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the Interim Multilateral Fund for the
Implementation of the Montreal Protocol

Eighth Meeting
Montreal, 19-21 October 1992

COUNTRY PROGRAMME: ZAMBIA

This document consists of:

- a) Evaluation Sheet (prepared by the Fund Secretariat)
- b) Country Programme Cover Sheet (prepared by the Fund Secretariat)
- c) The Country Programme

ZAMBIA COUNTRY PROGRAMME EVALUATION SHEET

The Zambia Country Programme is submitted to the Eighth Meeting of the Executive Committee as document UNEP/OzL.Pro/ExCom/8/18.

The Country Programme conforms to the format outlined in the Procedures for Presentation of Country Programmes and Project Proposals of the Executive Committee (UNEP/OzL.Pro/ExCom/5/5/Rev.2). However, the cost estimates for activities and projects in the document are subject to revision on the basis of suggestions provided by the Fund Secretariat to the implementing agency (UNEP) and the Government of Zambia.

It consists of:

Letter of Transmittal from the Government of Zambia (pending);
Country Programme Cover Sheet;
Introduction;
Consumption and use of controlled substances and analysis of their future demand;
Industry structure;
Institutional framework;
Status of response to the Montreal Protocol, and
Implementing phase out:
 Strategy statement by the Government
 Action Plan

Zambia neither produces nor exports ozone depleting substances (ODSs). It imports all its requirements. Zambia's calculated level of consumption for 1991 was 22.12 Tonnes ODP. This was made up mainly of CFC-12 (19 Tonnes ODP) and CFC-11 (3 Tonnes ODP).

The major end uses of ODS (1991) were as follows:

- . Servicing of refrigeration and air conditioning equipment:
 - CFC-12 : All (19 Tonnes)
 - CFC-11 : 1.3 Tonnes

CFC-11 is used "mainly for cleaning of equipment" during servicing of refrigeration and air conditioning equipment.

- . Foam manufacturing
 - CFC-11 : 1.7 Tonnes

Estimates of the use of CFC-12 by sector are as follows:

Domestic refrigeration	8 Tonnes
Commercial refrigeration	2 Tonnes

Cold storage and other industrial refrigeration	10 - 15 Tonnes
Automotive air conditioning	3 - 6 Tonnes

As a basis for estimating the costs of phasing out the use of ODS in Zambia, staggered growth rates of three per cent for the first three years from 1992, four per cent for the next four years (to 1999) and six per cent from 2000 - 2010, were assumed. These correspond to the forecasted rate of growth in GDP. Two scenarios were considered for the estimation of incremental costs:

- (a) Accelerated phase out following the Action Plan developed under the country programme, and
- (b) Phase out in accordance with the requirements of the Montreal Protocol for countries operating under paragraph 1 of Article 5.

The total incremental costs estimated for the two scenarios using ten per cent discount rate were:

Accelerated phase out: US \$51,400,000

Phase out in accordance with the Montreal Protocol: US \$41,089,728

It is stressed that the estimated incremental costs are "roughly indicative" and do not indicate the costs of the Action Plan.

The cumulative consumption until complete phase out under the Country Programme, Montreal Protocol and unconstrained demand are calculated to be as follows:

Country Programme	262 Tonnes (1992-1999)
Montreal Protocol	463 Tonnes (1992-2009)
Unconstrained Demand	1060 Tonnes (1992-2009)

On the basis of unconstrained demand the cost-effectiveness of the phase out would be:

Country Programme:	US \$48.5/Kg.
Montreal Protocol:	US \$38.8/Kg.

The high phase out costs could be partly due to the inclusion of the cost of acquiring new CFC-free refrigeration equipment in the incremental cost analysis. This may not be eligible for funding on the basis of the indicative list of categories of incremental costs which provides for the funding of the "cost of premature retirement or replacement of user equipment" under "end use" category. The equipment to be purchased are not replacement equipment but new equipment based on forecasted needs calculated on the basis of growth assumptions made for

the period. Besides one of the projects in the Country Programme caters for forced replacement and premature retirement of refrigeration equipment.

Another factor contributing to the high cost of phase out could be the potentially high cost of retirement and/or retrofitting and replacement of domestic refrigerators and freezers.

Reasons have been given for adopting the accelerated phase out schedule, among which is economic difficulties arising from the scarcity of ozone depleting refrigerants.

The following phase out targets have been considered under the Action Plan.

CFCs - complete phase out: 2000

Halons* - complete phase out: 1995

Carbon tetrachloride* - complete phase out: 2000

Achievement of the targets, however, is dependent on funds being made available for the implementation of activities and projects identified within the Action Plan and the pace of maturity of the technologies to be employed. These include retrofitting of domestic refrigerators and other equipment from CFC-12 to HFC-134a and funds to cover the scrapping of CFC-12 refrigerators after the year 2000, when importation of ODS and products containing ODS would be banned under the Action Plan, and funds to purchase new ODS-free refrigeration equipment in the period 1995 - 2000.

The Action Plan for achieving the goals of the country programme within the period 1993 - 1996 is composed of:

(a) Government Actions - US \$358,300

- legal and regulatory measures;
- institutional strengthening;
- creation of public awareness, and
- training.

(b) Industry Actions - US \$6,062,400

- projects (including recycling, retrofitting, technology transfer in the foam sector) (US \$62,400), and
- purchase of new non-ODS refrigerators and freezers (US \$6,000,000).

* The country programme document does not specify any consumption figure for these two ODSs.

Cost Estimates

Government Actions

1. The cost of government actions of US \$358,000 could be considerably reduced if some of the diverse activities are streamlined or scaled down to avoid overlaps and potential double counting. The recycling project (reduced in scope) should be combined with the training of technicians to make them more functional.

Industry Actions (Projects)

- The main cost item of US \$6,000,000 may not be eligible for funding as incremental cost since the equipment to be acquired are not replacement equipment.
- The retrofitting project should be reconsidered in line with developments in the relevant technology.
- The estimates for the recycling and servicing project may be revised in combination with the training activity. This should take into account the fact that recycling from domestic refrigerators is not cost-effective and that in Zambia only a small quantity of MACs and possibly some commercial and industrial equipment will provide the source of recycled refrigerant. Thus, a small number of workshops servicing these equipment needs to be considered.
- Premature retirement, scrapping or replacement of existing domestic refrigerators and freezers, a situation common to all the eligible Article 5 countries, may require further Executive Committee policy guidelines due to the inherent high cost.

Further Comments

The Fund Secretariat has provided detailed comments on the activities identified within the Country Programme and their corresponding cost estimates to the Implementing Agency and the Government, who have agreed to revise them accordingly.

Recommendations

The following recommendations are made for the consideration of the Executive Committee:

1. The Country Programme be approved without approval of the funding level.
2. The cost estimates be revised by the Implementing Agency in collaboration with the Government of Zambia in line with the comments made by the Secretariat.
3. The agreed revised activities and estimates be included in the UNEP work programme for 1993 for implementation except activities or projects whose agreed incremental costs exceed US \$500,000.

