NATIONAL COORDINATING AGENCY:	National Committee for Climate Change Environment Protection Department	

PROJECT SUMMARY: Horticulture is the only sector where methyl bromide is used in Libya (about 5% is used as QPS). In spite of the 2015 deadline for Article (5) countries, the Libyan Government is willing to discontinue the use of MB long before that deadline. However, the farmers and the Government are aware that they cannot achieve this immediately or even earlier than 5 years unless some assistance is provided. After careful consideration and discussions of the feasible alternatives for Libya, the farmers have selected the following: solarization combined with metam sodium, grafting and soilless culture depending the crop and type of farmer. The present document describes an investment project to be carried out jointly between UNIDO, the farmers associated in different cooperatives and unions, the Faculty of Agriculture and the National Research Institute. The project is endorsed by the National Committee for Climate Change, the responsible body for the implementation of the Montreal Protocol. It is also part of the ODS National Phase Out Plan and is reflected in the country programme.

IMPACT OF PROJECT ON COUNTRY'S MONTREAL PROTOCOL OBLIGATIONS: The project should result in a complete phase-out of methyl bromide in the horticultural sector (which represents almost the 95% of total MeBr consumption in Libya (the remaining 5% is for QPS) by the year 2009.

Prepared by:	G. Castellá Lorenzo and A. Amadio	Date: 01.09.2003
Reviewed by:	Marta Pizano	Date: 09.09.2003

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1. BACKGROUND

Country Background

Libya's economy is dominated by the oil extraction. In 2002, the oil sector represented about 92% of export earnings and 41% of GDP. Manufacturing and agriculture account for 5% and 10% of the GDP respectively, while services and trade and finance make up the balance.

Oil extraction has traditionally been concentrated in the East of the country, notably the Sirte basin area south of Benghazi, although in recent years major discoveries have opened up new tracts in the South-Western Fezzan region, as well as offshore.

Most of the population is concentrated along the Mediterranean coast, which is also where most of the country's agricultural activities take place. In 1999 around 6% of the workforce were employed in agriculture (FAO).

In the 70 and 80s, the government has started programmes to promote the growth of agriculture and industry. However, these diversification plans were not very successful and were abandoned after the revival of oil prices and the renewed international interest for investment in the oil sector.

Within the diversification plan (in the mid-80s), an average of 20% and 14% respectively of the total development budget were allocated to the agriculture and the industry.

The performance of the agricultural sector has been generally disappointing. Although water should no longer be a constraint, thanks to the Great Manmade River and planned desalination plants, agricultural output is still hindered by a shortage of arable land and labour. Labour shortages as a result of the migration of rural workers to urban areas have sometimes hampered the agricultural sector.

The government developed large State-owned farms, which were characterized by poor yields and low production. In 1994, agriculture still represented just an estimated 5.6% of GDP.

In the 90s, agricultural self-sufficiency was no longer seen as a priority. Due to unsuccessful efforts to increase agricultural productivity in the 70s, when the sector was regularly allotted up to 30% of total budget expenditure, the Government started to encourage small private farms.
Although the changes to private small farms has contributed to an increase of the agricultural production, Libya remains reliant on imported food for about 80% of its needs.

Environmental constraints place a severe limit on Libya's agricultural potential. Over 90% of the Libyan territory is a desert; productive arable land is limited to the area around the Mediterranean sea and amounts to only 1.7% of Libya's total area. Therefore each plot is frequently used to produce a number of commodities.

There are two main areas of natural farmland, which account for more than 80% of the country's agricultural production. The first is the partly wooded high coastal plateau of Jebel Akhdar in the Northeast, where crops including olives and grapes are grown. The second is the fertile coastal plain in the Northwest, where dates, olives, almonds and oranges are cultivated.

Inland cultivation relies extensively on costly well irrigation and yields are low. The area of land under irrigation rose in the 90s, although the government has used price controls to shift emphasis away from water-intensive crops, such as tomatoes and watermelons. It has also experimented with price controls to encourage farmers to grow wheat and barley more efficiently.

1.2. The Horticulture Sector

About 7,000 small growers compose the horticulture sector; with an average farm size of 0.5 ha. In addition, there are approximately 20 cooperatives, (previously State owned companies) with an estimated area of 5 ha each. Production is mainly focused on vegetables and fruits for the local market.

Horticulture production is mainly concentrated around the larger cities: a) Tripoli area, b) Benghazi area, c) Misurata and d) Zuwara and e) Sebha

The Tripoli and Benghazi areas are the main ones in terms of production and tradition, since they concentrate almost 1,700,000 inhabitants (the total population in Libya of 5 million).

The main crops are: tomatoes, melons (cantaloupes), pepper, cucumbers, eggplants and other vegetables such as onions, pumpkins, garlic, spinach and lettuces.

The approximate total area of production under protected horticulture is about 4000 ha.

Table 1. Nr. of growers, area yields by crop.

Crops	Nr of Growers	Area (has)	Average size	Yields (tons/ha)
Tomatoes	2300	1250	0.54	176
Peppers	1750	800	0.46	73
Cucumbers	800	500	0.63	161
Eggplants	48	200	4.17	50
Melons (cantaloupes)	250	200	0.80	
Squash	30	50	1.67	

Production system

In Libya, tomatoes and other vegetables are most often grown during one single season per year in greenhouses of one of the following types: glasshouses, fiberglass and/or plastic (small tunnels). The main cropping season involves tomatoes grown from November to July. However, it is also quite frequent to grow cucumbers in two short cycles from August to December and from February to June.

