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the Multilateral Fund for the
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COUNTRY PROGRAMME: BANGLADESH

This document consists of:

- Comments and Recommendations of the Fund Secretariat
- Country Programme Evaluation Sheet (prepared by the Fund Secretariat)
- Transmittal Letter from the Government of Bangladesh
- Country Programme Cover Sheet
- Country Programme

COMMENTS AND RECOMMENDATIONS OF THE FUND SECRETARIAT

COMMENTS

1. The Country Programme conforms to the format of the approved guidelines.
2. Consumption of ODS (236 ODP tonnes) is almost exclusively CFC for aerosol propellant and for service refrigeration and air-conditioning systems. The phase-out schedule proposes a freeze on import and consumption of controlled substances at the 1993 level by the end of 1995, a 60 per cent reduction in the consumption in the year 2000, and a complete phase out in 2006.
3. Of the three aerosol manufacturing plants in operation, only one is still using CFC as a propellant. A project for the conversion of this industry to LPG propellant has been identified and described in the country programme. The estimated project cost is about US \$650,000. Conversion of this plant will lead to a phase out of about 37 per cent of the total ODS consumed in the country.
4. The Government of Bangladesh is also proposing to convert 20 CFC-based cold storage units and 40 fish freezing plants to ammonia, at an estimated cost of US \$4 million (Annex II). Conversion of these refrigeration systems will lead to a phase out of about 10 per cent of the total ODS consumed in the country. A training programme for refrigeration service technicians is also proposed.
5. In order to facilitate the complete phase-out of the controlled substances, the Government is planning to build-up a strategic reserve of 1,000 tonnes of CFC.
6. An amount of US \$150,000 is been requested for an institutional strengthening project proposal.

RECOMMENDATIONS

7. The Fund Secretariat recommends as follows:
8. To approve the Bangladesh Country Programme. Approval of the Country Programme does not denote approval of the projects identified therein or their funding levels.
9. In accordance with the Executive Committee decision on implementation of country programmes (UNEP/OzL.Pro/ExCom/10/40, para 135), to request the Government of Bangladesh to provide information on the progress of implementation of the country programme within one year of its approval, and annually each subsequent year.
10. To request to the Government of Bangladesh, with the assistance of UNDP or any other implementing agency, to develop the project identified in the Country Programme following the relevant Executive Committee guidelines.

BANGLADESH COUNTRY PROGRAMME EVALUATION SHEET

National Implementing Agency:

Status of ratification of the Vienna Convention and the Montreal Protocol

	Signature	Ratification	Entry Force
Vienna Convention (1985)		02/Aug/90	31/Oct/90
Montreal Protocol (1987)		02/Aug/90	26/Jul/90
London Amendment (1990)		18/Mar/94	16/Jun/94
Copenhagen Amendment (1992)			

Production of controlled substances: 0 metric tonnes (mt)

Consumption of controlled substances (1993): 233.2 metric tonnes
(excluding methyl bromide) 233.2 weighted tonnes (ODP)

Substance (ton)	CFC						Halon			Solvents			M-Br
	11	12	113	114	115	Total	1211	1301	Total	CTC	MCF	Total	
ODS	67.4	157.4				224.8	2.5		2.5	0.3	5.6	5.9	
ODP	67.4	157.4				224.8	7.5		7.5	0.3	0.6	0.9	

Source: Country Programme (1994)

Distribution of ODP by substance:

CFC: 96.4% Halon: 3.2% CTC, MCF: 0.4%

Distribution of ODP by sector:

Sector:	Aerosol	Foam	Halon	Refrig.	Solvent
Consumption (tonnes):	86.0		7.5	138.8	
Percent of total:	36.9%		3.2%	59.5%	0.4%

Note: About 0.9 tonnes (ODP) are used in the chemical and pharmaceutical industries.

Country Programme

Duration of country programme: 12 years (1994-2006)

ODS phase-out target:

Freeze on import and consumption at the 1993 level by 1995. 50% reduction by 1996. 60% reduction by 2000, 80% reduction by 2005 and complete phase out by 2006

Phase-out priority area:

Aerosol and refrigeration sectors

Cost of activities in country programme: \$8,050,000

Strategy:

The phase-out schedule proposes a freeze on import and consumption of ODS at the 1993 level by end of 1995; 50% reduction by 1996; 60% reduction by 2000; 80% reduction by 2003-2005 and 100% reduction by 2006. Proposed actions include: conversion of an aerosol plant to LPG; conversion of refrigeration units to ammonia; training and awareness programme; use of non-CFC refrigerant equipment in domestic refrigeration subsector; and ban on import of CFC-based refrigeration equipment as soon as new technologies become available.



Abdullah Haroon Pasha
Secretary
Ministry of Environment & Forest
Dhaka

D.O. No. MOEF (KA.PRA) 4/94

Dated the 15-8-1994

Dr Omar El-Arini
Chief Officer
Multilateral Fund for the
Implementation of the Montreal
Protocol Secretariat
1800 McGill College Avenue, 27 th Floor
Montreal, Quebec Canada

Dear Sir,

Ref: Request for consideration for funding of Country Programme for
phasing out the use of Ozone Depleting Substances in Bangladesh.

A Country Programme for phasing-out the use of Ozone Depleting Substances in Bangladesh has been prepared under supervision of the UNDP, Dhaka, which has recently been sent to the Multilateral Fund for Implementation of the Montreal Protocol Secretariat. Government of Bangladesh is in agreement in principle with the recommendations of the Country Programme and solicits support of the Multilateral Fund for its implementation.

Suggested Action Plans are: implementation of the ODS phase-out plan as per Protocol requirements; establishment of an "Ozone Cell" at the Department of Environment; setting up of a National Technical Committee to oversee and support the Ozone Cell; and undertaking of regulatory measures in order to implement Action Plan to phasing-out of the ODS.

It is to be mentioned here that Bangladesh has ratified the Montreal Protocol on 2 August 1990 and also its London Amendment on 18 March 1994. Currently, we are taking steps towards ratification of the Copenhagen Amendment to the Protocol.

We thank UNDP for being the lead Agency in assisting preparation of Bangladesh Country Programme. We look forward to hearing from you in this regard.

With regards,

[Abdullah Haroon Pasha]
Secretary

COUNTRY PROGRAMME COVER SHEET

Country: BANGLADESH

Lead National Agency: Department of Environment (DOE)
Ministry of Environment and Forests (MOEF)

Participating Implementing Agency: UNDP

PHASEOUT SCHEDULE:

Substance	Consumption (1993 ODP t)	Cumulative Cons to Phaseout (ODP t)		Planned Year of Phaseout
		Article 5 Schedule (1)	Accelerated Schedule (2)	
CFC-11	67.4	2,167		2006
CFC-12	157.4	5,022		2006
HCFC-22	2.7	1,472		2006
Halons	7.5	246		1995
Methyl- chloroform	0.6	20		1996
Carbontetra- chloride	0.3	10		1996
TOTAL	235.9	8,937	1,675	

- (1) Forecast ODP consumption until year 2010 in accordance with Montreal Protocol schedule
- (2) ODS phaseout schedule based on the Government action plan.

ACTION PLAN

An accelerated ODS phaseout by the year 2001 has been considered. However, since Bangladesh has a significant dependency on neighbouring countries for ODS imports, the Government has selected an ODS phaseout strategy and timing that is in concert with those of other supplier countries in the region, thus ensuring consistency between the phaseout of CFCs and the availability of substitutes. Therefore, the proposed Action Plan aims at a complete ODS phaseout by year 2006. By the end of 1995, a freeze on ODS import and consumption at the 1986-1993 level (about 250 metric tonnes/year) will be achieved; thereafter a 50% reduction by 1996, 60% by 2000, 80% by 2003-2005 and 100% phaseout by year 2006.

The Action Plan includes short-term and long-term objectives for ODS phaseout and environmental awareness. The main objectives of the Action Plan are to reduce consumption first, through establishment of an ODS phaseout institutional and policy framework; and second, through ODS phaseout projects. The conversion of the existing aerosol plant from CFC to LPG will reduce consumption by over 40%. The rest will come from key projects such as converting large refrigeration units to use of ammonia, use of non-CFCs in refrigeration and air-conditioning; technician training and awareness programmes in the refrigeration sector; and import bans on CFC-based units as soon as alternative technologies become available.

PROJECTS IN ORDER OF THEIR PRIORITY TO THE GOVERNMENT OF BANGLADESH

Duration	Project	Estimated Cost (US\$)	Implementing Agency
1995-97	Institutional Strengthening for the phase out of ODS	150,000	UNDP
1995-96	Training, Workshop and Awareness Programme in refrigeration and air conditioning service sector	250,000	UNDP
1995-96	Aerosol sector phase out	647,000	UNDP
1995-98	Conversion to large refrigeration units to ammonia-based:		
	cold-storage (20 units)	2,000,000	UNDP
	fish-freezing plants (40)	2,000,000	UNDP
1996-2000	Conversion to use of non-CFC equipment in domestic sector	Not costed	
1995-2006	Establishment of a national CFC refrigerant bank	3,000,000	

EXECUTIVE SUMMARY

INTRODUCTION

Bangladesh ratified the Montreal Protocol on 2 August 1990. No ozone depleting substances (ODS) are manufactured in Bangladesh. All ODS consumed in the country are imported. In 1993, ODS imports amounted to around 281 metric tonnes (MT) of which CFC-11, CFC-12 and HCFC-22 together accounted for 97% of the total (273 MT), with the remaining 3% covering methyl chloroform, halons and carbontetrachloride as can be seen below:

<u>Substances</u>	<u>% share</u>	<u>ODS Tonnes</u>	<u>ODP Tonnes</u>
CFC-11	24%	67.4	67.4
CFC-12	56%	157.4	157.4
HCFC-22	17%	47.8	2.7
Methylchloroform	2%	5.6	0.6
Halons	0.9%	2.5	7.5
Carbontetrachloride	0.1%	0.3	0.3
TOTAL:	100%	281.0	235.9

With a population of 110 million at the end of 1993, the per capita consumption of ODS in Bangladesh in 1993 was 2.5 gm which is well below the limit of 300 gm (0.3 kg) per capita allowable under the Protocol. Thus, Bangladesh qualifies to operate under paragraph 1 of Article 5 of the Protocol.

USE OF ODS

The sectoral shares of ODS consumption were as follows:

- refrigeration and air-conditioning, cold storage, fish freezing plants, ice cream and dairy plants, etc (55%)
- aerosols sector use (42%)
- use of methyl chloroform, halons and carbontetrachloride in the pharmaceutical, chemical and fire fighting sectors (3%).

Thus ODS consumption in Bangladesh is dominated by the refrigeration and air-conditioning assembly and maintenance sector. The next largest sector is aerosol, from a single aerosol manufacturing plant which consumes about 42% of the total ODS in the country. Halons, methylchloroform and carbon tetrachloride accounted for about 3% of ODS consumption on a historical basis.

ACTION PLAN

An accelerated ODS phaseout by the year 2001 has been considered. However, since Bangladesh has a significant dependency on neighbouring countries for ODS imports, the Government has selected an ODS phaseout strategy and timing that is in concert with those of other supplier countries in the region, thus ensuring consistency between the phaseout of CFCs and the availability of substitutes. Therefore, the proposed Action Plan aims at a complete ODS phaseout by year 2006. By the end of 1995, a freeze on ODS import and consumption at the 1986-1993 level (about 250 metric tonnes/year) will be achieved; thereafter a 50% reduction by 1996, 60% by 2000, 80% by 2003-2005 and 100% phaseout by year 2006.

The Action Plan includes short-term and long-term objectives for ODS phaseout and environmental awareness. The main objectives of the Action Plan are to reduce consumption first, through establishment of an ODS phaseout institutional and policy framework; and second, through ODS phaseout projects. The conversion of the existing aerosol plant from CFC to LPG will reduce consumption by over 40%. The rest will come from key projects such as converting large refrigeration units to use of ammonia, use of non-CFCs in refrigeration and air-conditioning; technician training and awareness programmes in the refrigeration sector; and import bans on CFC-based units as soon as alternative technologies become available.

SUMMARY OF ACTIONS AND IMPLEMENTING BODIES

Number	Action	Starting Date	Implementing Body
<u>Short-term:</u>			
1.	Establishment of institutional and legal/policy framework (setting-up of an Ozone Cell & National Technical Committee on ODS, development of regulatory measures on ODS import and use, etc.)	Jan. 1995 to Dec. 1997	DOE/UNDP; Chamber of Commerce; Industry Association & NGOs.
2.	Enactment of laws and regulations on ODS use and import	Jan. 1995 to Dec. 1996	NTC on ODS; Min. of Law; Chamber of Commerce Ministries.
3.	Monitoring of ODS use and import Dec.2006	Jan. 1995 to	NTC on ODS; Ministries of Industries, Fisheries and Agriculture; Customs Department.
4.	Training Programme and Certification of Refrigeration Technicians, and awareness Programme	1995-97	DOE-Ozone Cell; UNDP; NGOs.
5.	Conversion of the only existing aerosol plant (ACI) to use of LPG,	1995-96	ACI; UNDP.
<u>Mid to Long-term:</u>			
6.	Conversion of large refrigeration units to ammonia-based	1996-98	UNDP; enterprises GOB.
7.	Conversion to use of non-CFC equipment in domestic sector	1996-2006	
8.	Import ban of CFC-based refrigeration and air-conditioning equipment	as soon as new technologies become available	NTC on ODS; GOB.
9.	Substitution of ODS in Cold Storage and other areas	1995/96	UNDP; enterprises; GOB.
10.	Establishment of national bank for CFCs to supply/service the refrigeration/air conditioning sector	1995	GOB; assemblers and contractors; chemical importers. —

PROJECTS IN ORDER OF THEIR PRIORITY TO THE GOVERNMENT OF BANGLADESH

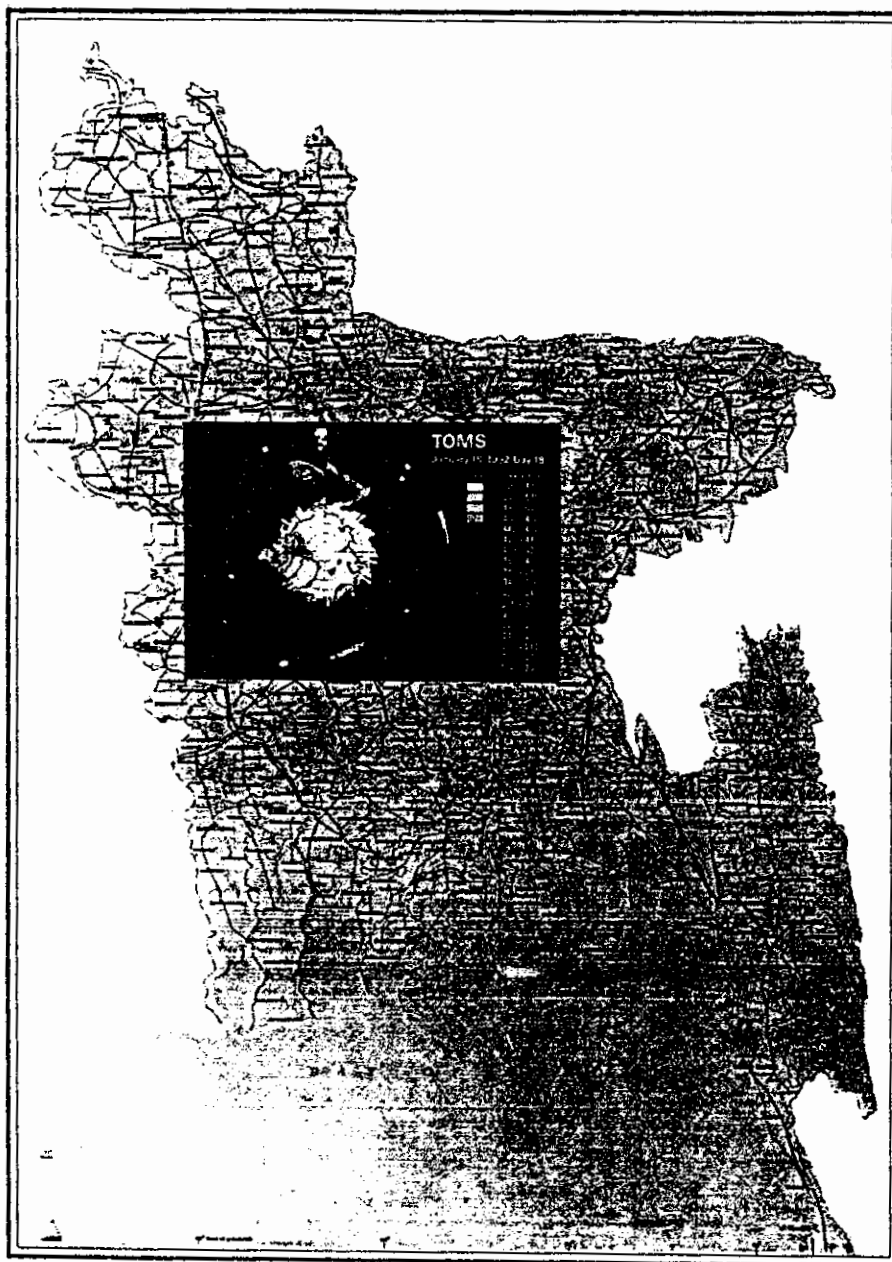
Duration	Project	Estimated Cost (US\$)	Implementing Agency	Remarks
1995-97	Institutional Strengthening for the phase out of ODS	150,000	UNDP	Subject to ExCom approval in Dec. 1994, project will start in early 1995.
1995-96	Training, Workshop and Awareness Programme in refrigeration and air conditioning service sector	250,000	UNDP	Only incremental costs to be sought from Multilateral Fund.
1995-96	Aerosol sector phase out	647,000	UNDP	Only eligible incremental costs to be sought from Multilateral Fund.
1995-98	Conversion to large refrigeration units to ammonia-based cold-storage (20 units) fish-freezing plants (40)	2,000,000 2,000,000	UNDP UNDP	More detailed project proposals need to be prepared in each of these two sub-sectors.
1996-2000	Conversion to use of non-CFC equipment in domestic sector	Not costed		Detailed project preparation required.
1995-2006	Establishment of a national CFC refrigerant bank	3,000,000		GOB; suppliers and assemblers.