COUNTRY PROGRAMME COVER SHEET

COUNTRY: ZAMBIA

LEAD AGENCY: MINISTRY OF ENVIRONMENT AND
NATURAL RESOURCES

LEAD IMPLEMENTING AGENCY:

DATE RECEIVED: 7 OCTOBER 1992

**PERIOD COVERED BY COUNTRY
PROGRAMME:** 1993 - 1996

1. Phase out Schedule

Substances	Current Consumption Tonnes X ODP (1991)	Planned Total Consumption Until Phase Out Tonnes x ODP	Planned Year of Complete Phase Out
CFC-11	3.0	31.0	2000
CFC-12	19.0	230.0	2000
CFC-115	0.12	1.0	2000
Halons	?	?	?
CTC	?	?	?
Total	22.12	262	

2. Government Action Plan

Year(s)	Description of Action	Sector	Intended Effect	Estimated Cost US \$
1993	Adoption of an overall ozone layer protection policy, amendment of existing legislations	All	To provide legal framework for action plan	127,000
1993	Establishment of Ozone Fund and ODS Unit	All	To provide institutional support for implementing action plan	
1993-94	Adoption of reporting mechanism for ODS (Customs coding and industry reports)	All	To monitor imports and consumption of ODS	
1994	Design and use of ozone-friendly logo	Aerosol, Refrigeration, Foam	To promote the use of ozone-friendly products	300
1993-94	Production and distribution of half-yearly pamphlets and quarterly newsletter	All	To disseminate information	32,000
1993-96	Production and dissemination of information through the media - Television, radio, newspapers, notices, etc.	All	To create public awareness of the ozone layer depletion and Montreal Protocol measures	10,000
1993-94	Press conference on Country Programme and ozone-friendly logo	All	To create public awareness	

Year(s)	Description of Action	Sector	Intended Effect	Estimated Cost US \$
1993	Organization of workshop for the media	All	To help sensitize the media to the issues of ozone depletion	2,000
1993-95	Organization of public lectures and industry seminars	All	To create public awareness	12,000
1993-95	Commissioning of popular articles	All	To create public awareness	4,800
1994	Printing and sale of ozone layer protection T-shirts	All	To increase public awareness	
1993-94	Upgrading of existing courses in refrigeration	Refrigeration	To provide facility for training of refrigeration technicians	
1993-95	Organization of training course for refrigeration and air conditioning service technicians	Refrigeration	To improve servicing techniques	82,000
1993	Training of customs officers	All	To familiarize with new coding system for ODSs	3,000
1994	Lecture on the conversion of the use of CFC-11 to methylene chloride in the foam industry	Foam	To provide information on conversion technology for phase out	60,600
1994-95	Training of technicians in safety measures in the use of ammonia refrigerant	Refrigeration	To ensure safety in the servicing of ammonia refrigeration equipment	24,500

3. Project Summary

Year(s)	Type of Project	Project Description	Project Cost	Incremental Cost	Participating Implementing Agency*	Tonnes x ODP Phased-out/ Year
1995-96	Recycling	To provide recycling and recovery equipment to local companies to recycle CFC, HCFC and HFC refrigerants	56,000	22,400	N.A.	N.A. ¹
Before 2000	Retrofit	To retrofit existing industrial refrigeration systems to use ammonia	To be determined	To be determined	N.A.	10-15
1995-96	Retrofit	To retrofit existing domestic refrigerators and freezers to HFC-134a for a trial period of two years	40,000	40,000	N.A.	8
1995-96	Equipment Acquisition	To purchase new equipment that do not contain CFCs or HCFCs	6,000,000	6,000,000	N.A.	Nil
1996	Substitution of CFC-11 (Technology Transfer)	To convert the use of CFCs in flexible and rigid foam manufacturing to the use of other substitutes	To be determined	To be determined	N.A.	2

* N.A. - Not indicated.

1. Not indicated. Estimated to be three to five tonnes on the basis 20 per cent servicing ratio in MAC, commercial and industrial refrigeration subsectors.

4. Costs of Activities and Projects in the Country Programme

US \$

Cost of activities and projects in the Country Programme:	6,420,000
Estimated cost of complete phase out (Indicative):	54,400,000
Estimated cost effectiveness (Based on unconstrained consumption):	US \$48.5/Kg

ZAMBIA
COUNTRY PROGRAMME

**FOR THE REDUCTION AND PHASE-OUT OF OZONE DEPLETING SUBSTANCES
CONTROLLED UNDER THE MONTREAL PROTOCOL**

SEPTEMBER 1992

**Ministry of Environment and Natural Resources
Department of Natural Resources
Republic of Zambia**

**United Nations Environment Programme
(Industry and Environment Programme Activity Centre)**

MEMBERS OF THE NATIONAL COUNTRY PROGRAMME TEAM

Overall Chairman: Mr. M. Banda, Director
Department of Natural Resources

Refrigerator and air-conditioning sector:

Chairman: Prof. P.C. Jain
Physics Department, University of Zambia (UNZA)
and
Chairman, Energy and Environment Group (EEG), UNZA

Co-chairman: Dr. E. Ohouno
School of Engineering, University of Zambia

Foams sector:

Chairman: Mr. L. H. Hangwele, Economist
Ministry of Commerce, Trade and Industry

Solvent sector:

Chairman: Mr. J. M. Kasonde
National Council for Scientific Research

Aerosols, halons and miscellaneous sector:

Chairman: Dr. P. Chipungu
Secretary General, National Environmental Council

Co-chairman: Mr. G. Chipeta
Meteorological Department

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Mr. G. Chasaya, Inspector
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EXECUTIVE SUMMARY**1. Introduction**

This Country Programme reflects the commitment of the Government of Zambia to comply with the obligations of the Montreal Protocol on Substances that Deplete the Ozone Layer, to which Zambia is a Party. It provides the framework for activities to be undertaken by Zambia to achieve the required phase out of ozone depleting substances controlled under the Montreal Protocol and its London Amendment (controlled substances) and forms the basis for requesting assistance from the Multilateral Fund (and the Interim Multilateral Fund) for those activities.

The Country Programme was prepared between the period March-September 1992 and it should be updated during 1996. The updated Country Programme should be implemented from 1997.

The Country Programme contains the following:

- (a) Data and information on the consumption and use pattern of ozone depleting substances (ODS) controlled under the Montreal Protocol and its Amendment (adopted in London in 1990) collected through a survey of over 100 industries/companies as well as Governmental bodies. Data and information for the years 1986, 1989, 1990 and 1991 are contained. The difficulties encountered in the survey and the probable inadequacies of data and information are explained and plans for improving the Governmental record keeping and reporting requirement for the industries are included.
- (b) Analyses of possible future demands for the controlled substances (unconstrained demand) and an indication of the total incremental cost for the phase-out of the controlled substances.
- (c) Information on the existing institutional and policy framework that are relevant to the use of controlled substances and the implementation of the Montreal Protocol.
- (d) Government strategy statement with regard to the implementation of the Montreal Protocol and the phase-out of controlled substances.
- (e) Action Plan of Zambia to phase out the consumption and use of controlled substances, based on the 1991 status of consumption and use of those substances. The Action Plan covers the period from 1993 to 1996 and it consists of various programmes and industry projects categorized under Government Programmes and Industry Actions. Budget estimates are included for the programmes and projects for which assistance is requested from the Multilateral Fund (Interim Multilateral Fund). The timetable for the implementation of the Action Plan clearly reflects the prioritization of the programme and projects. The necessary institutional strengthening and improvements in the record keeping and reporting by the industries for future monitoring purposes are included in the Action Plan.

The Country Programme was prepared under the responsibility of the Department of Natural Resources of the Ministry of Environment and Natural Resources with technical assistance of Industry and Environment Programme Activity Centre (IE/PAC) of the United Nations Environment Programme (UNEP) and financial support from the Interim Multilateral Fund through IE/PAC. A National Country Programme Team was established for the purpose of assisting the Department of Natural Resources in the preparation of the Country Programme.

The Country Programme was adopted by the Ministry of Environment and Natural Resources and finally approved by the Cabinet. It was decided that Zambia

(iii)

in 1986, 1989 and 1990 were approximately 17,500, 14,500 and 11,000, respectively. The main source countries include United Kingdom, South Africa, Italy and Japan. In Zambia, refrigerators are expensive. Due to occasional power surges and fluctuations in the electric power supply, the average life time of a compressor is estimated to be 6-8 years. The importation of compressors is therefore high. 7,000 - 10,000 domestic refrigerator and freezer compressors were imported each year in 1989 and 1990. The estimate of the current number of domestic refrigerators and freezers that are operating in Zambia is 180,000 to 200,000 units.