Glasshouses are usually about 1 ha in size, and belong to cooperatives (which produce in facilities derived from state owned companies). Fiberglass greenhouses range from about 500 m^2 to 600 m^2 and belong to medium size farmers, whereas plastic tunnels (mainly used by small farmers) are about of 250-350 m^2 the most common size being 9 m x 40 m.

Growers are organized in cooperatives or unions, such as the "Greenhouses Producer Union", which concentrates all farmers producing under greenhouses or horticultural producers.

1.3. Most Common soil-borne pests affecting horticulture

The most frequent soil related pests observed in tomatoes, cucumbers and peppers are: *Fusarium solani, F. oxysporum, Fusarium* spp., *Rhizoctonia solani, Verticillium dahliae, Sclerotium rolfsii, Phytium* spp., *Sclerotinia sclerotiorum, and Phytophtora capsici.*

As soils in Libya are predominantly sandy, most of them apply methyl bromide mainly to control root-knot nematodes: *Meloidogyne incognita*. However, cucumber crops are frequently attacked by *Fusarium.*

1.4. Use of methyl bromide in Libya

Registration and regulation of methyl bromide

Methyl bromide has been used in Libya during the past ten years as a soil fumigant. Libya imports Methyl Bromide from different countries, mainly from France and Belgium, in a formulation containing 98% methyl bromide and 2% Chloropicrin.

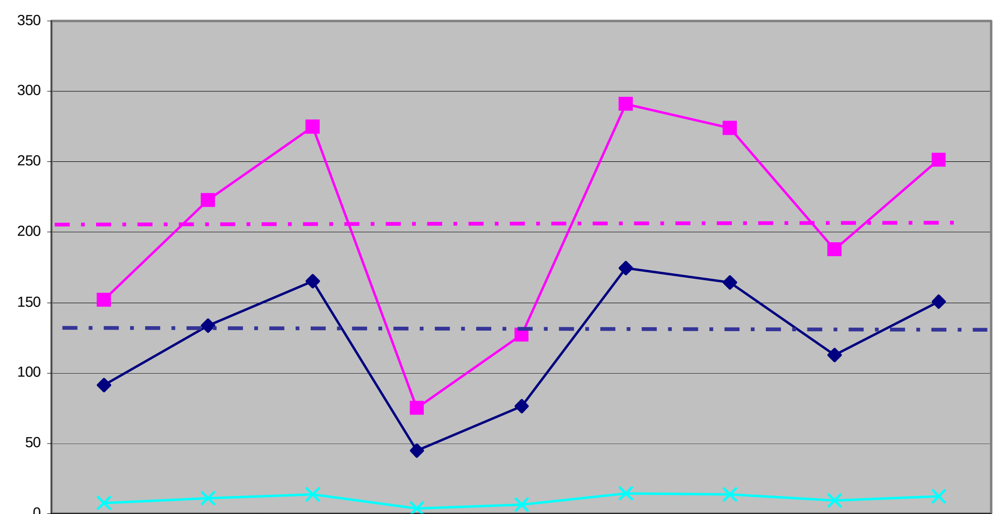
Libyan legislation regulates the use of MB for quarantine purposes (only about 5% is used for this purpose) and for the control of pests associated with agricultural production and products. The country has effective means to control the use and imports of MB. In the past, a State owned company imported MB but in 1994 the imports were opened to any company interested. Interested companies need to obtain licenses, which are issued by the Environment Commission. Authorization is only granted to companies meeting specific regulatory requirements. Although current Libyan legislation emphasizes that methyl bromide be applied by well-trained and qualified technicians only, this rule not always followed by the farmers.

Supply of methyl bromide

Some companies import methyl bromide individually, but are also imported directly by the Greenhouse Farmer Union. The Plant Protection for Phytosanitary Quarantine imports and uses about 13 tonnes for QPS purposes.

Figure 1 below summarizes estimated use and consumption of MB in Libya over the past 8 years.

Figure 1. *Evolution of MB consumption in Libya (1994-2002)*



	1994	1995	1996	1997	1998	1999	2000	2001	2002
TOTAL ODP	91.2	133.8	165	45	76.2	175	164	113	151
TOTAL ODS	152	223	275	75	127	291	274	188	251
QPS	7.6	11.2	13.8	3.8	6.4	14.6	13.7	9.4	12.6

Indicates the Country's Baseline 175 ODS (105 ODP)

MB application method in Libya

In Libya Methyl Bromide is applied under tarps using 50 kg pipes. Prior to the application the soil surface is prepared and the remains of the previous crop are removed. Then, perforated cans are located 10 cm from the soil surface, and the treated soil is covered with a clear and thin plastic sheet, which is perforated for the application of the methyl bromide. After three days, the plastics and the pipes are taken off and the soil is ready for planting. In Libya, MB is generally applied only in protected crops (under glasshouses, fiberglass and plastic greenhouses) to the total soil surface at a dosage of 60 g/m^2. (Recommended by the supplier). There is a very limited use in open fields for fruits and ornamental nurseries.

2. JUSTIFICATION OF PHASE-OUT PROJECT

The Libyan Arab Jamahiriya signed the Vienna Convention and Montreal Protocol in 1985 and 1990 respectively and qualifies as an Article 5 country. The Copenhagen Amendment is in the process to be ratified in the current year (2003). In order to comply with the provisions of the Montreal Protocol, the Libyan Government has appointed a National Committee for Climate Change, which is under the authority of the Environment Commission.