Government of Bangladesh
Department of Environment



COUNTRY PROGRAMME FOR PHASING-OUT THE USE OF OZONE DEPLETING SUBSTANCES IN BANGLADESH



April 1994



BANGLADESH CENTRE FOR ADVANCED STUDIES (BCAS)

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LIST OF ABBREVIATIONS

ACI	Advanced Chemical Industries
ARMCO	Associated Resources Management Company
BCAS	Bangladesh Centre for Advanced Studies
BFDC	Bangladesh Fisheries Development Corporation
BOI	Board of Investment
BOL	Bangladesh Oxygen Limited
CFC	Chlorofluoro carbons
CTC	Carbon tetrachloride
DOE	Department of Environment
EIA	Environmental Impact Assessment
ESCAP	Economic and Social Commission for Asia and the Pacific
FID	Factories Inspectorate Department
GNP	Gross National Product
GOB	Government of Bangladesh
HCFC	Hydrogenated chlorofluoro carbons
JARAC	Japan Association of Refrigerating and Air-conditioning Contractors
LDC	Least Developed Country
LPG	Liquid Propane Gas
LRU	Large Refrigerant Unit
MOC	Ministry of Commerce
MOEF	Ministry of Environment and Forests
MOF	Ministry of Finance
MOI	Ministry of Industries
MOL	Ministry of Law
MOST	Ministry of Science and Technology
MT	Metric Tons
NBR	National Board of Revenue
NGO	Non-Government Organization
NTF	National Tariff Commission
ODS	Ozone Depleting Substances
TTC	Technology Transfer Centre
UK	United Kingdom
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
USA	United States of America
WMO	World Meteorological Organization

Section A

EXECUTIVE SUMMARY

Background

1. Bangladesh is a signatory to the Montreal Protocol. The Protocol was formulated and signed by the Parties in 1987. Since then it has been amended twice, in London in 1990 and finally in Copenhagen, 1992. Bangladesh has ratified the London Amendment to the Montreal Protocol in 1990. Although the Copenhagen Amendment has already been entered into force (as of 14 June 1994), Bangladesh has not yet ratified it. However, as a signatory to this Protocol, Bangladesh is committed to phase-out the use of the Ozone Depleting Substances (ODS) by the time limit set in the Amendment to the Protocol.
2. The amended Protocol requires a complete phase-out of CFCs and halons by the year 1995-1996, while the developing countries with a calculated per capita consumption below 0.3 kg. per year are allowed a grace period of 10 years to phase-out their use of ODS. Even in developing countries, the ODS used in export products have to be phased out by the year 1996 and the 10 year extension applies only to ODS used to meet basic domestic demands.
3. The Montreal Protocol (as amended) provides in Article 10 for a mechanism to give financial assistance from the Multilateral Fund, established by the participating countries, to Article 5 Paragraph 1 countries to comply with the control measures of the Protocol.
4. As a first step to achieve the objectives of the Montreal Protocol a Reconnaissance Study on the use of ODS in Bangladesh was carried out in early 1993 by the Bangladesh Centre for Advanced Studies (BCAS) on behalf of the concerned agency of the Government of Bangladesh (GOB) - the Department of Environment (DOE). The study was sponsored by UNDP.

The study revealed that the per capita consumption of ODS in Bangladesh in 1991 was 2.02 g per year. This is well below the 0.3 kg. per capita per year for developing countries. Thus Bangladesh qualifies under Article 5 paragraph 1 of the Protocol to a ten year delay in the phase out of ODS, and Bangladesh is eligible for seeking assistance from the Multilateral Fund.

5. In pursuance of the commitment of Bangladesh to phase-out ODS by the time limit set in the revised phase-out schedule of ODS, UNDP, in consultation with the Department of Environment of the Government of Bangladesh, has contracted BCAS to prepare a Country Programme for ODS phase-out. This is essentially a requisite activity for seeking assistance from the Multilateral Fund. UNDP is providing financial support.
6. This report contains the essential information from the Reconnaissance Study on ODS use and import in Bangladesh during the period 1986-91, the import figures for 1992 and 1993, analyses of phase-out scenarios, description of the recommended phase out strategy including an estimate of the cost of complete phase-out, and an Action Plan for Government activities and project proposals for which the Bangladesh Government seeks assistance from the Multilateral Fund.

ODS Import and Consumption in Bangladesh

7. It was established that no ODSs are manufactured in Bangladesh. These substances are imported by a limited number of importers and directly by ODS-using companies. These are imported from nine countries of which 83% came from UK, Germany and USA. Since 1992, however, India has become the major supplying country for Bangladesh.
8. Over the period 1986-91, on the average, 230.3 Metric ton (MT) of various ODS were imported. Of this 96.9% account for CFC-11, CFC-12 and HCFC-22. Consumption of Me-chloroform, carbon tetrachloride and halons constitute the other 3%. No evidence has been found regarding the import and use of methyl bromide as fumigating agent in Bangladesh. The 1992 and 1993 import figures for CFCs stood at 262.73 MT and 272.99 MT respectively. Figures for import of other ODS are estimated. The share of CFCs in this figure is estimated to be the same as in 1986-1991 average.

9. The ODS consumption in Bangladesh is dominated by the Refrigeration and Air-conditioning Assembly and Maintenance (Service) Sector with a share of 46% of all ODS used in this country. The average consumption of the CFCs (CFC-11, CFC-12, HCFC-22) consumed in this sector from 1986-91 is about 95 MT/yr. The next largest consumer is a single Aerosol manufacturing unit, Advanced Chemical Industries (ACI), which consumes about 42% of the total ODS used for the manufacture of an insect spray. The average consumption of CFC-11 and CFC-12 by ACI is 86 MT/Yr. All other CFC consuming sectors like Split and Central Air-conditioning sector, Cold storage, Fish-freezing plants, Ice Cream and Dairy Processing plants together consume about 17.16 MT/yr. The use of non-CFC ODS amounts to an average of 8.14 MT/yr.

Phase-out Scenarios

10. Two basic phase-out scenarios have been considered :

- o Scenario A-I - Phase-out as per permissible time limit of Copenhagen Amendment to the Montreal Protocol.
- o Scenario A-II - Accelerated phase-out at a pace set by availability of Technology including CFC alternatives at an earlier date.

Scenario A-I utilizes the 10 year delay provision in the Protocol by considering a complete phase-out by the year 2006, whereas in Scenario A-II a complete phase-out is envisaged by the year 2001 based on the assumption that substitute for CFCs will be available at reasonable price at an earlier date. However, both the scenarios are found to be in agreement with the phase-out schedule updated in Copenhagen Amendment of Montreal Protocol.

11. There are no basic differences in the two scenarios in terms of strategies, sequences and numbers of implementing measures, except the time scale for availability of the new technology and the Government policy imposition.

Although Scenario A-II is achievable, Scenario A-I is considered to be the desirable and a more pragmatic phase-out schedule in the context of Bangladesh for the following reasons :

- o ACI, the manufacturer of aerosol spray, is already considering switching over from CFCs to LPG as the propellant gas. If incentive is provided to ACI a 50% reduction in ODS use may be effected when they stop use of CFC.
- o Enactment of laws for imposing tariff barrier or banning import may need some time because of the bureaucratic complexities involved.

Recommended Phase-out Plan

12. The recommended phase-out schedule proposes a freeze on import and consumption at the 1986-1993 level (about 250 MT/Yr) by end of 1995. Thereafter a 50% reduction by 1996, 60% reduction by 2000, 80% reduction by 2003-2005 and 100% reduction by 2006. This seems to be a more pragmatic schedule for Bangladesh on the grounds stated above.
13. The total cost of the recommended phase-out schedule is estimated at about US \$ 8.05 million. The benefit is a reduction of ODS consumption of about 7,500 MT ODS (low estimation being 5,500 MT) over a period of 1994-2006. The planned reduction in consumption is scheduled to be accomplished as follows :
- o Conversion of the only existing Aerosol Plant from CFCs to LPG
 - o Conversion of large refrigeration units to ammonia

- o Training and awareness programme for conservation of ODS use in Refrigeration and Air-conditioning Maintenance/Servicing industry
- o Use of non-CFC refrigerant equipment in domestic sector
- o Ban on import of CFC-based refrigeration and air-conditioning equipment as soon as new technologies become available.

Action Plan

14. In order to achieve the objective of ODS use phase-out in compliance with the requirements of the Copenhagen Amendment to the Montreal Protocol an Action Plan has been suggested in the Country Programme.
15. The plan requires the introduction of Government initiatives to strengthen the institutional and policy framework, which will effectively regulate and monitor the import and use of ODS in the country and lead to implementation of a number of proposed projects in the ODS end user sector. These are prerequisites for bringing out the ODS phase-out.

Government Actions

16. The first step toward implementation of the Action Plan would be to establish the institutional framework. As the Government agency for implementation of different international conventions including Montreal Protocol the Department of Environment (DOE) will be the appropriate Government Institution to implement the Action Plan. DOE will be required to set up an OZONE CELL within the DOE for ODS phase-out and necessary rules and regulations are to be enacted.
17. The Ministry of Environment and Forests (MOEF), on behalf of the Government of Bangladesh, will review the Copenhagen Amendment to the Montreal Protocol and take necessary actions to ratify it at the earliest convenience.
18. To oversee and support the functions of the Ozone Cell a National Technical Committee should be set up. Representatives from different Government agencies, who will conceivably be directly or indirectly involved in the ODS phase-out programme, should be included in the Technical Committee. Representatives from Chambers of Commerce, Industry Associations, NGOs and forum of environmental journalists are also proposed to be included.
19. The National Technical Committee will advise the Government on import and export policy concerning ODS during the transition period. The committee will also advise the Government on the legal instruments/regulatory measures for ODS phase-out and prepare specific proposals for ODS phase-out to the Ministry of Environment and Forest (MOEF) of which the DOE is an organ. The MOEF after inter-ministerial discussion and comments will submit specific proposals to the cabinet for approval and subsequent action by the Ozone Cell.
20. The ozone cell will act as the Secretariat of the National Technical Committee for ODS and co-ordinate and facilitate activities related to the phase-out of ODS.
21. A monitoring system for ODS use is to be introduced. This will be based on the requirement of obtaining permission from ozone cell to import before import process can be initiated and that the customs office will supply copies of all import declarations concerning ODS to the Ozone Cell, enabling the cell to be in control of all imports of ODS in Bangladesh. Ministry of Industries, Ministry of Fisheries and the Ministry of Agriculture will inform the ozone cell of the setting up of any industry based on ODS as refrigerant.
22. To enable the ozone cell to act effectively the policy framework in the form of appropriate laws and regulations should be enacted by the Government.

23. Other proposed Government Actions are :**Introduction of Regulatory Measures**

The regulatory measures proposed include a schedule of ban on the use of ODS for different purposes to be imposed at specifically given date; introduction of a special ODS tax on the import of all controlled substances and ODS using equipments. Since such a tax will, hopefully, encourage substitution of ODS in sectors where substitution may be easily accomplished, encourage import of ODS conserving technology. Tax exemptions for import of ODS recovering and recycling machines under a separate dedicated H. S. Code may be given. To assist in preparing a schedule of regulatory measures and draft regulations for consideration by the Government through the National Committee on ODS the services of a local legal consultant may be obtained. An economic consultant may be engaged to assess the cost of introducing the regulatory measures and the impact of these regulations.

The monitoring of regulatory measures will be the responsibility of the National Committee on ODS. Since this committee has no legislative and enforcement power it will act by making recommendations to other Ministries and Government agencies, especially the Ministry of Finance, Ministry of Commerce, Ministry of Industries, National Board of Revenue and the Factory Inspectorate. The ODS taxes will be collected by the Customs and Excise wing of the National Board of Revenue.

Introduction of Certification of Refrigeration Technicians

In order to minimize operational losses and increase efficiency during servicing of refrigeration and air conditioning equipments in the maintenance and servicing workshops it is necessary to enhance efficiency of the workforce in those units. It is recommended that a certification arrangement is introduced for technicians, who have successfully completed the training programme, to be initiated for refrigeration technicians. A Technical Assistance programme involving expatriate and local consultants is developed.

Action Plan on Creating Awareness

Major importers and some of the users of ODS in Bangladesh are well informed about the Montreal Protocol and the efforts to substitute ODSs by new generation refrigerant. The majority of users, particularly the technicians in the service sector, owners of fish freezing industries and the general public are unaware of the ozone depletion problem. Information dissemination to professional personnel/ technicians as well as to the citizens of Bangladesh about the ODS is, therefore, essential for bringing about ODS use phase-out.

An information campaign should, therefore, be launched for creating general awareness about ODS through television spots, movie house (cinema) spots and newspapers.

The ozone cell will undertake distribution of international and national literature, posters etc. on ODS alternatives to the ODS using industries. Industry Associations in the respective sector will also support this activity.

Project Proposals

Four project proposals are discussed in the Country Programme - one project each for CFC substitution in the aerosol sector, conversion of large refrigeration units to ammonia, technician training and institutional strengthening.

The total incremental cost, which represents additional fund requirements in order to replace ODS-based technologies by ozone friendly technologies, is estimated at US\$ 4,897,000. To facilitate complete phase-out of ODS use, an additional US\$ 3,000,000 will be required in order to build-up of a strategic reserve of 1000 MT of CFC. An additional US\$ 150,000 will also be required to establish the proposed Ozone Cell within the DOE to facilitate implementation of the proposed Phase-out Action Plan.

Section B

INTRODUCTION

1. Background

The role of chlorofluoro-carbons (CFCs) in depleting the ozone layer in the stratosphere, thus exposing the earth inhabitants and their environment to harmful effects of ultra violet (uv) radiation was recognized in the nineteen seventies. Concerted efforts by scientists, environmentalists, political activists, UNEP, WMO and others led to the signing in 1987 of an international agreement known as Montreal Protocol, to phase-out use of ozone depleting substances (ODS). Bangladesh is a signatory to the Montreal Protocol. Although

The detailed phase-out schedules for ODS (control substances as applicable to Bangladesh) as stipulated in the protocol are presented in Table - 1.

As a first step to achieve the objectives of the Montreal Protocol a Reconnaissance Study on the use of ODS in Bangladesh was carried out in early 1993 by the Bangladesh Centre for Advanced Studies (BCAS) on behalf of the concerned implementing agency of the Government of Bangladesh (GOB) - the Department of Environment (DOE). The study was sponsored by UNDP. This study was carried out with a

Table-1: Summary of Copenhagen Amendments to the Montreal Protocol

Chlorofluorocarbons (Group I, Annex A), baseyear 1986	
● 75% reduction :	1995 01 01 (1 January 1995)
● 100% reduction :	1996 01 01 (1 January 1996)
Halons (Group II, Annex A), baseyear 1986	
● 100% reduction :	1995 01 01 (1 January 1995)
Carbon Tetrachloride (Group II, Annex B), baseyear 1989	
● 85% reduction :	1995 01 01 (1 January 1995)
● 100% reduction :	1997 01 01 (1 January 1997)
1,1,1-Trichloroethane (Group III, Annex B), baseyear 1989	
● 50% reduction :	1995 01 01 (1 January 1995)
● 100% reduction :	1997 01 01 (1 January 1997)
Hydrogenated chlorofluorocarbons (HCFCs), baseyear 1989	
● 35% reduction :	2005 01 01 (1 January 2005)
● 65% reduction :	2011 01 01 (1 January 2011)
● 90% reduction :	2016 01 01 (1 January 2016)
● 99.5% reduction :	2021 01 01 (1 January 2021)
● 100% reduction :	2031 01 01 (1 January 2031)
Hydrogenated bromofluorocarbons (HBFCs)	
● 100% reduction :	1997 01 01 (1 January 1997)
Methyl bromide (CH₃Br), baseyear 1991	
● Freeze production	1996 01 01 (1 January 1996)

Government of Bangladesh has ratified the London Amendment, the Copenhagen Amendment (1992) has not yet been ratified. As a signatory to this protocol of great importance in the area of environmental protection efforts on a global basis Bangladesh is committed to phase-out the use of ODS by the time limit set in this protocol and its amendments.

methodology that involved data/information collection from both secondary as well as primary sources (direct micro-survey) and provided a comprehensive data/information base on the import and consumption of ODS in Bangladesh by different consumer sectors.