The medium to large size refrigeration systems comprising commercial, industrial and transport refrigeration equipment found in Zambia include open-top freezers, chillers, coolers and refrigerated display cases in shops and stores which use CFC-12 as refrigerant; cold storage/rooms, freezer rooms and chillers in various industries dominantly using CFC-12 refrigerant; mobile air coolers (for cooling airplanes) which use CFC-12 or HCFC-22; ice-making machines in the ice-making industries. Number of commercial refrigeration systems in operation are estimated to be 300-500, and cold stores and rooms, 1000-1200.

More recently, automobiles are imported with air-conditioners using CFC-12 refrigerant. It is estimated that 3-5% of the cars that are currently running in Zambia have air-conditioners. An estimated 2000-4000 automotive air-conditioners exist in Zambia.

Almost all the air-conditioning equipment found in Zambia use HCFC-22 as refrigerant. There are some large central air-conditioning systems that are using CFC-12.

Flexible and rigid foams: Foam products (mattresses, cushions, etc.) are produced in the country and most of the demand for these products are met through local production. Rigid foams used for building and [other] insulation are also produced but in limited quantities.

Aerosols: The three aerosol spray manufacturers (multinational companies) have substituted the use of CFCs with hydrocarbons during mid to late 1980s. Insecticides and air fresheners are being manufactured locally. Cosmetic aerosols that are likely to be containing controlled substances are imported. Import figures could not be obtained.

Halon fire extinguishers: All fire extinguishers are imported. Only a very limited use of portable halon fire extinguishers have been found and no fixed halon systems. The use of halon fire extinguishers is uncommon because halons are expensive. The users that were identified include: a number of fire brigade services under the City Councils in various regions; Zambia Airways and Roan Air (Zambian airline company) for their aircrafts; the national airports; and a cosmetic industry (multinational). Importation of portable units of halon fire extinguishers in 1986, 1989, 1990 and 1991 were 1,010, 320, 323 and 302, respectively.

(b) Analyses of Future Demand for the Controlled Substances

Unconstrained Demand:

The future demand for the controlled substances is estimated assuming that the Montreal Protocol did not exist. The annual GDP growth rate from 1986 to 1991 and the optimistic prediction of the GDP growth rate for 1992 to 2010 are as below and the average annual population growth rate from 1980 to 1990 was 3.2%.

(ii)

should implement the Country Programme under the responsibility of the Department of Natural Resources, Ministry of Environment and Natural Resources.

2. Consumption and use of controlled substances

(a) Past situation

Consumption of controlled substances as bulk chemicals:

Zambia's consumption of controlled substances does not produce or export any controlled substances, but imports CFCs (CFC-11, 12 and 115 only) for servicing refrigerators and air-conditioners, as well as for production of foams. No halons or methyl chloroform are imported as bulk chemicals. Only a very minor use of carbon tetrachloride was confirmed.

The total consumption, calculated consumption and calculated per capita consumption for the years 1986, 1989, 1990 and 1991 of the controlled substances were as follows:

Year	Consumption (Tonnes)	Calculated consumption (Tonnes x ODP)	Calculated per capita consumption (kg)
1986	34.6	34.56	0.005
1989	22.3	22.26	0.003
1990	38.9	38.82	0.005
1991	22.2	22.12	0.003

The consumption data may be an underestimate of the true consumption since the current record keeping system on importation of controlled substances does not differentiate each controlled substances and not all industries/companies importing/using controlled substances could be identified.

The consumption (Tonnes) of CFC-12 in the years 1986, 1989, 1990 and 1991 were 29.0, 18.5, 35.6 and 19.0, respectively. All the CFC-12 are used by servicing workshops to refill refrigerator systems and air-conditioners (both stationary and automotive). Negligible quantities of R-500 (containing 73.8% CFC-12 by weight) were imported.

The consumption (Tonnes) of CFC-11 in the years 1986, 1989, 1990 and 1991 were 5.5, 3.7, 3.1 and 3.0, respectively. CFC-11 primarily used by two foam manufacturing companies producing flexible foam products (mainly for mattresses and furniture) and some rigid foam. In 1986, 1989, 1990 and 1991, the percentages of the total imported CFC-11 that were used for manufacture of foam were 81% (4.5 Tonnes), 63% (2.3 Tonnes), 68% (2.1 Tonnes) and 57% (1.7 Tonnes), respectively. The remaining percentages of CFC-11 were used for servicing (mainly cleaning) refrigeration and air-conditioning equipment. The percentages of the total import of CFC-11 that were used under the refrigeration and air-conditioning sector in the four years were 19% (1 Tonne), 37% (1.4 Tonnes), 32% (1 Tonne) and 43% (1.3 Tonnes), respectively.

Very minor quantities of CFC-115 are imported as part of a refrigerant mixture R-502. Out of the total consumption of controlled substances as refrigerants, CFC-115 constituted approximately 1% in each of the four years.

Products Containing Controlled Substances:

Refrigeration and air conditioning equipment containing controlled substances: With exception of small numbers of equipment manufactured in the country, the demand for refrigerator systems are met through import. All air-conditioning systems (stationary and mobile) systems (fixed and portable) are not manufactured but imported. The importation of domestic refrigerators and freezers

The method used in the attempt to estimate the incremental costs for Zambia is a simple one, based on several simplistic assumptions. The estimation of the incremental costs are only roughly indicative and would not be comparable to incremental costs estimated for other countries due to the wide differences in the assumptions made and the methodologies for the estimation. The estimated incremental costs does not indicate the costs of the Action Plan.

The total incremental costs estimated for the two scenarios using 10% discount rate are as follows:

- (a) Accelerated phase-out: US \$ 51,354,349 (appr. 51,400,000)
- (b) Phase-out in accordance with the Montreal Protocol: US \$ 41,089,728 (appr. 41,100,000)

The comparison of the discounted costs (10% discount rate) of phase-out under the two scenarios indicates that the incremental costs are lower when the phase out schedule under the Montreal Protocol is followed. However, this should not lead to a conclusion that developing countries operating under paragraph 1 of Article 5 should rather follow the Montreal Protocol phase-out schedule rather than an accelerated one. The following points need to be kept in mind:

- In reality the controlled substances will soon become unavailable and the prices of the substances are already rising. Prolonged use of the controlled substances will result in difficulties and considerable cost increase to the consuming countries, in particular the countries that do not produce controlled substances, to meet the demand for the substances. The delayed phase-out would impose such burden to the developing countries;
- The magnitude of seeming cost advantage in delaying the phase out is dependant upon the discount rate chosen. If a lower discount rate is chosen, the cost advantage would become smaller;
- Most importantly, the environmental benefits of less consumption, hence emission of controlled substances would far outweigh the extra costs that may be incurred in accelerating the phase-out.

3. Implementing phase-out

(a) Action Plan

The Government of Zambia is committed to phasing out the consumption of controlled substances by the year 2000, before the required phase-out year for Parties operating under paragraph 1 of Article 5. In order for Zambia to meet this goal, financial and technical assistance from the Multilateral Fund (and the Interim Multilateral Fund) is essential so that the Country Programme could be implemented effectively.

The Action Plan for phasing out the controlled substances consists of two parts: the Government Actions comprising six programmes; and Industry Actions comprising six phase-out projects. The various programmes, projects and elements under the Action Plan are summarized in the table below with indications of the expected reduction of consumption of controlled substances and the total budget for each programme, project or element.

Since the programme and project budgets are estimates, there may be either surplus or shortage of funds to carry out the planned activities. Any surplus would be accounted for in the Country Programme update and shortage would have to be re-requested from the Multilateral Fund. An account will be submitted annually to the Secretariat for the Multilateral Fund.