The country was not able to comply with consumption freeze of 2002, and the 20% reduction in the year 2005 is under risk if no effective alternatives are immediately introduced.

The present project is the only investment project for the use of MB in soil fumigation that will be requested by Libya. The project will assist the country in its international engagement to gradually phase out 100% of all non-essential, non-critical uses of MB by the year 2009.

Libyan authorities recognize the need to stop methyl bromide use and are offering full cooperation through their agricultural and industrial organizations. Because no previous demonstration project has been implemented in Libya, now local authorities, as well as farmers are requesting assistance for the design and implementation of a national phase-out plan, which takes into consideration the particular conditions of the country. In order to gain the confidence of their farmers in new technologies and adapt them to the local environment, the project will be implemented in pilot sites during the first year continuing with the phase out plan late.

3. PROJECT OBJECTIVE

The objective of this project is to eliminate **251** tonnes (151 ODP) of methyl bromide used in soil fumigation in protected horticulture (tomatoes, cucumbers and others) and nurseries. All farms are 100% local ownership and their production is for the local market. This will imply almost the total elimination of methyl bromide used in Libya, as the use in QPS is not more than 5% of the total (13 tonnes).

The area treated with methyl bromide in Libya is approximately 433 ha. (The total number under protected horticulture is about 1800 ha) The number of farmers involved is over 1000. Therefore, the project will mainly concentrate on protected horticulture production of tomatoes and cucumbers. Since MB use in nurseries (mainly for fruits and ornamentals) is very small, the project will include these users only as part of the training programme.

During the first year (2004), the project will be implemented in three different locations with the aim of demonstrating the alternatives and adjusting them to the agricultural conditions of Libya. Over the following four years (2005-2008), MB use for soil fumigation will be phased out by implementing selected alternatives within an Integrated Pest Management approach (IPM). These alternatives are low dose chemical fumigants combined with soil solarization, soilless cultivation and grafting for cucumbers.

The Integrated Pest Management (IPM) programme will include farmer's training activities and the creation of a team of IPM experts, which receives continuous training and is responsible for disseminating information among the farmers and monitoring results.

The phase-out programme will be implemented as per strict schedule. This schedule will pay special attention to reducing the use of chemical agents during the implementation of the project. The programme will start in 2004 with three pilot sites: near Tripoli, near Benghazi and near Sebha . Here, MB consumption is high and the locations are strategically representative of the country. (Figure 1).

Considering that all growers are associated to the Greenhouse Farmer Union, project implementation will be based on this organization. The project would also have the support of the Agriculture Faculty and the Agricultural Research Center, particularly during the implementation of the pilot stage.

4. PROJECT DESCRIPTION

4.1. Alternative technologies available

There is already some experience with solarization in Libya; it is estimated that about 3% of the farmers use this technique. In addition, the project would introduce the following alternatives: **a)** soil solarization in combination with low doses of chemicals, **b**) production in soilles media (substrates) and **c)** grafting. All techniques will be used as part of an Integrated Pest Management (*IPM*).

A brief consideration of alternatives, which have been discussed with farmers and technicians during the project preparation and which are more likely to be successfully adopted in Libya, follows:

4.1.1 Solarization in combination with IPM

Soil solarization is the trapping of solar radiation under clear plastic sheeting with the aim at elevating the temperature of moist soil to levels that are lethal to soil-borne pests. The weakening of survival structures of pathogens by sub lethal temperatures create conditions that stimulate the action of antagonist agents, which are generally more thermo-tolerant. It is effective against many pathogenic bacteria, a wide range of nematodes and, to a lesser extent, fungi. In Libya, there are farmers already working with this technology with very promising results. Environmental conditions are adequate, more than 10 months of sun occurs per year and soils temperatures reach about 60 C. Irrigation systems are available and all soils are sandy, which make this technique more effective.

4.1.2 Low-dose chemicals in combination with IPM

Several chemicals compounds such as methylisothiocyanate and methylisothiocyanate-generating products, e.g., Metham sodium, (Vapam ®); Dazomet (Basamid ®), have shown efficiency for control soil-borne pests and pathogens that is comparable to that of MB. Their efficacy depends on factors such as soil type, soil preparation and soil moisture, prevalent climatic conditions, and application methods. Another chemical groups of interest is the halogenated hydrocarbons, e.g., 1,3-dichloropropene (TeloneII ®), which performs quite consistently for sensitive pests.

Once again, it is most advisable to apply these chemicals within Integrated Pest Management. IPM combines all available resources – not only chemical control – for the reduction of pest or disease incidence. Among these resources hygienic measures, disease-free plant material and cultural and physical controls are most important.

4.1.3 Soilles culture

Growing plants in containers, raised beds or otherwise isolated from the natural soils and filled with non-soil materials offers several advantages, in particular not needing fumigation or offering the possibility of sterilizing a limited amount of substrate. Better control of plant nutrition is also possible, which often leads to significantly improved yields. Soilless media may be roughly divided into two classes: organic and inert. Organic media, such as peat, sawdust, straw bales, spent mushroom compost, etc., have a good cation-exchange and water-holding capacity. Inert media, such as rock wool, perlite, polyurethane, expanded clay, polystyrene, etc., have a high water-holding capacity but low cation-exchange capacity. Vermiculite is not completely inert chemically. Organic media and some inert media can be easily sterilized with steam and re-utilized. Some inert media can also be re-extruded.