INTRODUCTION

The average consumption of ODS in Bangladesh from 1986 to 1991[#] was found to be 206.3 MT per year. As part of the Reconnaissance Study a projection of consumption of ODS upto the year 2010[†] were made based on three basic assumptions:

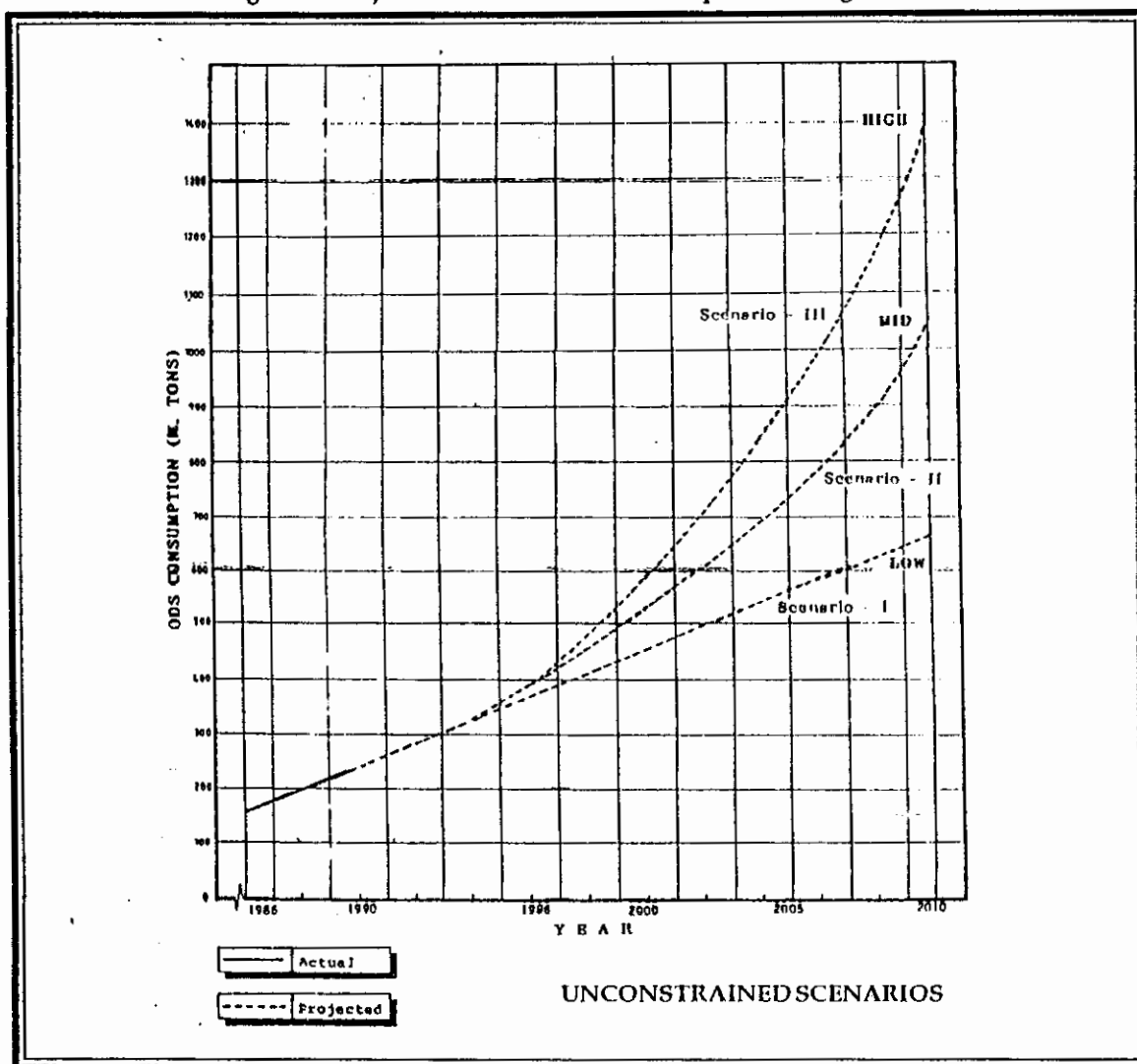
- o Constant growth rate based on past consumption (linear equation) - Scenario I
- o Complex growth rate taking into consideration population and income factors (exponential equation) - Scenario III

- o Intermediate growth rate which is average of low and high scenarios (mid-values) - Scenario II

These are shown in Fig. 1.

Using the HIGH growth scenario the projected consumption of ODS in Bangladesh in the year 2006 works out to be 1000 MT. The per capita ODS consumption in 1991 was found to be 2.02 gram and the high growth scenario makes a per capita consumption of about 6.6 gram in 2006.

Figure-1: Projection of Total ODS Consumption in Bangladesh



[#] During the course of the Reconnaissance Study, the ODS consumption scenarios have been formulated considering the consumption pattern between 1986 to 1991. The latest consumption figures are included in this Report and presented in Section C.

[†] This is to be mentioned here that, the Reconnaissance Study considered the London Amendment and accordingly the deadline appeared to be 2010 AD. Considering Copenhagen Amendment, the new dead-line for Bangladesh for achieving complete phase-out of CFCs will be 2006 AD.

INTRODUCTION

In pursuance of the commitment of Bangladesh to phase-out ODS use by the time limit set in the revised phase-out schedule of ODS the DOE of GOB has contracted BCAS to prepare a COUNTRY PROGRAMME for ODS phase-out. UNDP is providing financial support.

The Montreal Protocol (as amended in 1992) provides in Article 10 for a mechanism to give financial assistance from the Multilateral Fund to Article 5 paragraph 1 countries to comply with the control measures of the protocol. As the per capita consumption of ODS in Bangladesh is well below the 0.3 kg limit, Bangladesh is eligible for assistance from the Multilateral Fund for implementing the COUNTRY PROGRAMME.

2. Objectives

The objectives of the country programme for phasing out ODS use in Bangladesh are :

- o To make an analysis of ODS phase-out scenarios evolved during the reconnaissance study. To make

the analysis more realistic the import data of ODS in 1992 and 1993 are incorporated.

- o To evolve an ODS phase-out strategy for the Country Action Plan to comply with the time limit shown in Table 1.
- o To prepare a specific Action Plan for government activities in this regard.
- o To recommend appropriate Government Policy Framework and Institutional Framework to implement the proposed programme to phase-out ODS use in Bangladesh.
- o To prepare project proposals for achieving the objectives of phasing out of ODS use.

The Country Programme will serve as a key government document to monitor import and use of ODS and take effective steps to reduce these figures to complete phase-out.

An important part of the exercise is to estimate the cost of ODS phase-out to the Government, industries and consumers while complying with the requirement of the Montreal Protocol.

Section C

ODS IMPORT AND CONSUMPTION IN BANGLADESH

A summary of the major qualitative and quantitative findings of the Reconnaissance Study completed in 1993 through comprehensive surveys are presented in this section. For updating the information base the ODS import figures for 1993 are also included.

1. Import Scenario

It was established that no ODS are manufactured in Bangladesh. These are imported from nine (9) countries, of which 83% came from UK, Germany and USA. UK used to be the major supplier with its 42% share till 1991. However, since 1992 India has become the major supplying country for Bangladesh (33% share) followed by Germany (23%), UK (11%), USA (12%), Australia (10%) and other countries.

It was found that over the period 1986-1991, on the average, a total of 230.3 MT of various ODS were imported per year into Bangladesh. Of this 96.9% were the different CFCs, the balance 3% being Methyl-chloroform, Carbon Tetrachloride (solvents), a small percentage of Halons for fire-fighting. The data for imports were updated during closure of the Reconnaissance Study for 1992, when it was found that the import quantity increased to 262.73 M Tons of CFCs. A comparative summary of ODS imports for the periods 1986-'91 (ave), 1992 and 1993 showing quantities, countries of origins and ODS-mix are presented in table-2.

It may be noted that the 1993 import level is found to be 273 M Tons of CFCs. Data on other ODS (Halon,

Table-2: Comparative Summary of ODS Import into Bangladesh
1993, 1992 & 1986-91 (Average)

Variables (Qty. Origin, Mix)	Year	1993 (Current)	1992	1986-91 (Average)
01. Import (Quantity)		281.0 M Ton	270.8 M Ton	230.33 M Ton
02. Origin Country Share				
● India		31.30%	33%	3.47%
● Singapore		30.92%	-	6.32%
● Germany		23.21%	23%	29.32%
● USA		8.27%	12%	11.77%
● UK		6.30%	11%	42.20%
● Italy		-	-	1.78%
● France		-	-	4.42%
● Japan		-	-	0.43%
● China		-	-	0.30%
● Australia		-	10%	-
● All other Countries		-	11%	-
03. Import Mix				
* CFC-12		56%	56%	54.87%
* CFC-11		24%	23%	20.80%
* HCFC-22		17%	18%	21.22%
* Methyl chloroform		2%		2.13%
* CCl ₄		0.9%	3%	0.86%
* Halon		0.1%		0.12%
* Methyl bromide		N/A	N/A	N/A
	273.0 MT		262.7 MT	
	est 8.0 MT		est 8.1 MT	

Methyl-chloroform and Carbon tetrachloride) could not be made available by importing agencies/customs for 1992-93 within the short time frame of the country study, but it is estimated from 1986-91 surveys that their imports/use is about 3% of total. Hence that estimate has been used.

The reasons for a major drop in 1991 imports, were a combination of several factors, namely,

- Loss of market (unusually low business volume of refrigeration + air-conditioning service shops) due to an unstable political situation in the country in 1990/1991.
- First 'shock' of ODS manufacturing and export restrictions at international levels (ODS manufacturing and exporting countries).

- 'Price-effect' caused by slight increase of price of CFCs by a number of manufacturers.

In the present Country Study the average of import data from 1986-1993, which works out to be 250 M Tons is taken as basis for all considerations.

2. ODS Consumption

The pattern of consumption of ODS in Bangladesh was determined during the Reconnaissance study from a micro-survey of 203 units in different sectors out of an estimated total of 1442 units.

Table-3 summarizes the surveyed units/ industries by sectors and regions. The accompanying map of Bangladesh (Fig.-2) shows the areas where the survey was conducted.

Table-3: Summary of ODS Consumer (Sampling) Survey
Location-wise Units Surveyed and Estimated Total Units Operating in Bangladesh

Industrial Units Consuming ODS	Dhaka Region	Chittagong - Comilla Region	Khulna-Jessore Region	Rajshahi Region	Rangpur, Dinajpur & Bogra Region	Total Units Surveyed (Sampled)	Total Nos. of Such Units in Bangladesh ¹
01. Air-Conditioner Assembly Industry							About 1000 Nos.
02. Refrigerator/Deep Freezer Assembly	01	01	--	--	--	02	21
03. Air-Conditioner/Refrigerator & A/C Repair/Service Shops	39	18	19	08	08	92	[180] ⁺
04. Central A/C Installation/Service	08	03	--	--	--	11	173
05. Car Air-Conditioner Repair/Servicing	07	05	--	--	--	12	70
06. Cold Storage Units	15	06	02	07	09	39	03
07. Fish Freezing Plants	01	16	05	--	--	22	48
08. Aerosol Manufac. Industry	02	01 (ACI)	01	--	--	03	50
09. Ice Factory	04	02	01	--	--	07	6
10. Ice Cream Factory	02	--	--	06	--	08	1
11. Dairy Milk Processing	02	01	--	--	--	03	14
12. Rigid Foam Manufacture	--	--	--	--	--	--	--
13. Flexible Foam Manuf.	02	--	--	--	--	02	1
14. Fire Extinguisher Manuf.	--	--	--	--	--	--	--
15. Fire Extinguisher Servicing	01	--	--	--	--	01	6
16. Electronic Industry	--	--	--	--	--	--	1,442
17. Other Food Processing	01	--	--	--	--	01	
Total	85	53	27	21	17	203	

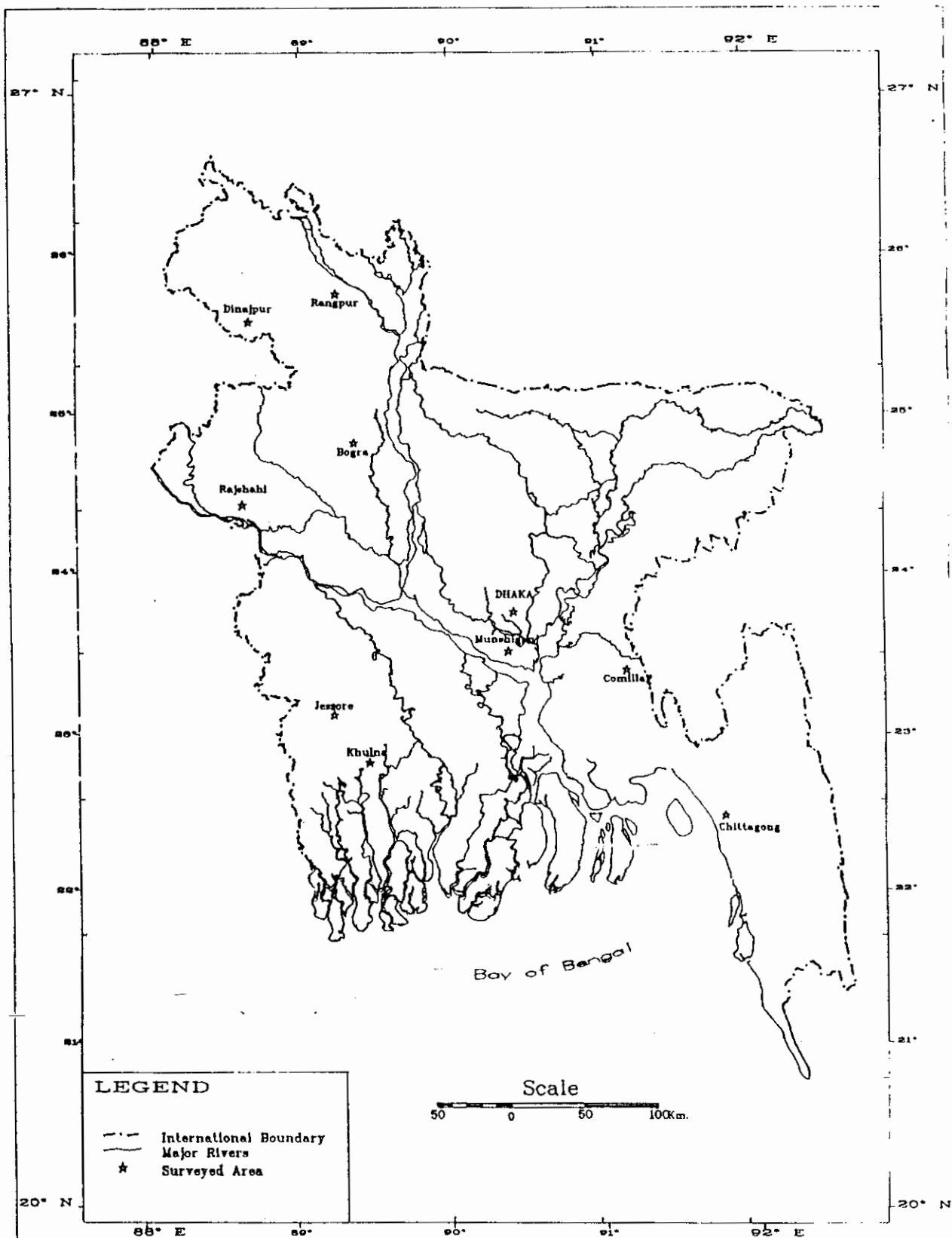
- Total approximate number of all possible ODS Consumers = 162 Units

- Numbers of Sampled (micro-surveyed) consumers = 203 Units

$$\text{Sampling} = \frac{203}{1442} = 14.08\% \text{ (avg.)}$$

¹ The total number of units in different sectors as above considers only those units which were registered with the professional associations of relevant sectors during the course of the Reconnaissance Study (December 1992 to February 1993). There may be other small units which were not registered and hence left out for consideration.

+ Car A/C Maintenance Shops included under S1. #01, 02 & 03.



GIS Centre
BCAS

THE MAP OF BANGLADESH SHOWING THE AREAS SURVEYED

FIGURE : 2

COUNTRY PROGRAMME FOR PHASING OUT THE USE OF ODS IN BANGLADESH

2.1. Strategy of Survey

The resources and time allocated for the Reconnaissance study were both limited, considering which the following strategy was adopted for the survey:

- Where the number of establishments were less than five (5), all units were surveyed.
- In case the number was large, a representative sample size (10-20%) was drawn, keeping in mind the geographical distribution within the country.

Considering the urban-oriented use of CFCs (ODS), all survey areas were limited to municipal areas of respective cities and towns, excepting for a few cold storages (in Munshiganj and Daudkandi) which were outside the municipal zones, but were within the Dhaka region. This was due to the fact that those were specifically potato-growing areas and a large number of cold storages were operating in those areas to support this business.

The survey was conducted using a carefully prepared questionnaire by ten qualified and trained surveyors (interviewers) who went to all the units surveyed in order to obtain as accurate information on ODS consumption as possible.

The survey revealed that between 1986 and 1991 Bangladesh consumed on the average 206.3 M Tons/yr. of various types of ODS.

The major findings and conclusions of the Reconnaissance Study on the consumption and

operational losses of ODS in Bangladesh are schematically represented in Figure-3 through Figure-5, as well as through the schematic overview presented in Figure-6 (ODS Balance Scenario).

- The ODS consumption in Bangladesh is dominated by the Refrigeration + Air-conditioning Assembly + Maintenance (Service) Sector with a share of 46% of all the ODS used in this country (Figure-3). The annual average consumption of all the ODS (CFC-11, CFC-12 and HCFC-22) in this sector from 1986-91 is about 95 M Tons.
- The next largest consumer of ODS is a single Aerosol Unit, Advanced Chemical Industries (former ICI, Bangladesh) Ltd. which alone consumes about 42% of the total ODS used for manufacture of an insect spray (Figure-3). The average consumption of ODS (CFC-11 and CFC-12 only) by ACI is 86 M Tons/Yr.
- All other ODS (CFCs) consuming sectors like Split + Central Air-conditioning Sector (5%), Cold Storages (2%), Fish-freezing Plants (0.6%), Ice Cream, Dairy Milk Processing and Beverage Industries consume together about 0.4% of all ODS used in Bangladesh, the total amounting to an average quantity of about 17.16 M Tons/Yr.
- CFC-12, CFC-11 and HCFC-22 are the most commonly used ODS constituting about 96% of the total ODS-mix being consumed in all different sectors (Figure-4).