(iv)

The actual and predicted annual GDP growth rate:

1986:	0.7
1987:	2.7
1988:	6.3
1989:	-1.0
1990:	-0.4
1991:	-1.8
1992:	1.2 to 2.0%
1993:	3.0 to 3.5%
1994:	3.6%
2000:	5.0 to 6.0% up to year 2010

The demand for refrigerants is assumed to grow at a similar rate as the GDP growth rate. 3.0% growth rate in CFC-12 consumption is assumed for years 1992 to 1994, 4% for the years 1995 to 2000 and 6% for the years 2000 to 2010. The demand for CFC-11 used for servicing refrigeration and air-conditioning equipment, mainly for cleaning the equipment, is assumed to grow at the same pace. The demand for CFC-11 used as foam blowing agent is assumed to show an average annual growth rate of 20%.

The GDP growth rate, the assumed unconstrained demand growth for the refrigeration and foam sector, the predicted consumption of each controlled substance and the total consumption are shown in the Table A below:

Table A Summary of the yearly predicted consumption following the unconstrained demand

Year	GDP Growth Rate	Assumed Growth Rates foam / refrigerant	CFC-11 (foam) Consump.	CFC-11 (refrig.) Consump.	CFC-12 Consump.	Total Consump.
1991	-1.8		1.7	1.3	27.3	30.3
1992	1.2 to 2.0	20% / 3.0%	2.0	1.3	28.1	31.4
1993	3.0 to 3.5	" / 3.0%	2.5	1.4	29.0	32.9
1994	3.6	" / 3.0%	2.9	1.4	29.8	34.1
1995	3.6	" / 4.0%	3.5	1.5	31.0	36.0
1996	3.6	" / 4.0%	4.2	1.5	32.3	38.0
1997	3.6	" / 4.0%	5.1	1.6	33.6	40.3
1998	3.6	" / 4.0%	6.1	1.7	34.9	42.7
1999	3.6	" / 4.0%	7.3	1.7	36.3	45.3
2000	5.0 to 6.0	" / 6.0%	8.8	1.8	38.5	49.1
2001	5.0 to 6.0	" / 6.0%	10.5	1.9	40.8	53.2
2002	5.0 to 6.0	" / 6.0%	12.6	2.1	43.2	57.9
2003	5.0 to 6.0	" / 6.0%	15.2	2.2	45.8	63.2
2004	5.0 to 6.0	" / 6.0%	18.2	2.3	48.6	69.1
2005	5.0 to 6.0	" / 6.0%	21.8	2.5	51.5	75.8
2006	5.0 to 6.0	" / 6.0%	26.2	2.6	54.6	83.4
2007	5.0 to 6.0	" / 6.0%	31.4	2.8	57.8	92.0
2008	5.0 to 6.0	" / 6.0%	37.7	2.9	61.3	101.9
2009	5.0 to 6.0	" / 6.0%	45.3	3.1	65.0	113.4
2010	5.0 to 6.0	" / 6.0%	54.3	3.3	68.9	126.5

Estimation of incremental cost:

The incremental cost is estimated for two phase-out scenarios:

- Accelerated phase-out following the Action Plan under this Country Programme;
- Phase-out in accordance with the requirements of the Montreal Protocol for countries operating under paragraph 1 of Article 5.

Table B continued_

Programmes/projects/ elements	Brief Description	Commencement/ Duration	Use sector and expected reduction of consumption	Budget
4. Project 5.4	Training of technicians on safety measures when operating ammonia refrigeration systems in industries.	Feb & Aug 1995 Feb & Aug 1996	Refrig.	24,500
5. Project 5.5	Special technical lecture on the conversion of CFC-11 using foam industries to methylene chloride (including safety aspects for the workers).	May 1994	Foams	60,600
Programme 6				
1. Pamphlet and Newsletter	Issuing of half yearly pamphlets and quarterly newsletter.	November 1993 (launch pamphlet) March 1994 (launch newsletter)	All	32,000
2. Public awareness	TV/radio/newspaper programmes/notices/articles/advertisement etc. on ozone layer issues and Zambia Country Programme.	1993-1996	All	10,000
- notices, programmes and announcements				
- press conferences	For the adoption of the Country Programme and launch of Ozone Friendly Logo.	January 1993 (country prog.) January 1994 (logo)	All	
- media workshop	Workshop to sensitize the media.	May 1993	All	2,000
- public lectures	On the protection of the ozone layer and the Country Programme.	1993-1995	All	4,000
- popular articles				4,800
- industry seminars				8,000
- T-shirts	Selling of T-shirts with ozone layer protection prints to increase public awareness.	January 1994 (begin preparations) June 1994 (release)	All	
INDUSTRY ACTIONS				
1. Project R1	Recycling of refrigerants.	1995-1996	Refrig.	22,400
2. Project R2	Retrofitting existing industrial refrigeration systems to ammonia.	Before 2000	Refrig.	
3. Project R3	Retrofitting existing domestic fridges and freezers to HFC-134a.	1995-1996	Refrig.	40,000

Table B: Summary of the programmes, projects and elements under the Action plan including indications of expected reduction of consumption of controlled substances and the total budget for each programme, project or element.

Programmes/projects/elements	Brief Description	Commencement/Duration	Use sector and expected reduction of consumption	Budget
GOVERNMENT ACTIONS				
Programme 1				
1. policy	Adoption of an overall policy for the protection of the ozone layer.	January 1993 (begin preparation) July 1993 (adoption)	All	
2. legislation	Amendment of existing legislations to include various laws to control and monitor the consumption of controlled substances.	January 1993 (begin preparation) December 1993 (adoption)	All	
Programme 2				
1. Ozone Fund	Establishment of Ozone Fund under the Dept. of Natural Resources for the implementation of the Country Programme.	January 1993	All	
2. Ozone Friendly Logo	Designing of a logo for ozone friendly products.	January 1994 (launch)	Aerosols, refrig., foams	300
Programme 3				
1. ODS Unit	Establishment of an ODS Unit under the Dept. of Natural Resources	January 1993	All	127,000
Programme 4				
1. Customs coding system	Adoption of separate subheadings for each controlled substances and reporting to the National Env. Council.	January 1993 (begin preparation) January 1994 (implementation)	All	
2. Industry reports	Reporting by each industry on the import and use of controlled substances.	1993 (preparation) January 1994 (implementation)	All	
Programme 5				
1. Project 5.1	Upgrading of existing courses on refrigeration and a/c.	1993-1994 (preparation) 1995 (incorporation)	Refrig.	
2. Project 5.2	Training course for refrigeration and a/c technicians.	June 1993 October 1995	Refrig.	82,100
3. Project 5.3	Training of customs officers.	May 1993	All	3,000

1. INTRODUCTION

1.1 Purposes

This Country Programme reflects the commitment of the Government of Zambia to comply with the obligations of the Montreal Protocol on Substances that Deplete the Ozone Layer, to which Zambia is a Party. It provides the framework for activities to be undertaken by Zambia to achieve the required phase out of ozone depleting substances controlled under the Montreal Protocol and its London Amendment (controlled substances) and forms the basis for requesting assistance from the Multilateral Fund (and the Interim Multilateral Fund) for those activities.

The objectives of this Country Programme are:

- (a) To survey, assess and analyze the situation with regard to consumption and use pattern of the controlled substances for the years 1986, 1989, 1990 and 1991;
- (b) To record the existing institutional framework in Zambia, including Governmental bodies and industry associations and related organizations, as well as policy framework that are relevant to issues of ozone layer protection and ozone depleting substances (ODS);
- (c) To analyse the possible future demands for controlled substances if no measures are taken to control the consumption (unconstrained demand) and to estimate the incremental cost for phasing out the controlled substances;
- (d) To spell out the Government strategy with regard to the phase-out of controlled substances;
- (e) To outline the Action Plan including strengthening of the institutional capacity and capability in Zambia for phasing out the consumption of the controlled substances;
- (f) To provide a framework (including a budget) for the future programmes and projects for which financial and technical assistance from the Multilateral Fund (and the Interim Multilateral Fund) is sought and to prioritize those activities through a time schedule for the activities;
- (g) To outline the scheme for implementing the Action Plan and for monitoring the consumption of the controlled substances to:
 - (i) ensure that the Country Programme is implemented;
 - (ii) enable observation/evaluation of effectiveness of the implementation of the Action Plan in reducing and phasing out the consumption and use of the controlled substances; and
 - (iii) ensure compliance with the reporting requirements of the Protocol (Article 7).