4.1.4 Grafting

Grafting cultivated plants into a resistant rootstock is an effective method to control soil borne diseases, for example vascular diseases caused by *Fusarium* spp and *Verticillium* spp, root-knot nematodes *Meloidogyne* spp, and viruses like the Melon Necrotic Spot Virus (MNSV), which is transmitted by a soil fungus *Olpidium bornovalus*. Another troublesome disease is Vine decline caused by *Monosporascus canonballus* for which the etiology is not yet thoroughly known. The most suitable rootstocks available for cucumbers are the hybrids *Cucurbita maxima* x *Cucurbita moscata*. Grafting is a useful technique when soil sterilization is not available or when other available alternatives cannot control certain diseases, e.g. fusarium crown and root not.

Grafting of annual crops is widely used in some developing countries from the area, e.g. Morocco, Tunisia, Lebanon, Egypt, Jordan and Cyprus. Presently, 100% of the watermelon crops in Spain are raised from grafted plants, a practice which eliminated the use of MB on crops in the South of Spain.

Grafted plants grown in solarized, biofumigated or chemically treated soil survive significantly better than the non-grafted ones.

ALTERNATIVE	CONTROL			ADVANTAGES	DISADVANTAGES	APPLICATION	NOTES
	FUN-GI.	NEMA-TODE	WEEDS				
CHEMICAL ALTERNATIVES (FUMIGANTS)							
1-3 Dicloropropene		X		Highly effective against nematodes	High toxic	Drip irrigation system or injection	Telone C17 or C35
Chloropicrin	X				High toxic, pungent odor, unknown effect at long terms		
Metam sodium	X	X	X		Low effective against nematodes	Drip irrigation system	
Basamid	X	X	X	Granular formulation easy to apply	Phytotoxicity, high cost	Granular	Dazomet
NON-CHEMICAL ALTERNATIVES							
Solarization	X	X	X	Increase self resistance	Efficiency related to environmental condition		
Grafting	X	X		Adaptable to every cultivars	High labor input		
Soiless media	X	X	X		High crop management skills, High equipment cost.		

4.2 Justification of the Alternatives Selected

The MB alternative techniques were selected based on their technical and economical feasibility, by taking into account the specific agricultural conditions of the country in question. All are well proven alternatives and listed by the Methyl Bromide Technical Options Committee (MBTOC) as technically feasible for controlling soil borne pests and diseases, and which may thus avoid or replace the use of methyl bromide (UNEP 1995, 1998, 1999, 2000, 2001 Report of the Technology and Economic Assessment Panel Montreal Protocol on Substances that Deplete the Ozone Layer; MBTOC Assessments 1998, 2002)

It is assumed that an alternative demonstrated in one region of the world would be applicable in another provided that there are not obvious constraints. Furthermore, all proposed alternatives are in use en countries of the region i.e. Lebanon, Morocco, Greece, Romania, Syria Turkey, Italy, Spain Portugal, etc.

Solarizarion in combination with chemicals- particularly with metam sodium appears as the alternative of excellence for Libya. Metam sodium has been selected as the main chemical, as it is already registered in the country. The combination of solarization with metam sodium is more effective in the control of pathogens that alone. The farmers, which are using methyl bromide, now are ready to change to such alternative provided that the metam sodium could be effective, as they do not want to rely only on solarization alone.

Some farmers have expressed reluctance to using solarization combined with one chemical and are much more in favor to go into long term technologies like growing in substrates. It was considered that, although water availability in the country is not limited for the time being, it still is a precious resource. Alternatives, which encourage the use of less water and make recycling possible, should be prioritized. In consequence the use of soilless technology with a fertirrigation system including water recirculation was considered a viable alternative.

Finally, an important group of farmers producing cucumbers were concerned with the need to control *Fusarium* and problems arising with high salinity of the soils. As a results and since many of them have been exposed to the experience in nearby countries on grafting, this alternative was selected for cucumbers. During the project preparation, a good explanation was given on the results of grafting in

Romania in both tomatoes and cucumbers. In Romania, results of grafting cucumber plants onto rootstocks resistant to *Fusarium* attack have been outstanding.

The rotation of grafting and solarization in combination of low doses of metam sodium is also effective in helping to prevent the development of pesticide-resistant organisms and risks related to this. Metam sodium would only be applied when levels of soilborne pathogens indicate this to be necessary; these would be monitored using soil and plant sampling and analyses.

For farmers to gain expertise and confidence in the new technologies and to favor their rapid adaptation and dissemination through the country, the alternatives chosen will need to be established in pilot sites and these experiments are expected to be conducted during 2004. This period will also to be used to register active pesticides currently not included in the country's pesticide listings and to adapt the technologies to the country's particular conditions.

As explained, the alternatives to be used in Libya will be a combination of different technologies, which depends on the crops, the region and the season of application. The following table summarizes the alternatives selected.

Table 2 Distribution of the alternatives by region

Area	**Alternative**	**Surface treated with the alternative(has)**
Tripoli area	Solarization+ Metham Sodium (60cc/m2)	100
	Soilless	65
	Grafting in cucumbers	85
Benghazi area	Solarization+ Metham Sodium (60cc/m2)	75
	Grafting in cucumbers	25
Misurata	Solarization+ Metham Sodium (60cc/m2)	50
Zuwara	Solarization+ Metham Sodium (60cc/m2)	24
Sebha	Solarization+ Metham Sodium (60cc/m2)	10
TOTAL		**434**

4.3. Compliance with Country Strategy

The General People's Committee has established the National Committee for Climate Change (NCCC), which reports to the Secretary of the General People's Committee and is entrusted with the development of a strategy and action plan for the phasing out of Ozone Depleting Substances. They have established the following strategy:

- Establish the Executive Office of the NCCC as a focal point for all activities related to the Montreal Protocol.
- Embark in a public awareness program.
- Develop and implement control measures, such as:

  Prohibit imports of ODS using equipment

  Prohibit new enterprises producing and/ or assembling equipment, foams or aerosols

  Prohibit expansion of existing manufacturing facilities with ODS based technologies

Establish a maximum on total tonnage imported (including methyl bromide) through the existing licensing system

Train Customs Department National Information Center and NOU in monitoring and collection of data to meet the reporting requirements of the Protocol

4.4. Equipment Needed

Four different alternative techniques will be implemented: in the use of fumigants pesticides combined with soil solarization, grafting and soilless cultivation.