Figure-3: Share of all ODS Consuming Sectors

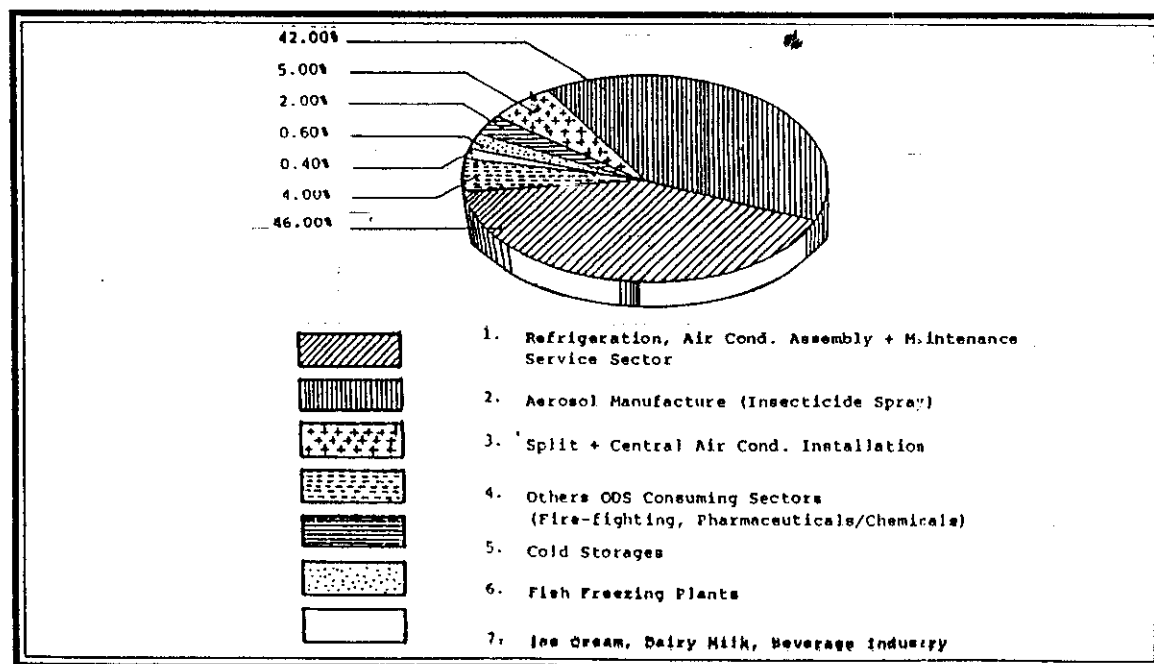


Table-4: Share of ODS Consuming Sectors

Sl. No.	ODS Consuming Sector	Average Quantity Consumed (MT)	Share (%)
1.	Air-Conditioning & Refrigeration Assembly and Servicing (Refilling) Sector	95.00	46.0
2.	Aerosol Manufacture (Insecticide Spray)	86.00	42.0
3.	Split and Central A/C Installation	11.00	5.0
4.	Cold Storage	4.00	2.0
5.	Fish Freezing Plant	1.30	0.6
6.	Ice Cream, Dairy Milk Processing and Beverage Industries	0.86	0.4
7.	Other (Fire Fighting/Pharmaceuticals/Chemicals)	8.14	4.0
	Total	206.30	100.0

Figure-4: ODS-mix As Consumed by All Sectors

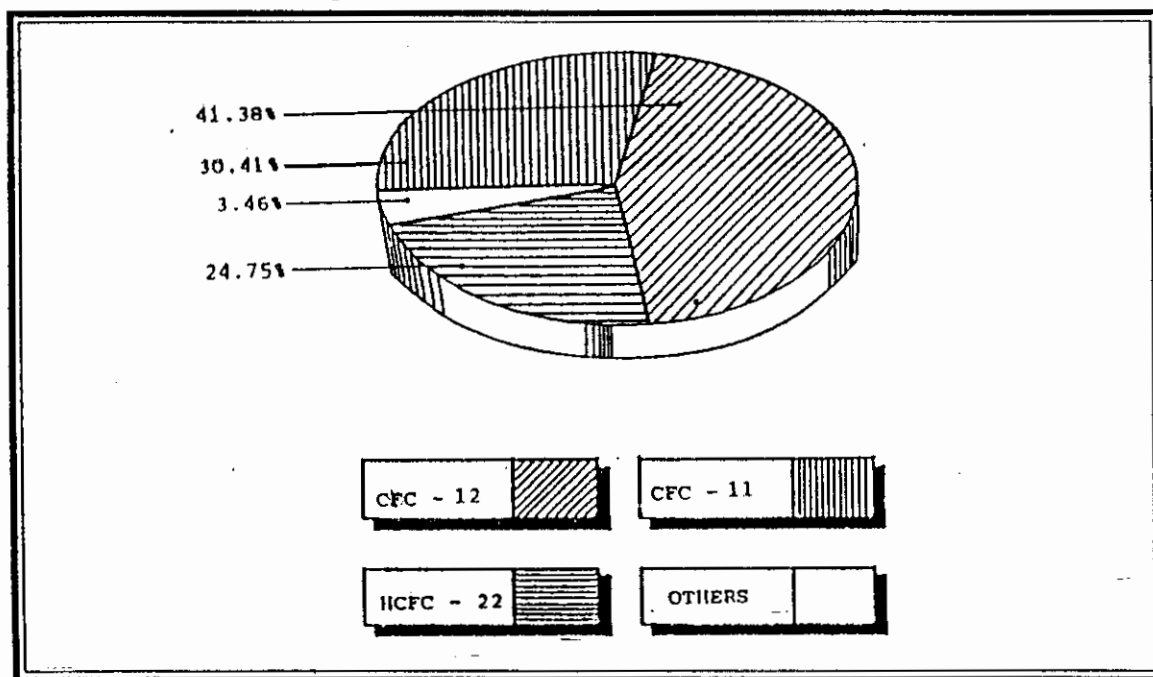


Table-5: ODS-mix As Consumed

Sl. No	Name of ODS	Average Quantity Consumed MT/Yr.	% Share
1.	CFC - 12	85.39	41.38
2.	CFC - 11	62.77	30.41
3.	HCFC	51.09	24.75
4.	CH ₃ CCl ₃	4.90	2.37
5.	CCl ₄	1.97	0.95
6.	Halon	0.27	0.14
	Total	206.30	100.0

- The use of other (non-CFCs) ODS like Methylchloroform, Carbon Tetrachloride (CTC) and Halon together account for the remaining 4% of total consumption only in the Pharmaceutical, Chemical and Fire-fighting sector respectively. The consumption amounts to an average quantity of 8.14 M Tons/Yr.

This is to be noted here that data on Consumption patterns for 1992-93 could not be obtained and henceforth excluded from the report.

3. Operational Losses

One important finding of the Reconnaissance Study is the fact that based on information provided by the consuming sectors on percentage of losses during refilling of Refrigerators, Air-conditioners, Cold storages, Fish-freezing plants, charging of Aerosol cans etc. a total of 19.6 M.Tons/Yr. was estimated to be lost just as operational losses. The actual ('Zero-loss') consumption, therefore is about 187 M Tons/Yr. (Table-6). While trying to draw an ODS Balance Scenario during the Reconnaissance Study it was further observed that a difference of 24 M.Tons/Yr. (230.3 - 206.3) existed between the total imports and total consumptions. It was concluded in the Reconnaissance Study that this difference could arise from the fact that compared to the import information/data, obtained from all known importers, the consumption data being based on sampling survey was relatively less accurate. Another possible cause of this difference is the excess stock (inventory) often maintained by the importers. Unlike the usual practice of drawing Energy Balance scenarios [IMPORTS = USE + LOSSES (+ INVENTORY)] a quasi-accurate ODS-Balance

estimate is very difficult to establish in developing countries like Bangladesh, where the service sector consumers (who are the largest ODS-users) do not regularly maintain their consumption data.

Hence, instead of focussing on this difference, found while looking at imports versus consumption of ODS in Bangladesh, more importance needs to be placed on reported operational losses, specially in the Refrigerator and Air-conditioner servicing sector, where the average value of such losses was found to be 21% or about 19.6 MT/Yr. of CFCs, based on information gathered through sampling surveys of 94 service shops.

4. PerCapita Consumption of ODS in Bangladesh

The data-base established through the Reconnaissance Study indicated that the average (1986-1991) per capita consumption of ODS in Bangladesh is very small, being 1.88 gm per year. The Copenhagen Amendment to the Montreal Protocol requires a complete phase-out of CFC and Halons by the year 1995/96 only for those countries whose per capita consumption of ODS is at or above 0.3 kg per year. Developing countries with per capita consumption below this quantity, for example, Ghana (0.007 kg per capita/year), Bangladesh (0.002 kg per capita/year in 1991) are allowed a further 10-year grace period to phase-out their ODS uses, i.e., by the year 2006.

5. Projection of Future ODS Consumption (Uninterrupted or 'Unconstrained' Demand Scenario)

The Reconnaissance Study considered the projected growth of ODS consumption (from 1986-91 / Actual)

Figure-5: Share of Operational Losses by Sectors

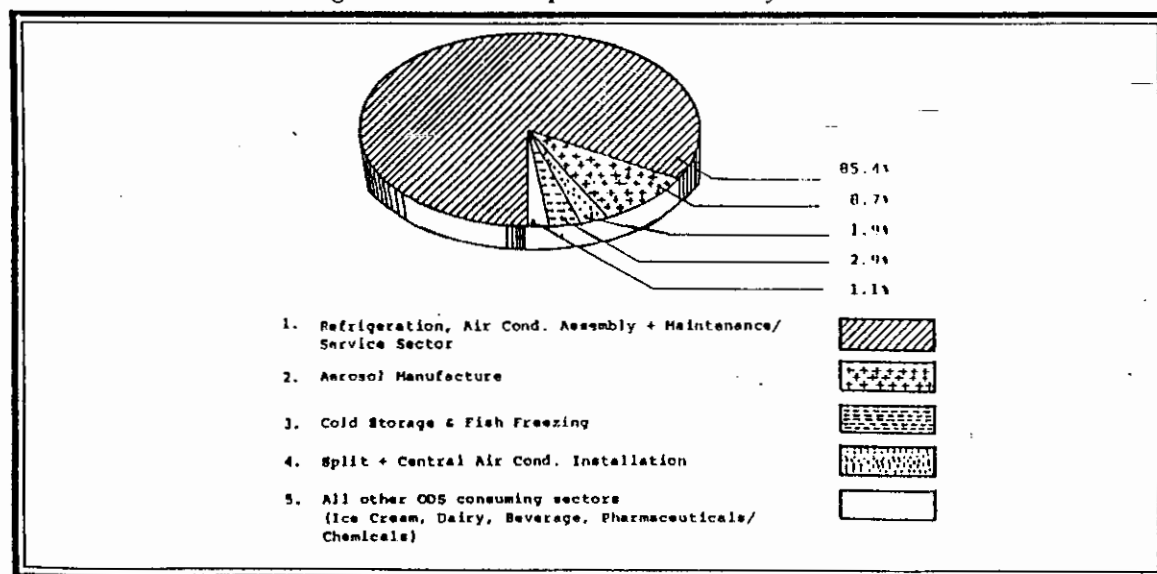


Table-6: Accounting of Estimated Losses, Theoretical Consumption and Total Average Consumptions by Each Sector

Sl. No.	ODS Consuming Sector	Theoretical Consumption (MT/Yr.)	Estimated Operational Losses (MT/Yr.)	Total Consumption (MT/Yr.)
1.	Air-Conditioning & Refrigeration Assembly and Servicing (Refilling) Sector	78.50	16.50	95.00
2.	Aerosol Manufacturing (Insecticide Spray)	84.00	1.69	86.00
3.	Split and Central A/C Installation	10.50	0.37	11.00
4.	Cold Storage	3.60	0.37	4.00
5.	Fish-freezing Plant	1.11	0.19	1.30
6.	Ice Cream, Dairy Milk Processing and Beverage Industry	0.81	0.05	0.86
7.	Other (Fire Fighting/ Pharmaceuticals/Chemicals)	7.98	0.16	8.14
Total		187.00	19.33	206.33

in Bangladesh upto year 2010 based on different assumptions like :

- Historical (past) trends of growth ('Low' or linear projection).
- Complex growth rate, taking into consideration parameters like Gross National Product (GNP) and population ('High' Exponential projection).
- Intermediate growth rate, which is average between 'low' and 'high' growth projections.

For a least developed country (LDC) like Bangladesh, in which the GNP grows very slowly, the 'Low' projection, being based on historical consumption trend is the most probable course that the growth curve is expected to follow in future (Scenario - I in Fig.-1). This is logical not only on the basis of low GNP (hence low purchasing power of people to buy luxury consumer items like Refrigerators, Air-conditioners, aerosol sprays etc.) but also based on the fact that even in absence of a strategy to phase-out ODS use in Bangladesh, the strict phase-out action plans being already started in developed countries would reduce the growth of ODS use in this country to a substantial extent due to creation of

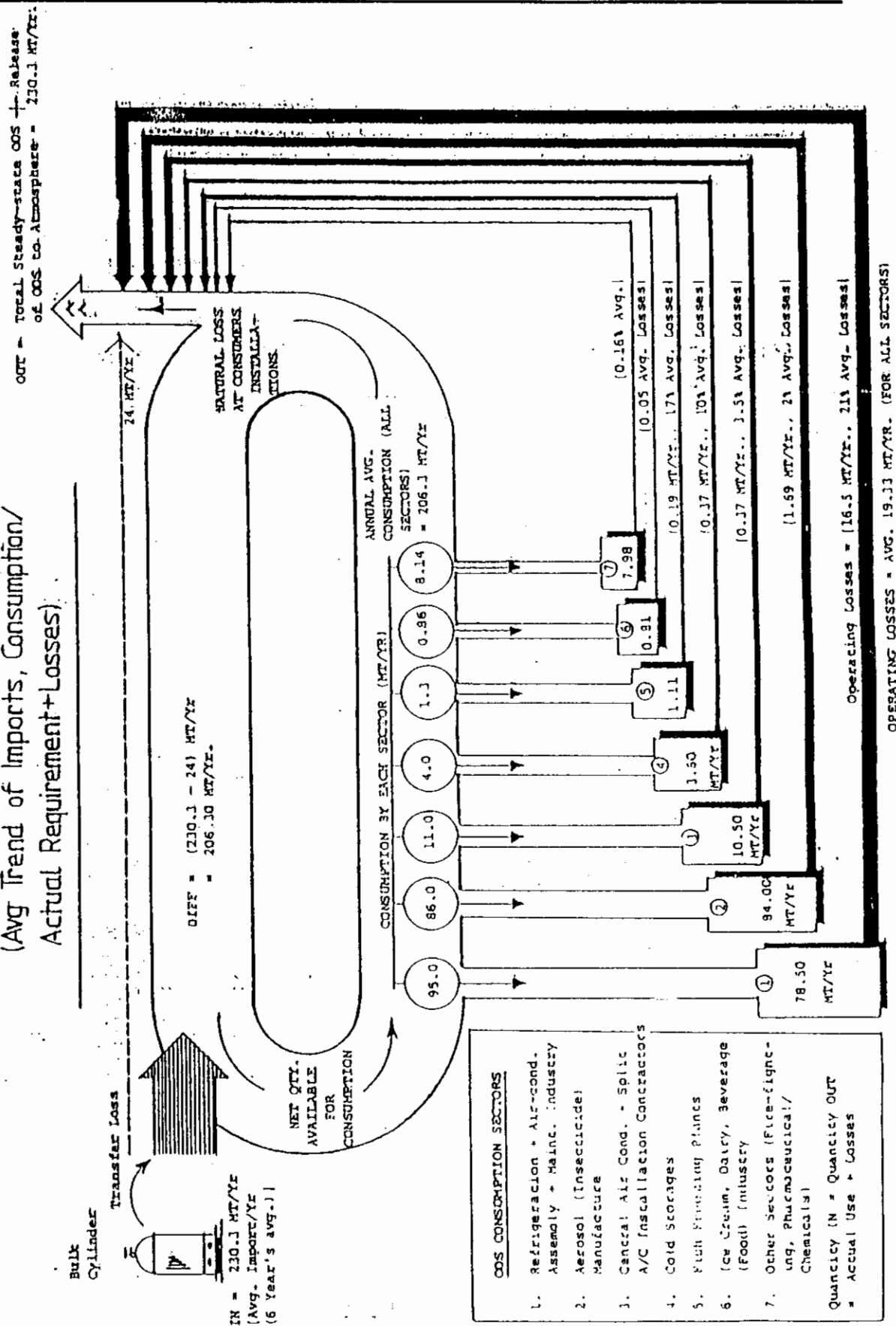
- a 'supply barrier' and
- a 'price barrier'

The 'LOW' Projection (Scenario-I/ Figure-1) indicates that if the historical consumption continues uninterruptedly, the total ODS consumption in 1993/ 94 would be slightly above 300 M Tons, which is projected to reach to 450 M Tons by year 2000 and 580 M Tons by the year 2006. This is the deadline of phase-out schedule for Bangladesh and other developing countries with current per capita ODS consumption of less than 300 gm (0.3 kg) per year.

The shaded area between the 'LOW' and 'HIGH' curves Scenarios-I and III (Fig-1) represents an 'envelope' projection and it is expected, based on all possible economic and technical parameters, that the ODS consumption in Bangladesh will lie within this 'envelope' even under most favourable socio-economic conditions of the country. In case of 'HIGH' growth (Scenario-III) the total ODS consumptions for the year 2000 and 2006 are expected to reach 678 and 1,000 M Tons respectively.