1.2 Status of the Country Programme

The Country Programme was prepared between the period March-September 1992, and contains data and information on the consumption and use of ozone depleting substances controlled under the Montreal Protocol and its Amendment adopted in London in 1990 for the years 1986, 1989, 1990 and 1991. It is the first Country Programme prepared for Zambia. No country study related to ozone depleting substances has been carried out in Zambia previously by any international organizations.

Table B continued_/_

Programmes/projects/ elements	Brief Description	Commencement/ Duration	Use sector and expected reduction of consumption	Budget
4. Project R4	Purchasing of new equipment that do not contain CFCs or HCFCs.	1995-1996	Refrig.	6,000,000
5. Project F1	Conversion of flexible and rigid foam industries from using CFC-11 to substitutes.	1996 (submission of proposals by industries)	Foam	

TOTAL BUDGET	Government Actions:	US \$ 358,300
	Industry Actions:	US \$ 6,062,400
GRAND TOTAL		US \$ 6,420,700

survey, and to participate in and advise on the development of the Action Plan and to review the report. The Team consisted of experts from the following institutions: Department of Natural Resources (Ministry of Environment and Natural Resources); National Environmental Council; Ministry of Commerce, Trade and Industry; Ministry of Legal Affairs; Meteorological Department; National Council for Scientific Research; Physics Department, Geography Department and Department of Mechanical Engineering of the University of Zambia (UNZA); the International Union for the Conservation of Nature (IUCN); and ICI (Zambia) Ltd.

The survey was undertaken by the National Country Programme Team under the leadership of the Department of Natural Resources. The staff of the Department of Natural Resources assisted in conducting the survey. The phase-out strategy and Action Plan were drawn up by the National Country Programme Team with assistance of the IE/PAC Consultant. The Department of Natural Resources reviewed and adopted the report together with the National Country Programme Team and recommended it for consideration and adoption by the Minister of Environment and Natural Resources. The report was then presented by the Minister to the Cabinet for consideration and final approval of the Government of Zambia.

It was decided that Zambia should implement the Country Programme under the responsibility of the Department of Natural Resources, Ministry of Environment and Natural Resources.

1.2.2 Participation in the Preparation of the Country Programme: Responsibilities and Roles

Short description of the bodies involved in the preparation of this Country Programme and their responsibilities and roles in the preparation are given below:

- (a) Department of Natural Resources, Ministry of Environment and Natural Resources:

Took the leadership in the preparation of the Country Programme and the survey. Directed the process of developing the strategy and Action Plan and the process of review and adoption of the report. Developed and decided on the strategy and Action Plan with the National Country Programme Team and with assistance from IE/PAC Consultant; reviewed and adopted the report. The Minister, after the adoption of the report by the Ministry, presented it to the Cabinet for consideration and final approval. The staff of the Department assisted in visiting the individual industries together with the members of the National Country Programme Team to collect the necessary data and information.

- (b) National Country Programme Team:

Advised on and conducted the survey of the consumption, use, imports and exports of the controlled substances and the products that contain controlled substances; reviewed the results of the survey and the analyses of data; assisted in the development of the strategy and the Action Plan for phasing out the consumption of the controlled substances; and reviewed the report.

- (c) Industry and Environment Programme Activity Centre of UNEP (UNEP IE/PAC) - Implementing Agency:

Provided the financial support and technical assistance including assistance in:

- (i) outlining the overall strategy and plans for the preparation of the Country Programme;

The survey of the consumption and use pattern of controlled substances was conducted through various Governmental bodies and individual industries/companies. The current situation in Zambia with regard to record keeping by the Customs and Excise Department on the importation of commodities and by the Ministry of Commerce, Trade and Industry on the existing industries are inadequate for conducting a survey of this nature. The difficulties encountered in conducting the survey and the likely inadequacies of data and information are explained under relevant sections. Plans for improving the Governmental record keeping and reporting requirement for the industries are included in the Action Plan for future monitoring purposes.

The possible future demands for the controlled substances have been analysed through which an indication of the total cost for the phase-out of the controlled substances was derived.

The Action Plan of Zambia to phase out the consumption and use of controlled substances is based on the 1991 status of consumption and use of those substances. The Action Plan covers the period from 1993 to 1996 and it consists of various programmes and industry projects categorized under Government Programmes and Industry Actions. Budget estimates have been made for the programmes and projects for which financial and technical assistance are requested from the Multilateral Fund (Interim Multilateral Fund) for the implementation. The timetable for the implementation of the Action Plan clearly reflects the prioritization of the programme and projects.

The existing institutional framework that are relevant to the use of controlled substances and the implementation of the Montreal Protocol is reviewed and recorded. Plans are outlined under the Action Plan for strengthening this framework in order to:

- (i) coordinate the implementation of the Country Programme;
- (ii) monitor the consumption of the controlled substances and the execution of the various programmes and projects for the reduction and phase-out of the controlled substances; and
- (iii) evaluate the effectiveness of the programmes and projects in achieving the reduction and phase-out.

This Country Programme should be updated during 1996 and the updated Country Programme should be implemented from 1997.

1.2.1 Preparation and Adoption of the Country Programme

The Country Programme was prepared under the responsibility of the Department of Natural Resources of the Ministry of Environment and Natural Resources with technical assistance of Industry and Environment Programme Activity Centre (IE/PAC) of the United Nations Environment Programme (UNEP) and financial support from the Interim Multilateral Fund through IE/PAC.

The Country Programme was prepared in two phases:

- Phase I: A survey of the consumption and use of the controlled substances and existing policy and institutional framework with regard to the controlled substances;
- Phase II: Analyses of data and information collected through the survey; development of strategy and Action Plan; identification of programmes and projects and their prioritization; and preparation, review and adoption of the report on the Country Programme.

A National Country Programme Team was established for the purpose of assisting the Department of Natural Resources in directing and carrying out the

controlled substance. Until 1990, the Customs Cooperation Council's Nomenclature (CCCN) was being used. Under the CCCN the controlled substances belong to a general classification code for halogenated derivatives of hydrocarbons. Since 1991, the coding system of the Customs and Excise Department has been changed to the Harmonized Commodity System.

In 1990, the Customs Cooperation Council recommended to its member administrations to adopt separate sub-headings for each controlled substance listed in Annex A of the Montreal Protocol. This recommendation was made after the Customs Cooperation Council examined and accepted the request of the Parties to the Montreal Protocol to facilitate the monitoring of trade in controlled substances by defining separate codes for each controlled substance. The separate sub-headings are not yet included in the Harmonized System of the Customs and Excise Department of Zambia. The Action Plan includes adjustments to the Customs coding system to incorporate separate sub-headings for each controlled substance.

The Customs and Excise Department is required to report data and information on the imports of all goods to Zambia to the Central Statistical Office which is responsible for compiling statistical information (including revenue from duties on imports). The Department submits a copy of the Bill of Entry (issued by the Department upon entry of commodities into the country) to the Central Statistical Office on a monthly basis.

In order to facilitate future monitoring of consumption of controlled substances and the activities under the Action Plan, it is essential that improvements are made in record keeping by the relevant Governmental bodies. The required improvements have been included under the Action Plan.

Over 100 industries/companies were surveyed. Several industries that are likely to be using heavy machinery were included in the survey because of the possibility that they might be using carbon tetrachloride as solvent for cleaning their machinery. Out of all the industries and companies surveyed, following 48 industries/companies indicated that they do not use controlled substances: aerosol producers (3); paint industries (3); scrap metal industry (1); electronics and electrical supplies and repairs (4); metal fabricators (3); large photographic laboratories (2); oil industry (1); chemical and pharmaceutical laboratories (7); dry cleaners (2); printing and related supplies (4); machinery and hardware supplies and maintenance (3); construction (1); synthetic rubber industries (2); industrial gas industry (1); aircraft service (1); paper mills (1); plastics (3); cleaning company (1); bitumen manufacturer (1); match manufacturer (1); household products including edible oils (1); agro-chemical supplier (1); car battery manufacturer (1).