<u>Soilless cultivation</u>

Specific equipment for 65 ha consisting in: (300 glasshouses)

Growing bags (polyethylene tube): 12000 m (480m / glasshouse)
Black polyethylene ground cover
Main pipes: 3000 m (10m / glasshouse)
Automatic Programmer for 3 electro-valves: 300
Small injection venturi devices: 300
Tanks of $0.5m^3$: 300
Pumps 1/2HP: 300
Small filters: 300
Taps: 1200
Electro-valves: 1200
Manometers: 600
Accessories (stoppers, ties, staples, misc. PVC parts)

Solarization in combination with Metam Sodium Metam Na:

In order to maximize chemical efficacy and to improve the distribution of the chemicals in the soil, to minimize recurrent infestations in the field, the chemical fumigants will be applied in a controlled manner through using the irrigation system (chemigation). Most farmers have an irrigation system available, although some adjustments are needed for chemigation in 260 ha (abut 1000 glasshouses).

Drip irrigation with appliances for chemigation
Main pipes: 10000 m (10m / glasshouse)
Integrated (auto regulated at 4 l/h) drippers,
Automatic Programmer for 3 electro-valves: 1000
Small injection venturi devices: 1000
Small filters: 1000
Taps: 3000
Electro-valves: 3000
Manometers: 2000
Accessories (stoppers, ties, staples, misc. PVC parts)

Grafting

The project will install two nurseries for the production of grafted plants one in the area of Tripoli and one in Benghazi, these will be run by the cooperatives of farmers. The equipment required has been calculated according to the following parameters:

a. Total area to be transplanted with grafted plants: 110 hectares
b. Plant density: 20,000 grafted plants/ha.
c. Transplanting period: 6 weeks

Each nursery will be composed of (a) cultivation greenhouses (b) grafting workshop and (c) healing greenhouse. The full list of the equipment needed to produce 2.2 million grafted cucumber plants on Curcurbita maxima x Cucurbita moscata rootstock in a period of 6 weeks is described in Annex B.

4.5. Training requirements

The training programme will be organized in collaboration with the National Ozone Unit, Environment Protection Department, the Agriculture Research Center, the Agriculture Faculty and Greenhouse Farmer Union.
Approximately 1000 farmers and 300 technicians will be trained on the proposed alternative techniques. This requires the organization of a detailed training programme, which takes into account the geographic location of the sites. The extension agents or trainers will initially receive a 2-days training by national and international experts in the field of IPM. This training course will be organized by UNIDO.

A national institution will be in charge of the day-to-day pilot phase consisting of a continuous education programme for all technicians. During the five years of the project three main workshops would be organized.

Training subjects

- Methyl Bromide and the environment
- Alternatives to MB
- The IPM approach
- General data on agriculture, chemistry and biology
- The soil
- On the field pest and disease monitoring
- When to treat?
- The use of soilless substrates
- The use of the fumigants
- Grafting
- General regulatory and safety aspects concerning soil treatments and fumigants
- Maintenance of the equipment
- Environmental care
- Practical demonstration of the technique for the users

4.6. Phase-out Schedule

Table 3. Phase-out Plan

Year	**MeBr Phased-Out (*tonnes*)**	**Plantation surface where MeBr is eliminated (*ha*)**
1 2004	0	Pilot phase Training farmers all over the country on selected alternatives
2 2005	76 (46 ODP)	In order to comply with 20% reduction 2005
3 2006	58 (35 ODP)	
4 2007	58 (35 ODP)	
5 2008	59 (35 ODP)	
TOTAL	251 (151 ODP)	

4.7. Project Sites

The project will be implemented in the area of **Tripoli,** (the main area of horticulture production) **Benghazi, Misurata, Zuwara** and **Sebha.** The project will be implemented by UNIDO and, at the local level; the National Ozone Unit from the Environment Protection Department will be the National

Coordinating Institution, acting in close cooperation with the Agriculture Faculty and the Agriculture Research Center.

5. PROJECT IMPACT

At the end of the project, the complete MeBr phase-out for protected horticulture production will be achieved. In addition, it is also expected that the corresponding farmers will be very knowledgeable on selecting alternatives, as well as in Integrated Pest Management - IPM, sustainable production and environmental care.

6. PROJECT INPUTS

6.1. Capital Goods

The specifications of the whole equipment are given in Annex B. For further details on calculation coefficients, please refer to Annex A.

7. PROJECT IMPLEMENTATION

The project will be implemented by UNIDO, under the national coordination of the Ozone Office at National Committee for Climate Change (NCCC) in Libya, in close cooperation with the implementing institutions Agriculture Faculty and Agriculture Research Institute from the Agriculture Ministry.