The 'HIGH' projection curve (Scenario-III) is logically considered as the 'worst-case' scenario and forms the base curve to represent an Unconstrained Demand/Consumption of ODS, i.e., the future demand/consumption scenario of ODS in Bangladesh had there been no Montreal Protocol, i.e., no action-plans to phase-out the use of ODS.

Figure-6 ODS BALANCE SCENARIO OF BANGLADESH
(Avg Trend of Imports, Consumption/
Actual Requirement+Losses)



Section D

ODS USE PHASE-OUT SCENARIOS

1. Phase-out Scenarios

With a current per capita consumption of less than 0.003 kg per annum, Bangladesh qualifies for a delayed (2006 AD, i.e., 1996 AD + 10 years) ODS phase-out, as already mentioned. However, subject to availability of global technology support (specially in substituting CFCs in the refrigeration and air-conditioning sector with cost-effective alternate refrigerants), an accelerated phase-out before the year 2006 may be possible for Bangladesh.

Two basic phase-out scenarios may, therefore, be considered:

- Scenario A-I - Phase-out as per permissible time-limit of Copenhagen Amendment of Montreal Protocol (for Article 5 countries)
- Scenario A-II - Accelerated phase-out at a pace set by availability of technology (CFC alternatives)

The consumption level of Halons, methylchloroform, carbon tetrachloride are very low and that of methyl bromide, if it is used at all, is insignificant. Therefore, these substances have not been included in the phase-out scenario.

2. Comparison of Alternative Phase-out Scenarios

Both the phase-out scenarios - A-I (Allowable) and A-II (Accelerated) - take into consideration the following National Plan for phase-out as generally identified through the Reconnaissance Study with modifications in time-schedule for concerned areas namely the Aerosol and the Refrigeration (Assembly and Service Maintenance) Sector.

The summary of the phase-out schedules considered for these two scenarios are graphically presented in Fig.-7 and are as follows :

■ Allowable Phase-out (Scenario A-I)

- 'Freeze' 1994/95 consumptions/imports of ODS at average of 1986-93 (about 250 M Tons/Yr.) level
- 50% Reduction by 1996 (i.e., bring down to approximately 125 M Ton/Yr.) through :
 - a) Conversion of Aerosol Propellant gas (a mixture of CFC-11 + CFC-12) to LPG [Project Proposal Brief I in ANNEXURE-1]
 - b) Reduction of operational losses in the Refrigeration Servicing and Maintenance

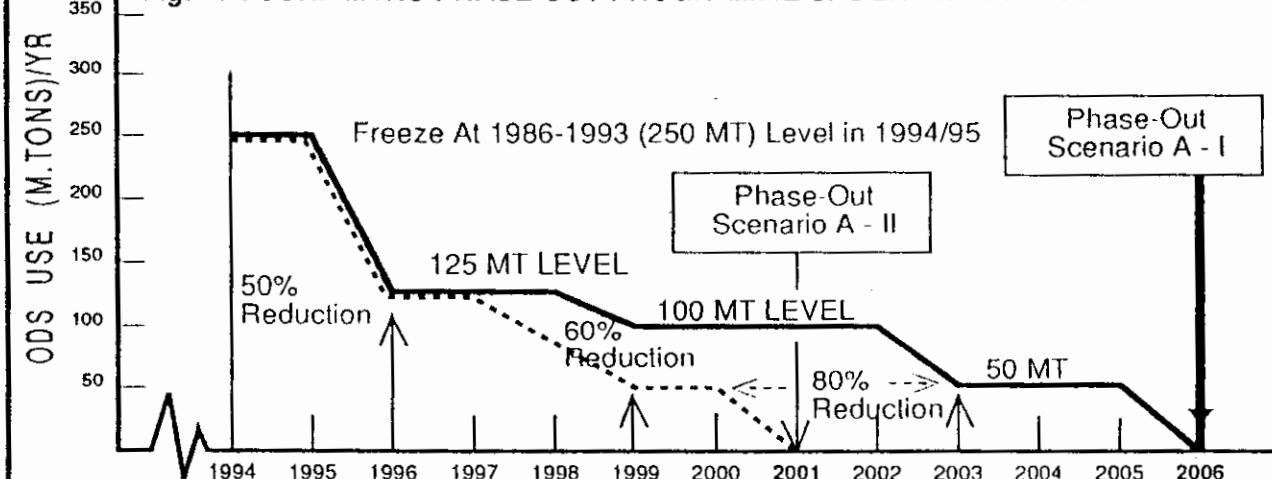
Sector through Technical Training [Project Proposal Brief - III in ANNEXURE-3].

- A further 10% drop through conversion of Large Refrigeration Units (LRUs) like Cold Storages and Fish-freezing Plants. These steps will reduce consumption to an average of 100 M Ton. level in absolute terms by the year 1999. [Project Proposal Brief II in ANNEXURE-2].
- Continuation at 100 M Ton/Yr average level upto year 2002 and reduction to an average of 50 M Ton/Yr by the year 2003. By then 50% of the CFC-based refrigeration gadgets will have been scrapped, being replaced by gadgets operating with alternative refrigerants such as HFC-134 a.
- A 100% phase-out of CFCs by the year 2006, the dead-line allowed by Copenhagen Amendment of the Montreal Protocol. By then all CFC-based old refrigeration gadgets are expected to be totally scrapped (end of refilling requirement), having finished their operational life.

■ Accelerated Phase-out (Scenario A-II)

- This scenario assumes that alternative refrigerant (HFC-134 a) based appliances start becoming available by the year 1995 and those are commercially acceptable to Bangladesh in terms of cost-competitiveness. The other assumption is that Government tariff and policy barrier (e. g. ban on import of CFC based appliances) can be imposed by the same time scale.
- As the phase-out in the Aerosol sector, implementation of conversion of LRU to ammonia-operated units will follow the same course as in Scenario A-I upto 1998, it would be possible to achieve 100% phase-out at an earlier date e. g. 2001 if the assumption as mentioned above are fulfilled.
- Since there are no basic differences in the strategy sequences, types and numbers of implementing measures, except the time scale for availability of the new technology, the Government policy imposition being a common factor, both the phase-out scenarios will involve the same magnitude of funds.

Fig. - 7 : SCHEMATIC PHASE-OUT PROGRAMME UNDER THE TWO SCENARIOS



Time Scale	Scenario A - II		100% Phase-Out		100% Phase-Out	
Activity Impact Budget	1994-96					
1) Aerosol Sector + Sub-sector	ACI Plant converts to LPG		Scenario A - II assumes accelerated phase-out (Ban on CFC-based gadgets by 1995, i.e. earlier availability of Alternative Technology) in Market		Scenario A - I assumes Allowable Phase-out (Ban on CFC gadgets in year 1999/2000 - later availability of Alternative Technology in market.)	
IMPACT	45% reduction		Aerosol Sector 100% phased-out (by 1996)			
BUDGET	US\$ 647,000.-		—		—	
2) Refrigeration & Air-Conditioning (Training + Awareness Programme)	2-year (1995-97) Programme for CFC Conservation & Public Awareness creation through intensive Training & Publicity (using mass media) Continues as Essential Sector.				Scenario A - I	
IMPACT	5% Drop		A - II : 50% Drop		100% Drop A - II Scenario 50% Drop A - I : 100% CFC phase-out by year 2006	
BUDGET	US\$ 250,000.-		—		—	
3) Refrigeration in Food Preserv/ Processing			Conversion of Large Refrigeration Units (Cold Storages, Fish-freezing Plants etc.) to Ammonia operation			
IMPACT	—		10% Reduction due to conversion of large refrigeration units		—	
BUDGET	—		US\$ 4,000,000.-		—	
4) Strategic Reserve of CFC-12			1000 MT CFC PURCHASE 1995/96		—	
JUSTIFICATION	CFC-12 Bank (Reserve)		For continued maintenance of CFC-based Refrigeration Equipment.			
BUDGET	—		US\$ 3,000,000.-		—	

* TOTAL BUDGET US\$ 897,000.- 1994-1996 7,000,000.- 1996-1998 Beyond Year 1999/2000 - no further Investments required for Bangladesh to phase-out ODS Use.

* For Institutional Strengthening another US\$ 150,000 will be required in addition to the total budget shown in this table.

Table-7: Comparative Summary of ODS Phase-out Scenarios

Major Aspects	Scenario A-I (Allowable Phase-out Schedule)	Scenario A-II (Accelerated Phase-out Schedule)
Time Schedule	Total time-scale for 100% phase-out for CFCs & other ODS : ● Year 2006, Bangladesh being a developing country (Article 5 of Montreal Protocol). This is the deadline for countries with per capita annual ODS consumption of less than 0.003 kg.	Total time-scale for ODS phase-out : ● Accelerated Phase-out Schedule by year 2001, i.e. 5 years earlier than allowable phase-out of all ODS used in Bangladesh.
Assumptions	● Alternative refrigerant (e.g. HFC 134 a) based appliances start becoming available to Bangladesh at cost-competitive prices to consumers earliest by the year 1999/2000. ● That GOB can plan and implement a total ban on import of ODS and ODS-based appliances by the year 2000.	● Alternate refrigerant based appliances start becoming available at competitive prices to consumers by 1995/96. ● That the same ban on import of ODS and ODS-based appliances can be imposed earlier, i.e. by the year 1995 due to earlier availability of commercially competitive ODS-replacement technology.
Sectoral Phase-outs	● Aerosol use of ODS (CFC-11 and 12) phased out by the year 1996. ● Use of ODS in Large Refrigeration Units (Cold Storages, Fish-Freezing Plants etc.) phased out by the year 1998. ● Use of ODS in Refrigeration and Air-conditioning sector continues as an essential sector upto year 2002 at constant level, then reduced by half due to availability of alternative refrigerant based technology and finally be phased out by the year 2006 (Dead-line).	● Aerosol use of ODS (CFC 11 and 12) phased-out by year 1996 (i.e. same as in case of Scenario - A-I) ● Same as in case of A-I i.e., ODS use in Large Refrigeration Units is phased out by the year 1998. ● Use of ODS in Refrigeration and Air-Conditioning Sector is reduced drastically by the year 1999 and finally phased out by the year 2001 due to earlier availability of cost competitive alternative refrigerant technology.
Impacts	● ODS use reduction from average 250 MT level in 1994 to 125 MT in 1996 due to phase-out of ODS use in Aerosol sector. ● Further reduction of ODS use by the year 2000 - drops to 100 MT, being limited to refrigerant use in air-conditioning and refrigeration sector. ● Drops to 50 MT by the year 2003 due to wide availability of cost competitive alternative refrigerants/ refrigerant based appliances and finally 100% phased out by the year 2006.	● Same as in case Scenario A-I. ● Reduction of ODS use by the year 1997 - drops to 100 MT, being limited to refrigerant use in air-conditioning and refrigeration sector. ● However, drastic reduction (50 MT/ Yr) by the year 1999 and final phase-out in year 2001 - all due to earlier availability of alternative technology by the year 1995/96 at cost-competitive prices.

Section E

PHASE-OUT STRATEGY : RECOMMENDED NATIONAL PHASE-OUT PLAN

Although an accelerated phase-out of ODS use (Scenario A-II) is achievable for Bangladesh, the Scenario A-I, taking full advantage of the delayed time schedule is considered to be the desirable and more pragmatic phase-out schedule for the following reasons :

- To achieve meaningful control of ODS import and use the institutional framework, particularly the setting up of the National Technical Committee for ODS phase-out and the OZONE CELL is the first priority. It may take some time for the Government to set up the machinery for the purpose and have it functioning.
- Enactment of laws for imposing tariff barrier or banning import of ODS may need time because of the bureaucratic complexities involved.

The following are the general strategies of Recommended National Phase-out Plan.

■ Short Term (2-year) Programmes involve two steps :

- Creation of an Ozone Cell within DOE and setting up the National Technical Committee.
- The only existing CFC-based Aerosol Plant ACI to be converted to LPG-based plant.
- Training and Awareness Programme for conservation of ODS (minimization of operational losses) in Refrigeration + Air-conditioning Maintenance/Service Industries.

■ Mid to Long Term Programmes involve the following :

- Conversion of Large Refrigeration Units (LRUs) to ammonia (or other appropriate CFC substitutes as refrigerants).

- Use of non CFC Refrigeration Equipment in domestic sector.
- Continuous Measures - Government Policy on such Action Plans as :

Creation of an ODS Monitoring Cell, Ozone Cell, within the Department of Environment.

Ban on import of CFC-based Refrigeration + Air-conditioning Equipment (including LRUs) as soon as new technologies become available.

If such bans are not possible, create "tariff barriers" (e.g., high import duties on CFC refrigerants and/or CFC-based equipments in spite of availability of alternate technologies in the world market).

1. Substitution of ODS by Alternative Propellants - Current Practices and Requirements

As established through the Reconnaissance Study, this is the single largest consumer sector of CFCs in Bangladesh, in which currently only one company - Advanced Chemical Industries (ACI - former ICI i.e., Imperial Chemical Industries), is still marketing an insect spray with a 50:50 mix of CFC-11 and CFC-12 as propellant gas. It's current share in ODS import/consumption is over 45% of total ODS imports of Bangladesh.

There are altogether three companies in Bangladesh which produce such aerosol insect sprays, e.g., Globe Aerosol Industries Ltd. Reckitt & Coleman and Advanced Chemical Industries (ACI). Of these Globe Aerosol Spray (brand name: Globe Insect Spray) and Reckitt & Coleman (brand name: Mortein), are using Liquid Petroleum Gases (LPG) as substitute propellant gases.

The ACI aerosol plant was established in 1970. It's capacity is 1.06 million units of 350 ml filled aerosol cans/year. Currently they are marketing about 350,000 cans/year. The plant is located within the premises of ACI Pharmaceutical complex.

It is to be noted that following the Reconnaissance Study, ACI had been seriously considering to switch over from CFC (11 and 12) propellant to alternatives, but had some reservations about the inflammability of LPG as a substitute. In this respect they had been following up closely the other two aerosol companies in Bangladesh - Globe and Reckitt & Coleman. The

details on the production capacity, LPG composition (Propane/Butane Ratio) and other technical data on this plant and the available LPG are given in ANNEXURE-I. Both Globe and Reckitt & Coleman have been successfully producing and marketing local insecticide sprays since 1991-92 based on LPG as propellant gas and till to date, there has not been any single accidents/ fire and/or explosions, either in their production plants or while in use by the customers.

Having gained confidence from the global as well as local operating experience of these two companies, ACI has finally decided to set up an LPG-based aerosol plant. Apart from the ODS-awareness the market-force of price-competition (locally available LPG is much cheaper) alone has become a major consideration for them. With this end in view ACI submitted a proposal in October 1993 to the local UNDP office to this effect, enclosing a budgetary offer from M/S KP-AEROFILL of U.K. The Price Summary of the offer obtained by ACI from AEROFILL is reproduced with detailed break-down of Equipment in ANNEXURE-I (Project Proposal Brief - I). As evident from the price summary, the F.O.B. price of the LPG-based aerosol plant quoted by AEROFILL, is U.K. £ 272,016 (US \$ 400,000). Considering the freight (estimated at 7.5% of F.O.B.), the C & F value of the plant from AEROFILL would be about US \$ 430,000.

Based on global estimates, specially the prices offered by Far Eastern Companies this budget seems to be very much on the high side. M/S Reckitt and Coleman, for example, purchased a similar plant in 1990 from Singapore (photocopy of Invoice enclosed in ANNEXURE-I under Project Proposal Brief - I) for S\$ 91,955. Considering an average escalation factor of about 8-10% per annum the same plant should cost approximately about US\$ 125,000. Reckitt & Coleman's LPG-based aerosol plant has a design capacity to fill 20 (of 300 ml. each) aerosol cans per minute, which equates to 240,000 cans/month (or 2,880,000 cans/year). They are currently producing only for 3 months (720,000 cans/year) i.e., at 25% of their maximum capacity on marketing reasons.

It may be mentioned here that, the proposed plant even at 25% production capacity will be capable of producing 720,000 spray cans which in effect is twice the present level of production of ACI. Therefore, the plant is envisaged to be able to support the growing need of the future, which in turn justifies the investment.

On discussion with the two present LPG-based aerosol producers (Globe and Reckitt & Coleman) as well as the only one in the aerosol-market (ACI) who, as already mentioned, has just applied to UNDP (local office) for availing the multilateral UNEP fund,

* Ref : Discussions with Production Department of M/S Reckitt & Colman, Chittagong.

it is felt that the requisite expert advice based on proven technical experience and guidance is very much required in this sector. The existing LPG-based aerosol producers, for example, had to rely initially on international (theoretical) literature and 'trial and error' or 'feed-back' approach. Although their aerosols based on LPG work, a number of technical guidelines are required on the following :

- Optimum Ratio of Propellant gas (LPG) versus solvent + active substances in aerosol cans.
- Spray-jet diameter optimization.
- Fire-suppressants/retardant additives (optimum ratios).
- Measures that need to be taken due to fluctuations of Propane-Butane (C_3/C_4) ratios and appropriate methods of vapour-pressure monitoring/adjustments.
- Overall standard (internationally practiced) safety regulations and fire-hazard preventive measures that need to be adopted in the LPG-based aerosol filling plants.

In view of the above considerations, the following Technical Assistance Package is developed. This involves both expatriate and local services, which will not only assist the new operator (ACI) for a switch-over from CFC to LPG-based aerosol in most professional and cost-effective manner but will also benefit all the existing and future aerosol producers to achieve an internationally acceptable standardization in terms of aerosol quality assurance plant and customer safety.

- One (1) LPG-based Aerosol Production Expert (Expatriate) x 12 months = 12 man-months.
- One (1) experienced local Chemical/Mechanical/Production Engineer (Counterpart for Technology Transfer to future plants) x 12 months = 12 local man-months.
- Total : 24 man-months of Technical Assistance Programme. (See Project Proposal Brief - I).