The three aerosol manufacturing companies are all producing insecticides and one of them is also producing air-freshener sprays. These are multinational companies and have already converted from using CFCs into hydrocarbons.

2.2 The Consumption of the Controlled Substances in 1986, 1989, 1990 and 1991

Zambia does not produce or export any controlled substances, but imports CFCs (CFC-11, 12 and 115 only) for servicing refrigerators and air-conditioners, as well as for production of foams. No halons are imported as bulk chemicals.

No importation or use of methyl chloroform as bulk chemicals has been found. One industry said that it imports and uses a small amount of carbon tetrachloride (see sub-section 2.2.1 below). Various industries that are using solvents were surveyed but those industries stated that they are not using controlled substance solvents (as bulk chemicals). A few of the electronic repair workshops and the airport is using small quantities of imported sprays containing CFCs (e.g. CFC-113) for cleaning purposes.

- (ii) conducting the survey;
- (iii) carrying out the necessary analyses of the data and information collected through the survey;
- (iv) developing the strategy and the Action Plan for phase-out of the controlled substances; and
- (v) the preparation of the report.

1.2.3 Sources of Data and Information

Both governmental bodies and private industries/companies cooperated and supported the survey by providing the necessary data and information for the survey. The bodies that provided data and information are as follows:

Governmental bodies:

- (a) Ministry of Commerce, Trade and Industry:
provided information on the industries that use controlled substances as well as on policies and regulations that affect trade and industries;
- (b) Central Statistical Office:
provided information on the importation of controlled substances and products containing controlled substances as well as data on GNP, GDP and population;
- (c) Ministry of Home Affairs, Traffic Statistics Section:
provided information on vehicles, ships and aircrafts;

Industries:

Individual industries and companies:
provided data on the consumption and use of the controlled substances in their own companies. (A full list of names and addresses, including the names of contact persons, of the relevant industries and companies is attached as Annex I to this report.)

2. CONSUMPTION AND USE OF CONTROLLED SUBSTANCES

2.1 The Survey and the Current Situation with Regard to Monitoring and Record Keeping

In Zambia, the industries are concentrated along the central line of rail from Livingstone to Copperbelt. The cities and towns in which survey was carried out include: Lusaka, Kafue, Kabwe, Ndola, Kitwe, Luanshya, Chingola, Mufulira and Kalulushi.

Most of the data and information were collected through direct contacts with the relevant industries/companies. From the Register of Companies and Business Names compiled by the Ministry of Commerce, Trade and Industry, industries/companies that could be dealing with controlled substances were selected and each of them was surveyed. Because the Register of Companies and Business Names only states the names of the companies and does not include a description of the functions or the materials being imported or used by the industry/company, it is likely that some of the companies that deal with controlled substances, especially the small companies, were not identified hence excluded from the survey.

The record keeping by the Customs and Excise Department on the importation of controlled substances is currently inadequate to allow monitoring of each

Table 1 Consumption, calculated consumption and calculated per capita consumption of controlled substances in 1986, 1989, 1990 and 1991

Substances	1986		1989		1990		1991	
	cnsr	calc	cnsr	calc	cnsr	calc	cnsr	calc
ANNEX A								
<u>Group I</u>								
CFC 11	5.5	5.5	3.7	3.7	3.1	3.1	3.0	3.0
CFC 12	29.0	29.0	18.5	18.5	35.6	35.6	19.0	19.0
CFC 113	0	0	0	0	0	0	0	0
CFC 114	0	0	0	0	0	0	0	0
CFC 115	0.1	0.06	0.1	0.06	0.2	0.12	0.2	0.12
<u>Sub-total</u>	34.6	34.56	22.3	22.26	38.9	38.82	22.2	22.12
<u>Group II</u>								
Halon 1211	0	0	0	0	0	0	0	0
Halon 1301	0	0	0	0	0	0	0	0
Halon 2402	0	0	0	0	0	0	0	0
<u>Sub-total</u>	0	0	0	0	0	0	0	0
TOTAL	34.6	34.56	22.3	22.26	38.9	38.82	22.2	22.12
ANNEX B								
<u>Group I</u>								
CFC 13	0	0	0	0	0	0	0	0
CFC 111	0	0	0	0	0	0	0	0
CFC 112	0	0	0	0	0	0	0	0
CFC 211	0	0	0	0	0	0	0	0
CFC 212	0	0	0	0	0	0	0	0
CFC 213	0	0	0	0	0	0	0	0
CFC 214	0	0	0	0	0	0	0	0
CFC 215	0	0	0	0	0	0	0	0
CFC 216	0	0	0	0	0	0	0	0
CFC 217	0	0	0	0	0	0	0	0
<u>Sub-total</u>	0	0	0	0	0	0	0	0
<u>Group II</u>								
Carbon tet	?	?	?	?	?	?	?	?
<u>Group III</u>								
Methyl chl	0	0	0	0	0	0	0	0
TOTAL	?	?	?	?	?	?	?	?
Population	6,840,000		7,520,000		7,820,000		8,070,000	
per capita consp. (kg) (calcul.)	Annex A: 0.005 Annex B:		Annex A: 0.003 Annex B:		Annex A: 0.005 Annex B:		Annex A: 0.003 Annex B:	

Notes:

- cnsr = consumption in Tonnes
calc = calculated consumption (Tonnes x ODP)
- Population for 1986, 1989, and 1991 have been estimated from the population census of 1980 and 1990 and the average rate of population growth of 3.2% (1990 Census of Population, Housing and Agriculture, Preliminary Report, Central Office of Statistics, 21 December 1990.)

It should be noted that many of the importers of CFCs are experiencing difficulties in obtaining these substances in the international market and the prices are rising. One of the main local distributors of CFCs indicated that the CFC refrigerants are becoming too expensive for some consumers. Some owners of domestic refrigerators as well as industrial cold stores and cold rooms can hardly afford to have their refrigeration equipment serviced for refilling refrigerants. Due to the high prices of CFCs the servicing workshops are careful not to waste the gases.

2.2.1 The Consumption of Each Controlled Substance (as bulk chemicals)

The consumption and calculated consumption for the years 1986, 1989, 1990 and 1991 of each of the controlled substances listed in Annex A of the Montreal Protocol and Annex B of the Amendment to the Protocol are shown in Table 1. The Table also includes population data and calculated per capita consumption for each of the four years.

Tables A.1 - A.4 in Annex II of this report shows the production, imports, exports and consumption for the four years, respectively, in the form that is ready for submission to the Ozone Secretariat for the purpose of fulfilling the reporting requirements under Article 7 of the Montreal Protocol.

In accordance with the definition of consumption under the Montreal Protocol, consumption shown for each year is production plus imports minus exports. In the case of CFC-12, relatively large consumption occurs every two years. The reason is that one of the main distributors of CFC-12 imports the substance every two years.

As mentioned under section 1.2 (Status of the Country Programme) and in section 2.1 (The Survey and the Current Situation with Regard to Monitoring and Record Keeping) the existing data and records kept by the Customs and Excise Department and the Ministry of Commerce, Trade and Industry were inadequate for conducting the survey in a comprehensive manner. It is likely that not all industries/companies importing/using controlled substances were identified, hence, the consumption data may be an underestimate of the true consumption. It is difficult to assess the extent of the underestimate.

Some carbon tetrachloride is imported. The data from the Central Statistical Office show that carbon tetrachloride is classified under a code that is defined as 'carbon tetrachloride and others'. Only one company importing small quantities of carbon tetrachloride was identified. It is suspected that other industries are also importing/using the substance.