Purchases of the equipment will be awarded on the basis of competitive bidding. The final specification of the equipment and the precise work plan can only be elaborated after an agreement has been reached with the different parties involved. (Preliminary specifications for the equipment are stated in Annex B)

As the implementing agency, UNIDO has the necessary experience and capabilities for the successful implementation of projects at the enterprise level. Upon approval by the Multilateral Fund for the Implementation of the Montreal Protocol (MFMP), the project budget will be transferred to UNIDO. UNIDO's Finance Section will then issue a project allotment document for the approved amount. Any substantial or financial deviation will be subject to approval by the Executive Committee of the Multilateral Fund for the Implementation of the Montreal Protocol.

The Government of Libya through the NCCC will be responsible for providing:

a. The legal framework for phasing out Methyl Bromide.
b. The necessary institutional support for implementing and following up on the project.

7.1. Phase-out monitoring

UNIDO will monitor the effective phasing-out of MeBr according to the established phase-out schedule, as well as the operational costs resulting from the substitution of MeBr by alternate technologies at farmer level. UNIDO will keep the Executive Committee of the Multilateral fully informed about the progress made through a yearly annual report indicating the progress of the conversion and the costs involved.

In case of unjustified delays, the Implementing Agency will inform the Executive Committee of the Multilateral Fund and eventually cancel any further release of funds.

7.2. Milestones

Table 4 Project Milestones

Item	Sem 1	Sem 2	Sem 3	Sem 4	Sem 5	Sem 6	Sem 7	Sem 8	Sem 9	Sem 10
Equipment										
Specifications										
Bidding										
Shipment										
Start-up										
Training to:										
First group										
Second group										
Transfer of Alternatives										
All over the country										

Sem. stands for Semester

8. PROJECT COSTS

8.1. Incremental Capital Costs

The investment costs (Equipment and Training) are presented in **Table 12** below.

Table 5. Total Investment Costs in US$.

Equipment as per Annex B	1,356,836
Training Programme as per Annex C	260,000
TOTAL INVESTMENT COSTS	**1,616,836**

8.2. Incremental Operating Costs

Table 6. Incremental costs for each alternative

	SOLARIZATION +METHAM SODIUM					**U$S/per hectare**	
	Quantity	Unit	Unit	YEAR 1	YEAR 2	YEAR 3	YEAR 4
Methyl Bromide	500	Kg	5.0	2500.00	2500.00	2500.00	2500.00
Plastic sheet for crop mulching	800	Kg	1.3	1040.00	1040.00	1040.00	1040.00
Labor for covering	4	wd	10	40.00	40.00	40.00	40.00
Labor for fumigation	2	wd	15	30.00	30.00	30.00	30.00
TOTAL SAVINGS				3610.00	3610.00	3610.00	3610.00
Metam sodium	600	Kg	2.5	1500.00	1500.00	1500.00	1500.00
Transp. Plastic sheet for solarization	1,000	Kg	1.0	1000.00	1000.00	1000.00	1000.00
Labor for covering	4	wd	10	40.00	40.00	40.00	40.00
Labor for fumigation	2	wd	15	30.00	30.00	30.00	30.00
Plastic sheet for crop mulching	800	Kg	1.3	1040.00	1040.00	1040.00	1040.00
Labor for covering	4	wd	10	40.00	40.00	40.00	40.00
TOTAL EXPENDITURES				3650.00	3650.00	3650.00	3650.00
BALANCE				40.00	40.00	40.00	40.00
Discount factor				0.91	0.83	0.75	0.68
Net present value				36.40	33.20	30.00	27.20
TOTAL OPERTING INCREMENTAL COST/HA				**127**			

Table 7 Incremental costs for each alternative

	Quantity	Unit	Unit price	YEAR 1	YEAR 2	YEAR 3	YEAR 4
Methyl bromide	500	Kg	5.0	2500.00	2500.00	2500.00	2500.00
Plastic sheet 0.2 mm	800	Kg	1.3	1040.00	1040.00	1040.00	1040.00
Labour for covering	4	wd	10	40.00	40.00	40.00	40.00
Labour for fumigation	2	wd	15	30.00	30.00	30.00	30.00
TOTAL SAVINGS				3610.00	3610.00	3610.00	3610.00
Plastic sheet for crop mulching	1,000	Kg	1.3	1300.00	1300.00	1300.00	1300.00
Labor for covering	4	wd	10	40.00	40.00	40.00	40.00
Additional soluble fertilizer	1,800	Kg	1.4	2520.00	2520.00	2520.00	2520.00
TOTAL EXPENDITURES				3860.00	3860.00	3860.00	3860.00
BALANCE				250.00	250.00	250.00	250.00
Discount factor				0.91	0.83	0.75	0.68
Net present value				227.50	207.50	187.50	170.00
TOTAL OPERATING INCREMENTAL COST/HA				**793**			

Table 8 Incremental costs for grafting

Table 9. Total incremental costs

Area	Alternative	Estimate Nr of hectares	Incremental cost per alternative/ha	Total
Tripoli area	Solarization+ Metham Sodium (60gr/m2)	100	127	12,700
	Soilless	65	793	51,545
	Grafting in cucumbers	85	126	10,710
Benghazi area	Solarization+ Metham Sodium (60gr/m2)	75	127	9,525
	Grafting in cucumbers	25	126	3,150
Misurata	Solarization+ Metham Sodium (60gr/m2)	50	127	6,350
Zuwara	Solarization+ Metham Sodium (60gr/m2)	24	127	3,048
Sebha	Solarization+ Metham Sodium (60gr/m2)	10	127	1,270
				-
TOTAL		**434**		**98,298**

8.3 Contingency Fund

A contingency fund consisting of 10% of the capital costs has been included. The contingency fund is established to cover unforeseen price deviations, which might occur during the project implementation.