As enclosed in Project Proposal Brief (ANNEXURE-I) and presented in summary form in AEROSOL SECTOR PHASE-OUT-Project proposal summary, the budget for Aerosol Main component (LPG-based filling plant) + Technical Assistance Programme for a sustainable Technology Transfer to local Aerosol companies is estimated at US\$ 275,000 (125,000 + 150,000).

The cost associated with the proposed Technical Assistance package is apparently somewhat higher than the required budget for the LPG-based filling plant. But actually the latter is only the "incremental cost", not the actual investment of ACI regarding their entire plant facilities, which means that it highlights the cost required for conversion to LPG-based propellant from ODS.

2. Support Project for Aerosol Conversion Sector (Logistics of LPG Supply)

After ACI converts to LPG propellant, the total requirement of LPG will be about 600 MT/Yr. (based on maximum design capacity of 1 million cans/yr.) for all the three aerosol factories assuming that these industries plan to expand their production in near future by diversification into aerosol-based toiletries such as hairsprays, perfumes etc.

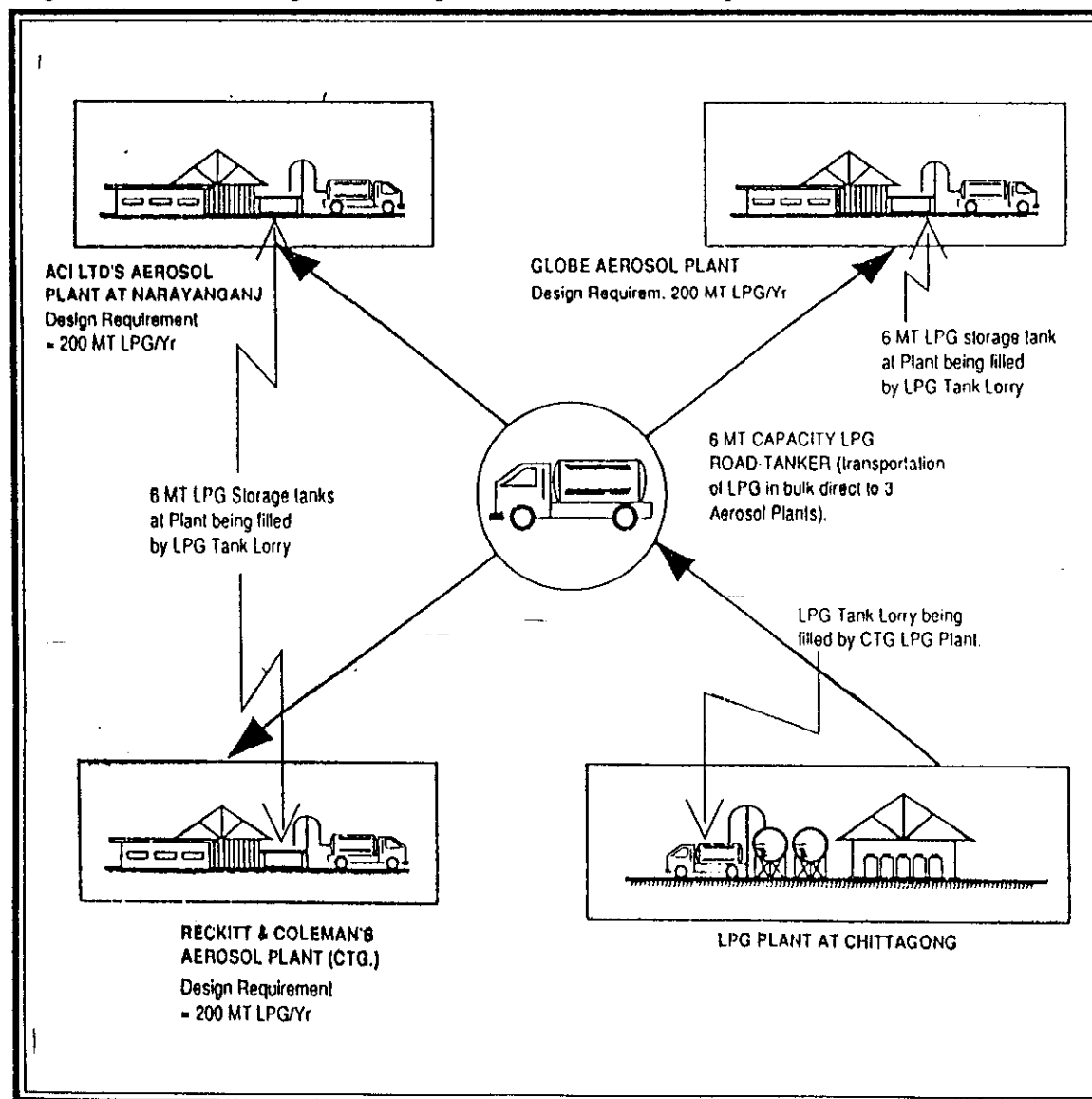
Presently, the LPG-supply to the two aerosol plants is being managed by Bangladesh Oxygen Limited (BOL)* - (Bangladesh subsidiary of British Oxygen Limited) in 45 kg cylinders (22 cylinder-fillings making a metric ton of LPG). To transport and handle an annual total of 600 MT LPG for the three aerosol

* BOL is a subsidiary of British Oxygen Limited

units in future, a bulk transportation system would be a more cost-effective way compared to smaller units of 45 kg cylinders, which would involve handling of about 470 numbers of cylinders a month by each plant (if run at design capacity). The uses of cylinders means unnecessary carriage/handling costs in terms of too much dead weight of steel.

The LPG supplying agent, BOL, is already thinking to improve such a bulk-transportation system for LPG using a 6 Ton LPG tank-lorry. As per international experience, standard 6 ton LPG (horizontal) pressure tanks (vapour pressure at Bangladesh ambient temp. in summer - 105 p.s.i.g. and Design Pressure 450 p.s.i.g.) can be mounted on appropriate truck chassis to make LPG Road Tankers more cost-effective and safe bulk transportation of LPG to these aerosol plants.

Figure-8: Schematic Diagram Showing Cost Effective Bulk Transportation of LPG to Aerosol Plants



In case of such a supply logistic system, each aerosol company can have its own horizontal storage tank (for about 5-6 days storage, i.e., another 10 MT LPG. Tank) at factory premises, which will receive weekly filling (transfer from LPG tank-lorry to such storage tank under system-pressure using special hoses, coupling systems and non-return filling valves).

The proposed support Project for Aerosol sector, involving technical components as above, is estimated to cost a further US \$ 372,000, the details being given in ANNEXURE-1 under Project Proposal Brief-1.

The total Aerosol Sector Phase-out budget for Bangladesh (incremental costs only) will, therefore, be US \$ 647,000 [i.e., US \$ (275,000 + 372,000)].

3. Substitution of ODS in Fish-freezing, Cold Storage and Other Food Processing Industries

The Reconnaissance Study identified that the total consumption of CFCs (for refilling purposes only) in the sector of large refrigeration units (LRUs) like Fish-freezing plants, Cold Storages, Ice Cream factories and Dairy Product industries amounted to about 8% of the total ODS consumption of the country.

Since completion of the Reconnaissance Study, the total number of these LRUs (in the Food Processing Sector) has increased and the updated (1993) data now stands as follows:

- Cold Storages - 180 units
- Fish-freezing - 91 units
(No increase in Dairy & Ice Plants which stayed at original number of 6 and 8 respectively).

Amongst the above LRUs the following numbers of Cold Storages and Fish-freezing Plants are currently using CFCs:

- Cold Storages - 20 units (about 10% of total)
- Fish-freezing Plants - 40 units (about 45% of total).

3.1. Choice of Refrigerants and Systems

There are two basic strategies for a developing country like Bangladesh to phase-out in this sector, namely:

- o Short-term - Conversion to HCFC-22
- o Mid to Long term - Conversion to Ammonia.

3.1.(a) Conversion to HCFC-22

An appropriate short term solution in this sector, without involving large investments, would be to

retrofit the existing CFC-12 operated units for operation with HCFC-22, which, from technical viewpoint, is very simple. The ozone depletion potential of HCFC-22 is very small compared to the same for CFC-12. In fact, it is expected by the scientific community that on this consideration nearly half of the CFC market of the world would be taken over by HCFC-22 as a short-term alternative, within the next 4-5 years, i.e., for the period 1998-99.

This short term measure involves a relatively large investment estimated at about US \$ 1.8 million (the average cost being US \$ 25,000 - 30,000 per unit for adaptation of compression capacity and management of compressor oil and oil return). Besides, Bangladesh being a hot country, the requisite design pressure may present a problem for a direct change-over from CFC-12 to HCFC-22. Taking into consideration these factors and the fact that the total consumption of ODS in this sector in Bangladesh is relatively very small, this short term option is neither necessary nor recommended for Bangladesh, and the projected cost in this sector has been omitted in calculating the incremental cost.

3.1.(b) Conversion to Ammonia

Despite being environment friendly, the availability and price of Ammonia (NH₃) makes it an ideal refrigerant for use in the LRUs of food processing industries of Bangladesh.

However, conversion of CFC-based units to ammonia demands some technical considerations. Ammonia being corrosive to the materials of constructions of different elements of the primary cooling circuit, i.e., compressor, condenser, evaporator, expansion valves etc., ammonia gas may not be compatible to the existing units. As it is discussed in the Reconnaissance Study (page 92) and in section 6.4.2.2 of the Report of the Refrigeration, Air-conditioning and Heat Pumps Technical Options Committee, 1991 Assessment Report on Montreal Protocol, one must consider the following technical factors:

- a) CFCs which are presently used in many of these large refrigeration plants do not attack such materials of construction, such as Copper, Brass, Mild-steel etc. Ammonia on the other hand, being corrosive, will require special materials e.g. Stainless Steel. All primary circuits having coils, valves, taps, vessels etc, constructed of Brass, Copper and similar materials need to be replaced by Stainless Steel in case Ammonia is used as a substitute refrigerants in HCFCs.
- b) Due to difference in thermodynamic properties use of Ammonia will require different sizing/capacity and other related design considerations, necessitating complete replacement of major equipment.

To convert such large Refrigeration units from CFC to Ammonia, a relatively large investment will be required even on incremental basis. Based on global estimates (from equipment suppliers of Singapore, South Korea etc, who are relatively cost-competitive in this region) the incremental cost of conversion of Cold Storage and Fish-freezing plants are expected to be as follows:

For average sized plants:

- Cold Storages - US\$ 100,000 per unit x 20 units.
= US \$ 2,000,000.
 - Fish-freezing - US \$ 50,000 per unit x 40 units.
= US \$ 2,000,000
-
- Total cost of conversion of all large Refrigeration units in the Food Processing Industries = US \$ 4,000,000.

It may be mentioned that this is only the incremental cost i.e. the cost of replacement of major equipments for successful operation and long life of such units.

It is estimated that through such replacement a further 10% reduction (on the present level of CFC import) would be possible by 1998-1999 which means that by the year 1999, the total annual CFC usage can be restricted to the 100 MT level (Scenario A-I, Figure-7), which is expected to continue unabated in the service sector due to domestic Refrigeration & Air-conditioning only.

A Project Proposal is presented in ANNEXURE-2 under Project Proposal Brief-II.

4. Refrigeration and Air-Conditioning Sector Phase-out Training Workshop and Awareness Programmes

As mentioned in section C.3 the Refrigeration and Air-Conditioning Service sector, comprising of over 1000 small service shops scattered all over the country, who do the job of refilling the CFC refrigerants in cooling/refrigeration gadgets, is not only the largest user but, at the same time the biggest "wasters". The share of operational losses (during filling) is 85% of all operational losses of ODS or about 16.5 MT/yr in absolute terms.

The operational losses in this sector amount to an average of about 17% of the quantity of CFC consumed in refilling. Based on current import figures of CFCs (273 MT) and neglecting the average share of about 3% for other ODS (such as Halons, Methyl chloroform etc), the 1993-94 level of operational losses of ODS in this sector is estimated to be about 25.5 MT/yr. (17% operational losses out of an estimated quantity of 150 M Tons consumed in 1993 for Refrigeration + Air-Conditioning Service Sector i.e. in absolute terms: $0.17 \times 150 \text{ MT/yr} = 25.5 \text{ MT/yr}$).

Such high operational losses have been found to be due to two basic reasons:

- Lack of proper technical knowledge/know-how of CFC-refilling operations by technical personnel engaged by service shops
- Lack of awareness (on harmful effects of CFCs/ other ODS on the Environment) of people working with such substances.

4.1. Recommended Measures - Training, Workshop Programmes and Awareness

The gaps in technical knowledge and awareness can be covered by introducing a comprehensive Training and Awareness Programme for Refrigeration and Air-Conditioning Service Sector. Basically by this approach an ODS conservation is expected to be achieved by preventing loss during refilling of refrigeration and air-conditioning units.

Out of the total annual wastage of 25.5 MT (1993-94 estimate) it is possible to reduce the annual operational losses to 12.25 M T with a two-year (1995-97) Training Workshop and Awareness Programme.

5. Certification Arrangement

It is considered in the Action Plan (see section H.5) that a certification arrangement is introduced for technicians, who successfully have completed the training programme to be initiated for refrigeration and air-condition maintenance technicians. This is similar to the licensing of A and B class electricians, arranged and monitored by the Electric Certification Board. It may be notified that, the after 2 years of successive training, technicians will not be able to carry out maintenance job without the certificate. This precondition may be bound by proper legal mechanisms and the DOE through the Ozone Cell may be made responsible for implementing it.

An attempt has been made to set the initial framework and that is, by no means, final. However, it is anticipated that a transition period (2 to 3 years), within which a public awareness programme will be carried out, will be allowed in order to ensure that all the technicians in refrigeration and air-conditioning servicing sector have been trained and made conversant with the new system before it is fully implemented.

The cost of implementing this arrangement is covered by Project Proposal Brief-III and is given in ANNEXURE-3.

6. Awareness Programme

Awareness of both the professionals and technicians involved in the refrigeration & air-conditioning sector as well as the general public on the negative impacts of ODS is absolutely essential in a developing country like Bangladesh, where the level of knowledge of even the educated people on environmental pollution and their impacts is very limited.

While such awareness sessions on environmental impacts of ODS will form an integrated part of training curriculum through audio-visual modes for the concerned technical group (Trainers and 'grass-root' level Trainees), public awareness on the subject also needs to be created through the following approaches:

- Television 'Spots' (short documentary films)
- Movie (cinema) House 'spots'
- Local Newspaper

A separate budget of US\$50,000 has been estimated (ANNEXURE-3) for above mass-media approaches for creating general awareness at the public (consumer) levels, the ultimate impact of which is expected to show up through more rigorous consumer resistance against the CFC-filled refrigeration and air-conditioning gadgets, CFC-based aerosol products etc.

The existing level of awareness of the ODS issue among the ODS users in Bangladesh varies considerably. The aerosol sector user ACI is well aware of the Protocol and are actively considering to switchover to other propellant gas, e.g., LPG. In the refrigeration and air-conditioning maintenance sector there is lack of awareness as is evident from the huge operational losses during refilling.

Among the fish-freezing industries owners the awareness is also less, as can be judged from the increase of ODS based installation between 1993 and 1994.

Since Bangladesh is a signatory to the Montreal Protocol the industries, being the users of ODS and operating under the laws of the the government and its concerned agencies, should comply with the Protocol. The industries should promote ozone friendly technologies, provide training to its workforce and raise awareness through repeated

informal talks. They should also seek guidance of the proposed Ozone Cell of DOE in order to get information about cheaper alternatives developed in the developed countries.

7. Consideration of the Problems of Essential Users

Almost 50% of CFC used in Bangladesh is accounted for maintenance of the domestic and commercial Refrigeration and Air-conditioning gadgets. Bangladesh as a developing country would naturally strive to improve the quality of life/standard of living of its people, which is directly related to use of such gadgets in the household and commercial sector. Hence, it is only logical to adopt a policy to consider and declare this sector as an **Essential Sector** - a sector which should be allowed to continue over a longer period with a base line import/consumption of approximately about 100 M Ton/year of CFC until such time that all CFC based old Refrigerators and Air-conditioners are completely scrapped. Normally the average life of such gadgets is about 7 years and in fact, the complete phase-out of CFCs as presented through Scenarios A-I and A-II (Figure-7) will depend on how soon the new refrigerant based technology is made available globally.

The philosophy behind Accelerated Phase-out (Scenario A-II by the year 2001) and the Allowable Phase-out (Scenario A-I by the year 2006) have already been discussed (under Section D). These are relevant to continuation of the use of CFCs in the Essential Sector and their ultimate replacement by the CFC substitutes (new technology-based Refrigeration and Air-conditioning gadgets). In fact the two scenarios considered whether these new technology-based Refrigeration/Air conditioning gadgets could be made available cost effectively to the public earlier (1995/96) or somewhat later (year 1999/2000).

In both cases of the phase-out scenarios, however, maintenance of the older CFC-based gadgets in this "essential sector" have to be continued because of the fact that such gadgets cannot be scrapped overnight. In order to keep these older gadgets running, occasional refilling will be continued, only if the refillable gas, i.e., CFC-12, is still available in the market. Hence, for a pragmatic planning a strategic reserve of 1000 MT CFC-12 have to be maintained in the country.

PHASE-OUT STRATEGY: RECOMMENDED NATIONAL PHASE-OUT PLAN

Keeping the consumption pattern in mind, a rough estimate gives us the following phase-out schedule of the strategic reserve of CFC :

Year	Consumption (MT)
1995	125
1996	125
1997	125
1998	125
1999	100
2000	100
2001	100
2002	80
2003	80
2004	20
2005	20

A total of 1000 MT

Since the production of CFC-12 (or any other Group-I, Annex A material) will cease by the end of 1994, in order to build-up such a national reserve, procurement should start by 1995 by the concerned countries. At a global average projected price of US \$ 3.00/kg of CFC-12, the Government will require US \$ 3.00 million to procure the reserve. Hence, a total of US \$ 3.00 million will be required to support the strategic action plan in the essential sector.