2.2.2 Consumption of Each Controlled Substance by Use Sectors

Figures 1.1. - 1.4 show, for the years 1986, 1989, 1990 and 1991, respectively, the percentages of total consumption of the imported bulk chemicals, consumed by each use sector.

Refrigeration and air-conditioning sector:

All the CFC-12 imported are used by servicing workshops to refill refrigerator systems and air-conditioners (both stationary and automotive). Negligible quantities of R-500 (containing 73.8% CFC-12 by weight) were imported in 1986, 1989, 1990 and 1991.

In 1986, 1989, 1990 and 1991, the percentages of the total import of CFC-11 that were used under the refrigeration and air-conditioning sector (for servicing and/or refilling refrigeration and air-conditioning systems) were 19% (1 Tonne), 37% (1.4 Tonnes), 32% (1 Tonne) and 43% (1.3 Tonnes), respectively.

Very minor quantities of CFC-115 are imported as part of a refrigerant mixture R-502. Out of the total consumption of controlled substances as refrigerants, CFC-115 constituted approximately 1% in each of the four years.

Foams sector:

There are two foam manufacturing companies using CFC-11. In 1986, 1989, 1990 and 1991, the percentages of the total imported CFC-11 that were used for manufacture of foam were 81% (4.5 Tonnes), 63% (2.3 Tonnes), 68% (2.1 Tonnes) and 57% (1.7 Tonnes), respectively.

2.2.3 Products Containing Controlled Substances

In Zambia, there is one manufacturer of refrigeration equipment such as display cases, chillers for bar counters, freezers, coolers and mortuary units. The equipment are manufactured when orders are received, however, the quantities of units manufactured are very small. The prices of locally manufactured equipment are not much lower than the imported equipment since parts are imported and import duties are high. With little exception, the demand for refrigerator systems are met through import. Similarly, all air-conditioning systems (stationary and mobile) and fire extinguishers systems (fixed and portable) are not manufactured in Zambia but imported.

Foam products (mattresses, cushions, etc.) are produced in the country and most of the demand for these products are met through local production. Small quantities of rigid foams used for building insulation panels are also locally produced. The three aerosol spray manufacturers have already substituted the use of CFCs with hydrocarbons. Cosmetic aerosols that are likely to be containing controlled substances are imported. Import figures for the foam products and aerosols could not be obtained.

Estimates of the numbers of various equipment containing controlled substances that are currently in operation in Zambia have been made. These estimates are shown in Table 2 which also shows the type of controlled substances contained in each category of equipment and approximation of the total quantity of the controlled substances contained per equipment for each category of products.

Only limited data on annual importation of products containing controlled substances could be obtained. Available data on the quantities of products imported, and their main source countries are indicated below in connection with general information on each type of products being used in Zambia.

Domestic refrigerators and freezers:

Domestic refrigerators and freezers are considered to be luxury items, hence the duty for these equipment is high at 50% on top of which sales tax of 20% is charged. Hence, refrigerators are expensive. Current prices of domestic refrigerators range between 100,000 and 250,000 Kwachas (US \$ 500 - 1,250). Only high income earners are able to afford buying such equipment. (N.B. In 1991 there were approximately 360,000 people in the formal sector employment.) Several offices are also equipped with domestic refrigerators. An estimated number of 180,000 to 220,000 domestic refrigerators and freezers exist in Zambia.

The importation of domestic refrigerators and freezers in 1986, 1989 and 1990 were approximately 17,500, 14,500 and 11,000, respectively. The main source countries include United Kingdom, South Africa, Italy and Japan.

In Zambia, a refrigerator is usually a life-time investment. Some refrigerators from late 1960's are still in operation. However, due to occasional power surges and fluctuations in the electric power supply, the average life time

Figure 1.1 1986 Consumption of Controlled substances by end-use

TOTAL CONSUMPTION
34.6 TONNES

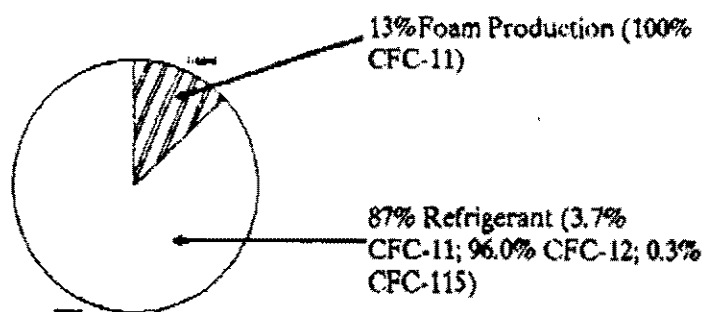


Figure 1.2 1989
Consumption of Controlled
substances by end-use

22.3 TONNES

TOTAL CONSUMPTION

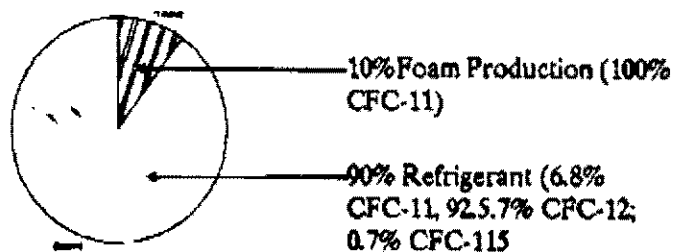


Figure 1.3 1990
Consumption of Controlled
substances by end-use

TOTAL CONSUMPTION
38.9 TONNES

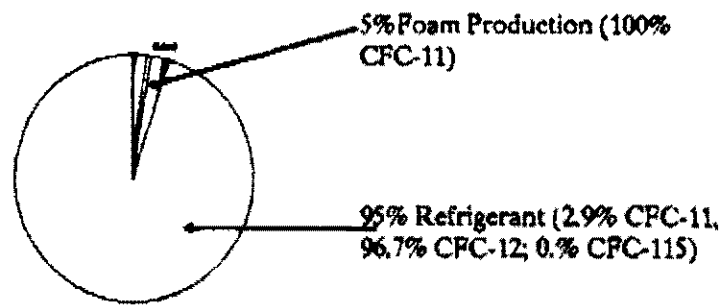
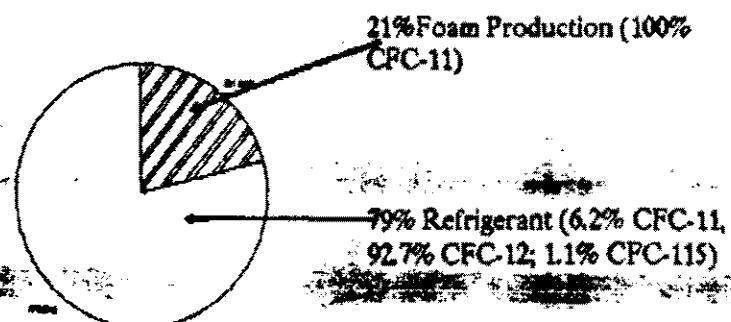


Figure 1.4 1991 Consumption of Controlled substances by end-use

TOTAL CONSUMPTION
22.2 TONNES



found. The use of halon fire extinguishers is uncommon because halons are expensive. There seems to be no fixed halon fire extinguisher systems. Only one company selling fire extinguishers imports 1.5kg portable fire extinguisher units containing halons among other fire extinguishers (carbon dioxide, foam and powder). The halon fire extinguishers are sold to various small scale users. The users that were identified include:

- (i) a number of fire brigade services under the City Councils in various regions had locally bought some portable units of halon fire extinguishers in the mid 1980's but they now resort to non-halon extinguishers;
- (ii) Zambia Airways and Roan Air (Zambian airline company) for their aircrafts;
- (iii) the national airports; and
- (iv) cosmetic industry (multinational).

It is possible that halon fire extinguishers are being directly imported and used for military purposes. However, data could not be obtained from these sources.

Importation of portable units of halon fire extinguishers in 1986, 1989, 1990 and 1991 were 1,010, 320, 323 and 302, respectively.