8.4. Total Project Costs

In line with the progressive schedule proposed for purchasing the equipment and shifting from MeBr to the alternatives considered, the project costs will be as follows:

Table 10. Total Project Costs

Equipment as per Annex B	**1,356,836**
Metam Sodium	378,140
Soilless	403,650
Grafting	575,046
Training Programme as per Annex C	**260,000**
TOTAL CAPITAL	**1,616,836**
Contingencies 10%	161,684
TOTAL INVESTMENT COSTS	**1,778,520**
TOTAL OPERATIONAL INCREMENTAL COSTS	**98,298**
TOTAL PROJECT COST	**1,876,818**

9. PREREQUISITES

In accordance with the regulations of the Executive Committee of the Multilateral Fund, the project funds will only cover incremental costs related to the conversion. All other expenses have to be covered by the counterpart including: **a)** any additional input not included in the present project document; **b)** infrastructure work.

Prior to the start of the project, a Memorandum of Understanding will be prepared and signed by the Government authorities. This memorandum, which will specify the responsibilities of the counterpart to follow the Agreed Conditions explained in Annex E, will be considered as an integral part of this project document.

10. PROJECT MONITORING

Table 11. Milestones For Project Monitoring

Milestones	Date	Month	Results			Remarks
			Achieved	Not Achieved	Delay	
Grant agreement signature		03				
Equipment bids prepared		04				
Bids for training prepared		05				
Equip. contract awarded		07				
Training contract awarded		07				
20% Training implemented		09				
1st 20% Equipment delivered		11				
30% Training implemented		11				
1st Reports Results Achieved		12				

Milestones	Date	Month	Results			Remarks
			Achieved	Not Achieved	Delay	
40% Training implemented		18				
2nd 20% Equipment delivered		18				
50% Training implemented		23				
2nd Reports Results Achieved		24				
60%Training implemented		28				
3rd 20% Equipment delivered		30				
70% Training implemented		35				
3rd Reports Results Achieved		36				
80%Training implemented		40				
4th 40% Equipment delivered		42				
100%Training implemented		47				
Final Report Results Achieved		48				

11. POLICY MEASURES AGREED BY THE GOVERNMENT OF LIBYA

The Government of Libya has agreed to issue and implement the following policies:

- **(a)** To establish a maximum level of imports of methyl bromide through the existing licensing system.
- **(b)** Train the Customs Department in monitoring the and collection the data of imports of methyl bromide

- **(c)** To speed up the registration process of the additional alternatives chemicals.

2 ANNEX A

3 CALCULATION COEFFICIENTS AND OPERATIONAL COSTS

1. General assumptions

- The size of greenhouse (in glass) is 10.000 m^2, which is a standard size
- The size of greenhouse (in fiberglass) is 6.000 m^2.
- The size of greenhouse (in plastic) is 340 m^2
- The cost of labor 15-20 Libyan Dinar (1US$= 1.36 LYD) per day depending on the qualification

4. Farmers

- Big farmers are cooperatives of 5 ha (normally former State owned companies) greenhouses in fiberglass or glass
- Medium farmers greenhouses (fiberglass) between 0.6 to 1 ha
- Small farmers plastic greenhouses about 10-14 units of 340 m2 total less 0.5

3. Cost element per alternative selected

- Methyl Bromide
  - Cost of the methyl bromide US$ 5.0 per kg.
  - Plastic rolls 10x100 12rolls per/ha 130 LYD/per roll
  - 2 persons to applied the methyl bromide

- Other chemicals
  - Cost of Metam sodium US$ 2.5 per liter.

- Solarization
  - Nylon (40microns) 40kgs
  - Labor

4. Cycles

- Tomatoes: November –July (one cycle). Variety mainly used: Naziha
- Cucumbers: August- December
  February-May/June

5. Yields

- 80-100 tonnes tomatoes/ha (Variety
- 50-60 tonnes /ha cucumber

4 ANNEX B SPECIFICATIONS OF THE EQUIPMENT TO BE INSTALLED

Equipment for tomato

METAM SODIUM

ITEM	unit	unit/Ha	total units	unit cost US$	total costUS$
Dripping line (Not needed)	m	10,000		0.15	-
Venturi injector and acessories	n	2	518	700	362,600
Main line	m	100	25,900	0.6	15,540
Total Ha	n	259			
TOTAL US$					378,140

SOILLESS

ITEM	unit	unit/Ha	total units	unit cost US$	total costUS$
Dripping line (Not needed)	m	10,000		0.15	-
Fertirrigation plant	n	0.2	13	8,000	104,000
Main line	m	100	6,500	0.60	3,900
Plastic bags	m	6,500	422,500	0.50	211,250
Mulching	m2	6,500	422,500	0.20	84,500
Total Ha	n	65.00			
TOTAL US$					403,650

CAPITAL COST FOR GRAFTING

110	total area to be transp. grafting (Ha)
20,000	grafted plants/Ha
6	weeks of transplantation