It is to be mentioned here that the reserve is not planned to serve beyond the year 2005. This is because of the fact that, by that time most of the older gadgets will have completed their life-time and will be scrapped anyway. New generation non-CFC-based gadgets will replace the older ones and no further refilling with CFCs will be required.

8. Institutional Strengthening

It is considered that the present institutional framework may not be adequate enough to implement the ODS Phase-out Plan and it needs to be strengthened. Strengthening refers to enhanced monitoring capabilities, better net-working, legal mandate and enforcement, human resource development etc. Enhanced capabilities will enable the Government to set-up the proposed National Technical Committee and the proposed Ozone Cell within the DOE. The Ozone Cell will then be able to operate in order to monitor import and use of ODS alternate technologies, conduct training and arrange certification to the technicians, provide advocacy services to the relevant industrial sector and organize awareness raising campaigns. The total cost for setting up the Ozone Cell is estimated to be US \$ 150,000.

Section F

INSTITUTIONAL FRAMEWORK FOR ODS PHASE-OUT

An Institutional Framework suitable for phasing out ODS use is not presently available in Bangladesh. Ministry of Environment and Forest looks after the environmental issues and Department of Environment (DOE) is an organ of MOEF. The following Institutional Framework is envisaged to ensure implementation of the ODS use Phase-out Plan.

1. Ministry of Environment and Forest (MOEF)

A Ministry of Environment and Forest was created in 1989. This Ministry has the following components to work on:

1. Environment and ecology.
2. Matters relating to environmental pollution control.
3. Conservation of forests and development of forest resources (Government and Private), forest inventory, grading and quality control of forest products.
4. Afforestation and regeneration of forest, extraction of forest produce.
5. Plantation of exotic cinchona and rubber.
6. Botanical gardens and botanical surveys.
7. Tree plantation.
8. Planning Cell - preparation of schemes and coordination in respect of forest.
9. Research and training in forestry.
10. Mechanical forestry operations.
11. Protection of wild birds and animals and establishment of sanctuaries.
12. Matters relating to marketing of forest produce.
13. Administration of Bangladesh Civil Service (Agriculture and Forest).
14. Liaison with international organizations and matters relating to treaties and agreements with other countries and world bodies relating to subjects allotted to this Ministry.
15. All laws on subjects allotted to this Ministry.
16. Inquiries and statistics on any of subjects allotted to this Ministry.

This Ministry is still very young and has limited capabilities. It is, however, in the process of strengthening. There is a Directorate of Forestry which looks after the Forestry Sector and the environmental affairs are the responsibility of the Department of Environment.

The Government of Bangladesh, in recent years, has attached high priority to promotion, protection and preservation of the environment. A National Environmental Policy has been enunciated. A National Environmental Management Action Plan (NEMAP) is also under preparation. All these reflect the Government's commitment on environmental protection.

Regional and International Activities of MOEF

The Ministry of Environment and Forest is the contact ministry for all the regional and international issues concerning environment dealt by UNEP, ESCAP, SACEP and other relevant international organizations. The Ministry is also the focal point of Agenda 21 and implementation of different international conventions including Montreal Protocol for the control of ozone depleting substances. The Ministry also represents the Government in most of the international meetings concerning these issues. On all these matters the Department of Environment is the technical arm of the Ministry.

2. Department of Environment (DOE)

The Department of Environment has its headquarters in Dhaka. There are four divisional offices - one each in Dhaka, Chittagong, Bogra and Khulna. Each of the divisional offices have attached laboratories - with limited equipment, mainly to analyze different parameters of water and waste water. The laboratories in Dhaka and Chittagong are better equipped than those at Khulna and Bogra.

The Department is headed by a Director General (DG) and has 25 personnel with scientific/technical training/education, and administrative and support staff. The Department is in the process of expansion with induction of more scientific/technical personnel.

The Department has, however, too many constraints to act effectively. The manpower is inadequate to discharge the responsibilities entrusted to it. The logistics, laboratory facilities, guidance and budget are also inadequate. The head of the organization has been changing frequently. They are of different backgrounds and fill the position for a limited time. This hampers the normal functions of the Department.

Responsibilities of the DOE

The Department of Environment is the national government agency responsible for environmental planning, management, protection and monitoring. As the Technical arm of the Ministry its major responsibilities include:

- coordinating environmental assessment and monitoring.
- undertaking certain assessment and monitoring tasks such as on-site surveillance of development projects.
- follow-up monitoring of development projects to determine if environmental improvement measures have been effected.
- preparing reports for submission to pertinent planning and implementing agencies.
- promoting environmental awareness through public information programmes.
- controlling and monitoring of industrial pollution.
- assisting the Ministry on technical issues.

3. ODS Phase-out and DOE

As the Government agency for implementation of different international conventions including Montreal Protocol the Department of Environment will be the appropriate government institution to implement the Action Plan to phase-out ODS use by the target date set by the Copenhagen amendment of the Montreal Protocol. In implementing the Action Plan DOE will be required to set up an Ozone Cell within the DOE for ODS phase-out. In this regard necessary rules regulations and procedures are to be enacted. The ozone cell may be created by filling up the vacant positions in the DOE.

- In implementing the Action Plan and smooth functioning of the Ozone Cell, the following organizational set-up is to be established.

To oversee and support the functions of the Ozone Cell there should be a National Technical Committee. The function of the Technical Committee will be as follows:

- to advise the government on import and export policy concerning the ODS during the transition period.
- to advise the government on the legal instruments/regulatory measures for ODS phase out and submit specific proposals for ODS phase out to MOEF.
- to create public awareness on environmental problems caused by ODS.
- to approve environmental impact assessment (EIA) of all new industrial projects using ODS or any interim substitutes before project implementation is permitted.

- The National Technical Committee may be set up with the following members:

- A representative from the Ministry of Finance.
- First Secretary, Customs, Board of Revenue.
- A representative of the Ministry of Industries not below the rank of Deputy Secretary.
- A representative of the Board of Investment not below the rank of Deputy Secretary.
- A Deputy Secretary of the Ministry of Commerce.
- A Director of the National Tariff Commission.
- A Deputy Secretary to the Ministry of Science and Technology.
- Chief Inspector, Factories Inspectorate Department.
- Chairman or his representative from Bangladesh Federation of Chambers of Commerce.
- President or his representative from National Refrigeration and Air-condition Workshop Owners Association.
- Executive Director, Bangladesh Centre for Advanced Studies.
- President or his representative from the Forum of Environmental Journalists.

The committee should be empowered to co-opt any other relevant persons as member.

- The Technical Committee will submit specific proposals to the MOEF for phase out of ODS. The MOEF, after inter-Ministerial discussion and comments, will submit specific proposals to the cabinet for approval and subsequent action by the ozone cell.

- The Ozone Cell may be headed by the Director General of DOE to be actively assisted by a full time Director of DOE and his staff.

- The functions of the Ozone cell may include the following:

- to act as the Secretariat for the National Technical Committee for ODS.
- to co-ordinate and facilitate activities related to the phase-out of ODS.
- to continuously monitor activities related to ODS use in Bangladesh and report on Bangladesh's compliance with Copenhagen Amendment to the Montreal Protocol to the Ozone Secretariat.
- to collect, collate, analyze and disseminate information on the ozone problem and related issues.

- to grant permits for ODS import during the transition period (1996 to 2006).
- to facilitate exchange of information with other parties and organs established by the Protocol.
- to facilitate access of local information with other parties and organs established by the protocol.
- to facilitate access of local entrepreneurs to relevant information, particularly the Ozone Action Computerized Information System to relevant experts, specialists involved in technology transfer.
- to organize seminar/workshop etc. for the purpose of recycling, reclamation and substitute of ODS.
- to participate in relevant meetings on ozone issues.
- to organize OZONE WEEK and arrange Certification with the help of an environmental NGO and Technology Training Centre.

■ Involvement of different Government and Non-Government agencies

The National Technical Committee and the ozone cell will have to work in collaboration with other Government and Non-Government agencies to be able to effectively implement the Action Plan for ODS phase-out.

4. Government Agencies

● Ministry of Finance

Ministry of Finance has the legislative power with respect to taxes and tariffs. The ministry must be involved if any financial incentives/disincentives concerning ODS and ODS related equipment are introduced.

● National Board of Revenue (NBR)

NBR works under the Ministry of Finance and is responsible for enforcing and collection of duties and taxes through the Customs and Excise services. Also the proposed monitoring system for ODS import is based on the assumption that NBR through its Customs and Excise services will provide copies of all import declaration concerning ODS to the Ozone Cell through appropriate import-monitoring system using a newly formulated H. S. coding.

● Ministry of Industries

The ministry of Industries is responsible for formulation of industrial policies, control and regulation of existing industries. The ministry is also in charge of permitting establishment and operations

of all new industries and has the power of preventing setting up of new industries using ODS and of banning use of ODS in the existing industries. In this capacity the representative of this ministry in the National Technical Committee will have a very important role to play.

● Board of Investment

Board of Investment is an autonomous body established for promoting speedy implementations of industrial projects and to provide infrastructural support and registrations. The Board will have the authority to ban use of ODS in new industrial ventures. It can also provide investment opportunities for the ODS substitution products.

● Ministry of Commerce

Ministry of Commerce controls the import and export of commodities in Bangladesh. It has the authority to ban import of ODS into the country in accordance with the proposed Action Plan for ODS phase-out.

The Ministry is represented in the National Committee for ODS phase-out and has a very important role in implementing the Action Plan.

● National Tariff Commission

National Tariff Commission, by creating tariff barrier to the import of ODS, will have significant contribution to the reduction of import of ODS presently being used and provide incentive to the use of ozone friendlier substitution products.

● Ministry of Science and Technology

This ministry in collaboration with the Bangladesh Council of Scientific and Industrial Research (BCSIR) is to provide scientific back up service for technological research based on locally available substitutes and develop environment friendly and user friendly substitution products and technologies. Both are represented in the National Committee.

● Factories Inspectorate Department

Factory Inspectorate Department has the responsibility of overseeing the safety and occupational health of the work places in the industries. Substitution products of CFCs may include inflammable substances. It is essential that appropriate safety measures are included in the project. The Department can also assist the ozone cell in identifying the industries who use ODS or their substitution products.

- **Bangladesh Fisheries Development Corporation**

Fisheries are a growing industrial sector. The corporation is in a position to raise awareness to the industries in this sector about ODS and guide the sectoral industries in phasing out ODS use through providing technical support.

- **Ministry of Law**

One of the key element in ODS phase-out Action Plan is the enactment of legal basis for regulating and monitoring ODS phase-out. The Ministry is represented in the National Committee to assist in drafting appropriate laws and regulations/acts to be in force for implementing the Action Plan.

- **Ministry of Information**

A very important part of the attempt to phase-out ODS is creation of awareness among the people about ODS. The Ministry of information will provide media support in raising people's awareness.

5. Informal and Private Sector

- **Bangladesh Frozen Food Exporters Association**

The Association comprising of owners of Fish-freezing plants will act as a clearing house for dissemination of information about ODS well ahead of time to its members for switching over to substitution technologies. A complete list of the members of this Association is given in ANNEXURE-6.

- **Bangladesh Pesticide Association**

Some ODS like methyl bromide, methyl chloroform are being used on a limited scale as insect killers or fumigating agents. Close contact with the Ozone Cell through the National Committee will enable the Association to raise awareness of its members about ODS and discourage use of ODS as well as provide information about safer products.

- **National Refrigeration and Air-Conditioning Workshop Owners Association**

In implementing the Action Plan this Association will be a significant contributor. It has about 1000 member workshops. The main objective of the Association is to support members with respect to professional, economic as well as social issues. The Association can be actively involved in the training of air-conditioning and refrigeration technicians on recycling, reclamation and refilling technologies in ODS in close coordination with the Ozone Cell and the relevant NGO who will be involved in imparting the proposed Training Programme.

- **Commerce and Industry Associations**

The various Commerce and Industry Associations in the country can play a very important part in implementing the Action Plan through its active participation in the attainment of the target for ODS phase-out.

- **Cold Storage Association**

The Association will be involved in rendering technical and logistic support to its members who require structural adjustment in switching over to the environment friendly technologies.

- **Bangladesh Federation of Commerce and Industries**

A representative of the Federation in the National Technical Committee will help disseminate relevant information about ODS phase-out to its members on a regular basis.

- **Non-Government Organizations (NGO)**

A large number of NGO's operating in Bangladesh are already involved in environmental issues. Their continued assistance in raising awareness about ODS would be a significant contribution towards reduction in ODS use.

Section G

GOVERNMENT POLICY FRAMEWORK

Government Response to the Montreal Protocol

Historically, the Government of Bangladesh has always been a party to international initiatives taken to save the ozone layer and to reduce the use of substances that deplete the ozone layer. As a result, the government became a signatory to the Vienna Convention and to the Montreal Protocol and ratified both on 2nd August, 1990. The latter has been amended by the Parties, once in London (June, 1990) and later in Copenhagen (November, 1992). The Copenhagen Amendment to the Montreal Protocol was adopted on 25 November 1992 and entered into force on 14 June, 1994. Bangladesh already has ratified the London Amendment. However, the Copenhagen Amendment has not yet been ratified.

The Copenhagen Amendment to the Montreal Protocol put forward the dead-line for complete phase-out of ODS. As a result the phase-out scenarios applicable to Bangladesh considered priority actions to comply with the Amended Protocol. However, the priority actions are incorporated in the recommended National Phase-out Plan as parts of the projects proposed in Section E. Although the Copenhagen Amendment is considered instead of the relaxed London Amendment, no cost would be required in addition to the incremental cost.

Since MOEF represents the government in taking part in international activities, the responsibility of ratifying the Copenhagen Amendment of the Montreal Protocol lies on its shoulder. It is expected that the Ministry will review the amended Protocol and take necessary steps allowing the government to seek financial assistance from the Multilateral Fund.

The Montreal Protocol provides in Article 10 for a financial mechanism to assist parties under Article 5

paragraph 1 to comply with the control measures of the Protocol. The Government of Bangladesh decided to follow the procedures to receive the assistance and as a first step, contracted Bangladesh Centre for Advanced Studies (BCAS) to carry out a Reconnaissance Study of ODS use in Bangladesh. Supported by UNDP, the study was completed in February 1993. As a follow-up of the study, the current Country Programme for Phasing Out the Use of ODS is prepared, again by BCAS, on behalf of the Government of Bangladesh and with assistance from UNDP.

With the preparation of the Country Programme, policies, strategies and action plan will be suggested to be formulated to achieve the objective of the protocol.

The preparation of this Country Programme reflects the commitment of the Government of Bangladesh to fulfil its obligations as a party to the Montreal protocol.

Environmental Legislation

The main piece of legislation concerning environmental management and pollution control is the "Environmental Pollution Control Ordinance, 1977". This legislation or any other legislation now in practice in the field of environmental management in the country have no implication or bearing on the control of ODS use in the country.

An important step in the implementation of the Country Programme will be to enact legislation for control, regulate and ultimately ban the import and use of ODS in Bangladesh by the target date. The National Technical Committee will recommend enactment of such laws and regulations. The legislation will make it binding for different government agencies like customs, excise, ministries of industries, commerce to take well concerted actions in phasing out ODS use in Bangladesh.

Section II

ACTION PLAN

The phase-out of ODS use in Bangladesh by the target date calls for a specific action plan which will be implemented by the Government agencies along with the private and informal sector.

Government Actions

The Government actions recommended for implementing the proposed phase-out schedules fall into the following categories:

- a) Development of the **institutional framework** for implementation of the Action Plan
- b) Strengthening of the **policy framework** required for the implementation.
- c) Introduction of a **monitoring system** for ODS import and use.
- d) Introduction of **regulatory measures** on the import and use of ODS.
- e) Introduction of **training and certification** arrangements for refrigeration workshop technicians.
- f) Creation of **public awareness** about ODS.

This is to be mentioned here that both the proposed phase-out schedules (A-I and A-II) are achievable following the same Action Plan and utilizing the same budgetary allocation and both the schedules have properly accommodated the phase-out deadlines provided by the Copenhagen Amendment of the Montreal Protocol. In proposing the Government Action Plans, due attention has been given so that both the schedules could be achieved.

Each of the elements of Government actions are discussed below:

1. Institutional Framework

The first step toward implementation of the Action plan would be to set up a National Technical Committee for ODS phase-out and an Ozone Cell within the Department of Environment of the Ministry of Environment and Forest. The financial requirement for this action for the period 1995-1997 is estimated to be US\$ 150,000.

2. Policy Framework

The salient features of policy level interventions would be the following:

- Ratification of Copenhagen Amendment of Montreal Protocol and thereby strengthen international activities regarding environmental protection.
- Formation of the Ozone Cell and the National Technical Committee to guide through the functions of the cell.
- Creation of "import barrier" on CFC and CFC-based gadgets. Provide "Incentives" for import of ozone friendly technologies.
- Enactment of laws (including Acts/Ordinances) regarding implementation of bans on import and use of ODS beyond the phase-out deadlines.

3. Monitoring System

A monitoring system for ODS use by substance is to be introduced in Bangladesh. The system should require all importers of controlled substances to obtain permission for import from the Ozone Cell of DOE before import process can be initiated. The Customs Department will supply copies of all import declarations concerning ODS to the Ozone Cell, enabling the cell to be in control of all imports of ODS, classified according to substance, origin and importer. In order to facilitate the monitoring process, a special H.S. coding (with sub-headings) system should be introduced for all ODS.

Ministry of Industries, Ministry of Fisheries and Ministry of Agriculture will inform the Ozone Cell of any proposal for setting up of any industry based on ODS as refrigerant.

Importers will be required to keep records of the end-users of ODS and send quarterly report of the ODS sale by substance and user to the Ozone Cell of DOE.

ACTION PLAN

The financial implication of the monitoring action are included in the project proposal for the development of the institutional framework.

4. Regulatory Measures

For effective implementation of the ODS phase-out plan the following regulatory measures are recommended:

- a) **Bans** on the use of ODS for different purposes may be introduced at specifically given dates for each. A draft schedule of proposed ban is given in Table 7. This is by no means a definite schedule, but may be used as a guideline. Before introducing the ban, however, a more detailed study of the consumption pattern in different sector and consultation with ODS users may be

undertaken. The services of a legal and an economic consultant may be used for these activities.

This is to be mentioned here that, from a realistic point of view, without the proposed "strategic reserve" (section E-7) bans can not be imposed before the year 2000 since latest technologies/products may not be made available and or economically viable for Bangladesh.

- b) In order to discourage import of ODS or ODS using equipments a special ODS tax on the import of all controlled substances may be imposed. Such a tax will, hopefully, encourage substitution of ODS in sectors where substitution may be easily accomplished.

Table-8: Proposed Schedule of Bans on ODS Use in Bangladesh (Under Scenario A-I)

The use of ODS is allowed in the production and servicing of the below listed application areas until the given date.	
All CFCs[#]:	
1. Servicing of domestic and commercial refrigerators	January 1st, 2005
2. Installation of Industrial refrigeration and air-conditioning equipment	January 1st, 1999
3. Servicing of industrial refrigeration and air-conditioning equipment	January 1st, 2005
4. Servicing of mobile air-conditioners	January 1st, 2005
5. Import of new refrigeration equipment/appliances	January 1st, 2000
All halons:	
6. Import/installation of new portable/transportable fire fighting equipment	January 1st, 1995
7. Servicing of halon fire fighting equipment installed before Jan. 1st, 1990	January 1st, 1995
Carbon tetrachloride:	
8. All uses	January 1st, 1996*
Methyl chloroform:	
9. All uses	January 1st, 1997*
Other uses[¶]:	
10. All other uses not mentioned above	January 1st, 1996

[#] Ban on CFC-based servicing sector may only be imposed if the "strategic reserve" is maintained.

* Subject to availability of replacement solvents.

[¶] Uses of ODSs for research, laboratory purposes and special essential uses (if any) are so far not regulated. Recycled ODSs are not regulated either.

The revenue from the ODS tax could be used to partly finance the activities of the National Technical Committee for ODS and the Ozone Cell. The revenue may also be used for financing minor projects aimed at ODS substitution, creation of public awareness or other projects related to ODS phase-out. A tax of US \$ 0.5-1.0 per kg is suggested. The tax could be progressively increased as the target date of complete phase-out of each controlled substance approaches.

- c) To encourage import of ODS substitution and/or conservation technology, tax exemptions for such imports may be considered. Imports of ODS conserving technology such as recovery and recycling machines should be partially or totally exempted from general import duty.

The "sacrificing revenue" due to tax exemptions, instead of being collected, would be recorded and calculated in each financial year by the National Board of Revenue. When the international communities will agree upon exchanging environmental credit and carbon tax, this sacrificing revenue could then be compensated and realized.

- d) The monitoring of regulatory measures will be the responsibility of the National Committee on ODS. Since this committee has no legislative and enforcement powers it will act by making recommendations to other Ministries and Government agencies, especially the Ministry of Finance, Ministry of Commerce, National Board of Revenue, Ministry of Industries, and the Factory Inspectorate. The ODS taxes will be collected by the Customs and Excise wing of the National Board of Revenue and will be provided to the Ozone Cell to meet the partial resource requirements of the cell.

5. Training and Certifications

To achieve this ODS conservation Programme as well as transfer of technology (practical know-how) to maintain and service refrigeration and air-conditioning equipment in most professional manner, including the alternate refrigerant use, the following Technical Assistance Package is recommended:

- One Expatriate Refrigeration and Air-conditioning Expert having specialized operating knowledge in the following:

- Refilling of CFCs using existing technology with minimum CFC losses
- Collection of used CFCs from refrigeration equipment (without venting to atmosphere)
- CFC Recycling Techniques
- Use of Alternate Refrigerants (e.g. HFC 134a)
- Handling & refilling techniques (both theory and practical demonstration)

Duration : 6 man-months

- A Local Refrigeration and Air-Conditioning Consultant (as Counterpart) for the T.A. Programme

Duration 24 man-months

Total duration : 30 man-months
of Expert service only.

Apart from the services of the expatriate and local experts, the following programmes should also form an integrated part of this package:

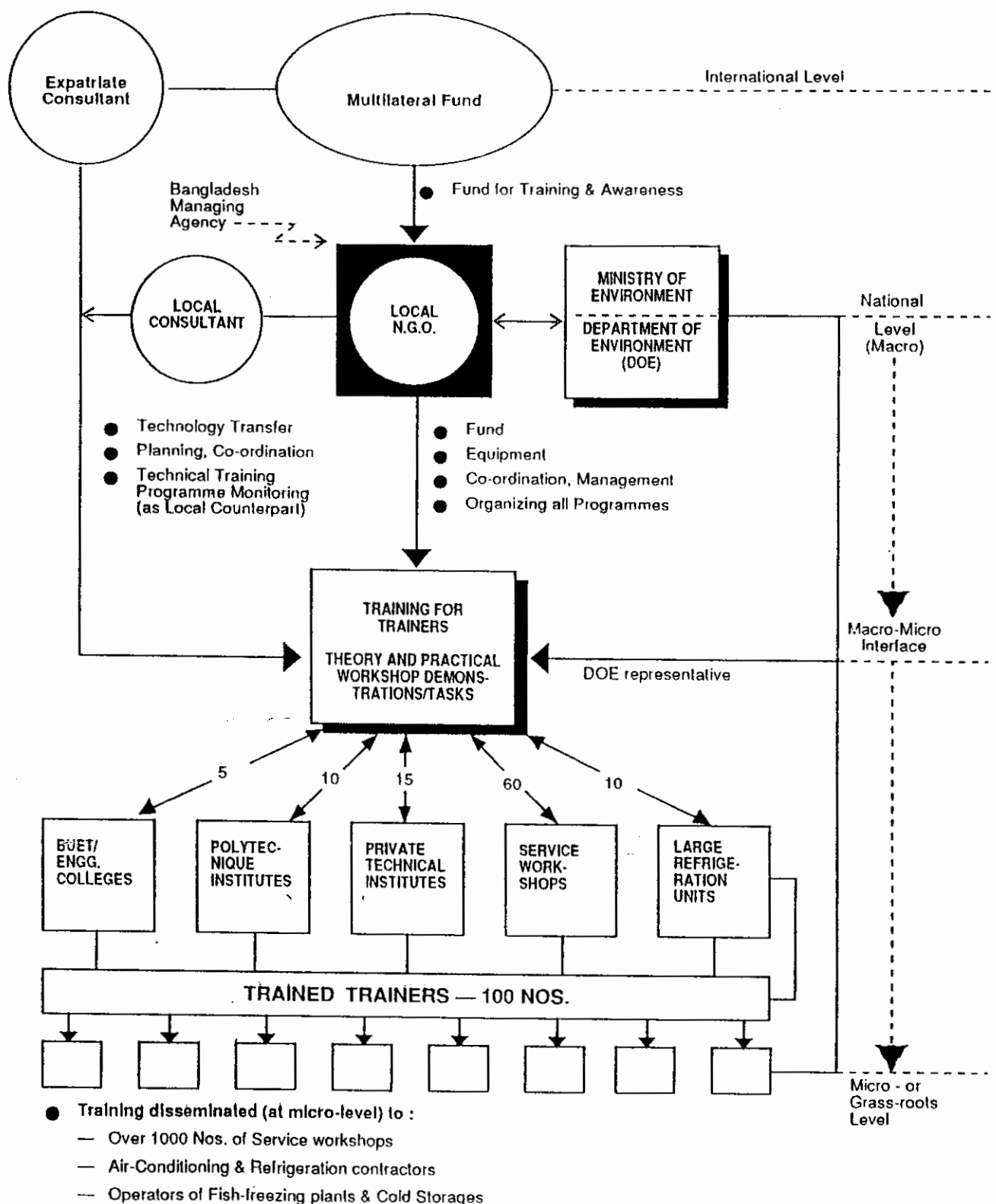
- o Audio-Visual Training Materials (Projector, VCR/TV/Cassettes)
- o Technical Literature (Practice-Oriented Service Manuals)
- o Demonstration Equipment/Instrumentations (e.g. CFC sensors/ Detecting Instruments, Evacuating Pumps, Refilling Modules, Transfer Cylinders, Manometers, Capillaries, Multi-testmeters, Tool Sets, Cut-Way Models of Compressors, etc.).

5.1. Approach and Mode of Training/Awareness Programme

The approach and the mode of the Training and Awareness Programme is recommended to be as per the schematic model given in Figure-9.

As evident from this schematic model, a competent Non-government Organization (NGO) is proposed to be supported by the multi-lateral fund for organizing, managing and operating the whole Training and Awareness Programme in the Refrigeration + Air-conditioning sector, with a co-ordination function between Department of Environment (DOE) - ODS Monitoring and Phase-out Cell and the practical operators at Micro or grass-roots level.

Fig - 9 : PROPOSED MODEL FOR A SUSTAINABLE TRAINING & AWARENESS PROGRAMME



5.2. Training for the Trainers

For initiating a sustainable Training and Awareness Programme at the grass-roots level, the first step should be to organize and manage a "Training for the Trainers." The ultimate target is to impart practical training to refrigeration technicians (highly skilled and skilled levels), who essentially constitute the 'macro-micro' interface, carefully chosen from the private Air-conditioning & Refrigeration service industry of Bangladesh.

A target group comprising of 100 selected representatives with adequate background in refrigeration servicing is recommended to be imparted an intensive hands-on technical training on Conservation of Refrigerant Gas During Servicing.

Although the trainers, who will receive such a training course should be selected from all technical institutions of the country involved in imparting basic refrigeration courses, the maximum weightage should be put in training representatives (trainers) from Service Workshops and Private Technical Institutes, as these are the 'grass-root' level institutions who directly apply their know-how to practice. A suggested break-down of the proposed 100 representatives (trainers) from different institutions is as follows:

Participants from	Numbers
Service Workshops	60
Private Technical Institute	15
Cold Storage & Fish-freezing Units (Large Refr. Plants)	10
Polytechnic Institutes	10
Bangladesh University of Engineering and Technology (BUET)	5
* Total Representatives to be selected	100

The training will be provided in 4 sessions, each with 25 participants and a complete session will last for 5 weeks. The expatriate consultant will talk about refilling of CFCs on old gadgets with minimum CFC loss, collection of used CFCs from refrigeration equipments, CFC recycling techniques, use of alternate refrigerants and safe handling techniques. The series of lectures will be accompanied by audio-visual demonstration. The local expert will act as a facilitator in explaining the technical aspects of the proceedings in a user-friendly manner. Finally the participants will have ample opportunity to initiate the audio-visual demonstrations and thus will gain practical experience.

5.3. Certifications

At the end of the training each of the participants will be given a particular task to carry-out in order to judge his/her skill acquired through the training imparted. On satisfactory completion of the training each of the successful participants will be awarded with a certificate.

5.4. Training Dissemination by the Trainers

The entire step involving further dissemination of training has three modalities:

- Training arranged by the local consultant.
- Training offered by the "newly graduated" trainers.
- Training courses organized by an institute.

5.5. Role of Local Consultant

For training of the Trainers the major role will be played by the expatriate expert along with his local counterpart. The expatriate is expected to leave after six (6) months, by then the associated local (counterpart) Consultant is expected to pick-up international-level technical knowledge and skill to:

- i) further continue the "Training for the Trainers" programme for another eighteen (18) man-months of his tenure independently
- ii) continue to manage, co-ordinate and monitor the actual dissemination of knowledge and training to technician level workers engaged in this particular ODS-consuming sector.

The Ozone Cell could provide him the necessary logistic support in arranging such training sessions. Instead of having a random selection of participants from all the sectors at a time, he may concentrate mainly on the refrigeration and air-conditioning servicing sector and disseminate the technical know-how. The Ozone Cell will liaise with the Association of Refrigeration and Air-conditioning Service Centres in order to organize such a programme.

In 18 months, he is supposed to arrange, with the help of the Ozone Cell and the environmental NGO, at least 10 training sessions and impart training to 250 "trainers" from different sector. At the end of each of his training sessions certificates will be awarded to the successful trainees.

5.6. Training by the Trainers

Once the proposed 100 nos. Trainers are trained properly, this core group of trainers will disseminate their technical know-how at the service shop/

ACTION PLAN

practical installation, maintenance and service levels of the entire Refrigeration and Air-conditioning sector of Bangladesh.

The desired mode of transfer of technology at this grass-root level would be 90% through practical demonstrations and only 10% theoretical courses to standardize the professional skill of service jobs (filling/ refilling of CFCs and their alternatives such as HFC 134a, Ammonia etc.), as well as use of retrofit in existing CFC gadgets for their conversion to alternative refrigerant operation.

A core group of about 70 certified technicians from the service workshops and LRUs will demonstrate their newly acquired technical knowledge to their fellow workers. It is expected that, once the "lead technicians/skills" go back to their respective practical job places the "seeds" to disseminate the technical know how are planted. It is these professionally trained skilled level who will spread their professional knowledge (received during execution of Training for the Trainers programmes) amongst a large number of their assistants, apprentices and associated technicians and/or institutions.

While the major dissemination of professional knowledge will take place through direct further practical work-sub-ordinates and associates, provision has been considered to facilitate the training with audio-visual demonstrations in seminar sessions which would be organized by the environmental NGO. A realistic budget for such seminars have been estimated at Tk 150,000/- per

seminar or a total of Tk 1,800,000/- (about US \$ 50,000) over the entire training period of 24 months. The details of the budget is given in ANNEXURE-3 under Project Proposal Brief III.

This is envisaged predominantly as a demand driven mode of dissemination of technical know-how and fits well with the existing method of doing the same in Bangladesh.

However, in order to continue "certification" process, the Ozone Cell in cooperation with the local NGO will arrange "certification week" every 6 months. During this week those who will be able to demonstrate their skill, will be awarded his/her certificate. The fund for conducting such a week-long programme will be provided by the Ozone Cell from their operational cost. Depending on the demand, the certification week may be conducted more than twice a year.

5.7. Institutional Approach

An institution, similar to the proposed Technology Transfer Centre (TTC), can be established in the country. In order to ensure quality of training at least 50% of their trainers should be selected from the first 100 "certified trainers". Since this training institute will be a privately operated body, those who need to be trained will essentially buy the training as it happens in many other sectors all over the country. Once trained, the trainees will wait for the certification week to be jointly organized by Ozone Cell and the local NGO to obtain the certificate and start/continue his professional life thereafter.

TECHNOLOGY TRANSFER CENTRE : A CASE STUDY

In this connection, it is worth mentioning that in 1991 a team of experts from Japan Association of Refrigerating and Air-conditioning Contractors (JARAC) visited Thailand, Bangladesh, India and Pakistan to explore the feasibility of setting up Refrigeration Training Institutes in these developing countries with their technical collaboration with the following objectives:

- i) To create an inventory of highly skilled refrigeration & air-conditioning technicians in these low-cost production bases with the ultimate objective of either relocating their existing CFC-based refrigeration gadget manufacturing units in these countries since Japan, being a developed country, has to phase-out ODS by year 1996
- ii) To transfer the professional knowledge and skill of minimizing the release of CFCs during service (refilling) operations of Japanese refrigeration gadgets marketed in these countries, being obligated

to do so if and when such relocations of CFC-based refrigeration equipment are made in these countries

- iii) To utilize, on short-term, the services of such trained refrigeration technicians in Japanese Refrigeration & Air-Conditioning industries through on-the-job training programmes in Japan.

A detailed Feasibility Study on establishment of such a Refrigeration and Air-conditioning Training Institute in Bangladesh was conducted by Associated Resources Management Company (ARMCO), being commissioned by JARAC, in 1991. Being encouraged by the positive findings and recommendations of this study a Draft Agreement has been signed between JARAC, and ARMCO, at Tokyo on 27 July 1993 and the action plan to set up a Technology Transfer Centre (TTC) in private sector at Dhaka is under process. It may be noted that JARAC, Japan, has already set up a similar TTC in Refrigeration sector in Thailand.

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The approach to train the trainers can optimally be made by supporting similar efficient private sector technical institutes, because Bangladesh experience has shown that the technical hierarchy, specially those engaged in Technical Universities and government institutions have very often failed in the past to disseminate practical technical know-how at grass-roots level. Such an institution can easily be set-up by the professionals in the relevant field. The government could be instrumental in allocating the initial resources. It could also be a donor-assisted establishment within the existing programme of an environmental NGO. In any case, such an institution could play a very important role in achieving success and long term sustainability of such training programmes.

6. Creating Public Awareness

The concerned environmental NGO in close co-operation with the DOE will produce short feature films, color slides etc. through professional advertising agencies and tie-up with the local television, movie and radio broadcasting institutions for telecasting and/or projecting them. The themes of such short feature films and/or colour slides should be simple, attractive and responsive to general mass and be so designed as to create a consciousness to care for the environmental protection in general and protection of the Ozone layer in particular. The same kind of approach will be taken for Newspaper publicity materials, whereby most widely circulated Bengali and English Newspapers should be chosen for dissemination.

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