CULTIVATION GREENHOUSE		Unit	Unit/he	Total Unit	$/Unit	Total $
Structure		m^2	64.000	7,040	14.0	98,560
Suspended trays frame		m^2	50.000	5,500	3.4	18,700
Covering	plastic film	m^2	103.333	11,367	0.9	10,230
	insect net	m^2	39.333	4,327	0.7	3,029
	shading net	m^2	73.333	8,067	0.6	4,840
Trays	rootstock 30 cc cell	n°	57.333	6,307	1.1	6,937
	saion 20 cc cell	n°	55.000	6,050	1.1	6,655
	grafted 90 cc cell	n°	146.000	16,060	1.1	17,666
Heating plant	boiler (1,200,000 K cal)	n°	0.018	2.00	6,850	13,700
	pumps (5 CV, 1.2 bar)	n°	0.055	6.00	427	2,562
	pipes (galvanized dif. Diam.)	m	11.167	1,228	2.6	3,194
	radiators (15,000 K cal)	n°	0.400	44.00	650	28,600
	installation	n°	0.018	2.00	2,500	5,000
Ventilation plant (fans 0.5 CV, diam. 60 cm)		n°	0.167	18.33	325	5,958
Irrigation plant	pump (14 CV, 5 bar)	n°	0.018	2.00	1,680	3,360
	pipes (PVC PN10 dif. Diamet.)	m	8.000	880.00	1.6	1,408
	filters (1 sand + 1 disk, 20 m^3/h)	n°	0.018	2.00	535	1,070
	ferti-irrigation computer (20 m^3/h)	n°	0.018	2.00	7,250	14,500
	valves, etc.	n°	0.500	55.00	12.7	699
	irrigation bar	n°	0.100	11.00	3,150	34,650
		SUBTOTAL				**281,318**

HEALING GREENHOUSE		Unit	Unit/he	Total Unit	$/Unit	Total $
Structure		m^2	26.67	2,933	14.0	41,067
Covering	plastic film	m^2	55.33	6,087	0.9	5,478
	insect net	m^2	28.00	3,080	0.7	2,156
	shading net	m^2	32.00	3,520	0.6	2,112
Pegs		n°	7,500	825,000	0.030	24,750
Shading plant		m^2	26.67	2,933	7.3	21,413
Heating plant	pumps (5 CV, 1.2 bar)	n°	0.04	4.00	427	1,708
	pipes (galvanized dif. Diam.)	m	18.67	2,053	2.6	5,339
	installation	n°	0.02	2.00	2,500	5,000
Cooling plant		m^2	26.67	2,933	7.1	20,827
Irrigation	pipes (PVC PN10 dif. Diamet.)	m	4.67	513	1.6	821
	valves, etc.	n°	0.27	29	1.7	50
Healing tent (Humid tent)		m^2	11.67	1,283	26.8	34,393
		SUBTOTAL				**165,114**
ANNEX		Unit	Unit/he	Total Unit	$/Unit	Total $
Grafting work-shop	structure	m^2	7.33	806.67	14.0	11,293
	covering	m^2	15.00	1,650.00	0.9	1,485
	shading plant	m^2	7.33	806.67	7.3	5,889
	cooling plant	m^2	7.33	806.67	7.1	5,727
	troley	n°	0.40	44.00	450	19,800
Sowing room	structure	m^2	4.00	440.00	14.0	6,160
	shading plant	m^2	4.00	440.00	7.3	3,212
	covering	m^2	8.17	898.33	0.9	809
Sowing machine (300 trays/h)	substrate mixer (2 m^3)	n°	0.018	2.00	5,610	11,220
	filling plant	n°	0.018	2.00	7,520	15,040
	sowing plant (seeding roller)	n°	0.018	2.00	9,750	19,500
	watering	n°	0.018	2.00	2,240	4,480
Germination room (20 m2)		n°	0.018	2.00	12,000.0	24,000
		SUBTOTAL				**128,615**
TOTAL GRAFTING UNIT COST						Total $
CULTIVATION GREEN HOUSE						281,318
GRAFTING GREEN HOUSE						165,114
ANNEX						128,615
TOTAL						**575,046**

5 ANNEX C TRAINING AND EXTENSION SERVICES

Calculation of Training Requirements and Corresponding Costs

The project involves the following with a minimum number of farmers to be trained on the new technologies, as follows:

Total 1000

The total number of technicians should be split into groups of about 30 people:

Total number of technicians: 300

There would be a total of approximately 10 groups. Each group will attend one 2-days session where they will learn about the IPM system and everything possible in relation to preparation and installation of the selected alternatives and the problems that may occur during the growing cycle.

In addition, three workshops will be organized on the three alternatives: Solarization +Metam Sodium, Grafting and soilless technology

A national institution will be in charge of the day-to-day pilot phase. There would be some support for international consultant but very limited and only for the introduction and training in the alternatives.

TRAINING	**Nr**	**$/unit**	**Total**
Training session 2days x10	10	2,000	20,000
National workshop	3	8,000	24,000
National specialist provided by the subcontractor	2	30,000	60,000
Subcontract national institution for pilot phase	1	96,000	96,000
International cons. Solarization and MS (w/m)	1	15,000	15,000
International cons. Grafting (w/m)	1.5	15,000	22,500
International cons. Soil less (w/m)	1.5	15,000	22,500
			-
			-
			-
TOTAL			**260,000**

6 ANNEX D PROJECT BUDGET

Description	**w/m**	**US$**
International Consultants	4	60,000
Subcontract training		200,000
Equipment		**1,356,836**
Metam Sodium		378,140
Soilless		403,650
Grafting		575,046
TOTAL CAPITAL COSTS		**1,616,836**
Contingencies 10%		161,684
TOTAL INVESTMENT		**1,778,520**
Incremental Operational Cost (IOC)		**98,298**
TOTAL PROJECT COSTS		**1,876,818**
Overheads (7.5%)		140,761
TOTAL BUDGET COSTS		**2,017,579**