Table 2.1 Estimation of the numbers of equipment containing controlled substances that are currently in operation in the country

TYPE OF EQUIPMENT	QUANTITY IN OPERATION	CONTROLLED SUBSTANCE CONTAINED	ESTIMATED TOTAL CONTENT OF CONTROLLED SUBSTANCES (Tonnes)
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(A) REFRIGERATION AND AIR-CONDITIONING SYSTEMS

domestic refrigerators and freezers	180,000 - 220,000	CFC-12	32 - 36
commercial refrigerators	300 - 500	CFC-12	0.2 - 0.3
cold stores/rooms	1,000 - 1,200	CFC-12/(HCFC-22)	?
refrigerated trucks	50	(HCFC-22)/CFC-12	?
automotive a/c	2,000 - 4,000	CFC-12	1 - 2

(B) FIRE EXTINGUISHERS (HALONS)

portable	2,000	Halon 1211	3
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2.3 Analyses of Future Demand for the Controlled Substances

2.3.1 The Economy

Copper has been the backbone of Zambia's economy for many years, accounting for approximately 90% of the country's export earnings and providing more than 50% of the Government's revenues. Until about 1970, the GDP increased at an annual rate of around 13% as a result of increased copper output and rising prices of copper in the world market. However, in 1974 the world market price of copper fell and with it the GDP growth rate.

of a compressor is estimated to be 6-8 years. The importation of compressors is therefore high. 7,000 - 10,000 domestic refrigerator and freezer compressors were imported each year in 1989 and 1990.

Medium to large size refrigeration systems:

The medium to large size refrigeration systems comprising commercial, industrial and transport refrigeration equipment found in Zambia include:

- (i) Open-top freezers, chillers, coolers and refrigerated display cases in shops and stores which use CFC-12 as refrigerant;
- (ii) Cold storage/rooms, freezer rooms and chillers in dairy, meat, food, beverage, fisheries, and shoe making industries; stores; restaurants; hotels; and farms. The dominant refrigerant is CFC-12. Exceptions that use ammonia refrigerants include cold storage in fisheries and cold storage company and refrigeration systems in the dairy industry. The most common type of cold rooms are the ones that are 9m x 9m in size. Almost every farmer owns one cold storage/room;
- (iii) An estimated total of 50 refrigerated trucks are owned by fisheries, foods and meat industries, farms and transport companies. Most of these trucks use HCFC-22 as refrigerant;
- (iv) Each of the four existing fisheries have blast freezers of approximately 20 tonnes capacity, using ammonia refrigerant;
- (v) mobile air coolers which use CFC-12 or HCFC-22 for cooling airplanes.
- (vi) An estimated 200 units of ice-making machines, some of which use CFC-12 and others use HCFC-22. There are about 6 ice-making industry in Zambia.

Automotive air-conditioners:

More recently, automobiles are imported with air-conditioners. It is estimated that 3-5% of the cars that are currently running in Zambia have air-conditioners. All the automotive air-conditioners contain CFC-12. There are an estimated number of 70,000 cars running in Zambia. Hence there are an estimated 2000 - 4000 automotive air-conditioners.

The business of importing automotive air-conditioning units for installation does not seem to exist in Zambia. The car dealers and motor garages sometimes undertake to replace the already-fitted air-conditioners that break down. Refilling of the car air-conditioners are done by refrigeration and air-conditioning servicing workshops and some motor garages.

Central and room air-conditioners:

Almost all the air-conditioning equipment found in Zambia use HCFC-22 as refrigerant. There are some large central air-conditioning systems that are using CFC-12. Since HCFCs are not yet controlled under the Montreal Protocol, this Country Programme does not discuss the consumption of HCFCs. However, future monitoring as stated under the action plan will also require reporting by the industries on use of HCFCs.

Aerosols:

Insecticides and air fresheners are produced locally by three multinational companies. During mid to late 1980s these companies switched from using CFCs to hydrocarbons. Cosmetic aerosols are being imported and these are likely to be containing CFCs.

Halon fire extinguishers:

Only a very limited use of portable halon fire extinguishers have been

2.3.2 Projection of Demand for Controlled Substances: Unconstrained Demand

Basic Assumptions:

The future demand for the controlled substances is estimated assuming that the Montreal Protocol did not exist. The estimation of the unconstrained demand is based on the assumption that the GDP growth rate will follow the optimistic prediction as stated in the sub-section above (2.3.1 The Economy). The population growth rate taken is the 1980 to 1990 growth rate of 3.2%.

Zambia consumes CFC-11, CFC-12, CFC-115 and carbon tetrachloride. CFC-115 has not been included in the estimation of the unconstrained demand because the consumption is very small (between 0.1 and 0.2 Tonnes in 1986, 1989, 1990 and 1991) and refrigeration equipment using R-502 (which contains CFC-115) is very uncommon. It is assumed that the growth in demand for such equipment will not be significant. Due to lack of adequate data on carbon tetrachloride, this substance has not been included in the analyses.

At present, there is no indication that any new industries which would use controlled substances will be established in Zambia.

Projection of demand of each controlled substance:

CFC-12 is used entirely for refilling and servicing refrigeration and air-conditioning equipment. The import of the CFC-12 shows a biennial fluctuation due to the fact that one of the major importer and distributor of the substances imports CFC-12 on a biennial basis. Estimations of the amounts of CFC-12 used in each sub-sector in 1991 are:

Domestic refrigeration: 8 Tonnes
Commercial refrigeration: 2 Tonnes
Cold storage and other industrial refrigeration: 10-15 Tonnes
Automotive Air-conditioning: 3-6 Tonnes

Although information from some larger refrigeration and air-conditioning servicing companies indicated that 10-20% increase in consumption of CFC-12 could be expected, part of the reason is that CFCs are becoming expensive, and driving some of the smaller workshops out of business. The predicted increase in demand for servicing therefore largely reflects increased market shares.

If the average population growth rate between 1980 and 1990 of 3.2% persists, the GDP per capita will only show a small improvement even with the optimistic prediction of the GDP growth rate. Therefore, it is assumed that the increase in demand for the CFC-12 will follow closely the GDP growth rate. This implies that the ratio of refrigeration equipment to population would increase slightly.

3.0% growth rate in CFC-12 consumption is assumed for years 1992 to 1994, 4% for the years 1995 to 2000 and 6% for the years 2000 to 2010. The consumption in 1991 for the purpose of calculating the unconstrained demand is taken as the average consumption for the years 1990 and 1991 (27.3 Tonnes). With these assumptions the consumption of CFC-12 in the years 2000 and 2010 would be 37.7 and 71.6 Tonnes, respectively (see Table 2.2 below).

CFC-11 is primarily used by two foam manufacturers to produce flexible foam mainly for mattresses and furniture and some rigid foam. The consumption of CFC-11 is small and declining (in 1986, 1989, 1990 and 1991, 4.5, 2.3, 2.1 and 1.7 Tonnes, respectively). It is assumed that the decline is due to the economic recession. Another assumption made is that the growth in the demand for the foam products will increase at a faster rate than the GDP growth rate largely because the market is likely to be far from saturated and the foam products are relatively easy to afford with improvement in the economy. The average growth

The general recession in the industrialized countries has also affected Zambia's economy. Changes in technology has also led to decrease in demand for copper in the developed countries and the cost of manufactured goods, especially equipment and their spare parts have increased considerably. The decreased export earning of Zambia has widened the foreign exchange gap and the countries external debt is now at around US \$ 7 billion.

The annual GDP growth rate from 1986 to 1991 has been as follows:

1986:	0.7
1987:	2.7
1988:	6.3
1989:	-1.0
1990:	-0.4
1991:	-1.8

The positive growth rate recorded in 1987 and 1988 was the result of a launch of New Economic Recovery Programme in 1987. The theme of the Programme was 'Growth from our Own Resources' representing the country's commitment towards self-reliance in all areas of development. However, the positive growth rate was short lived. In 1989 the Government launched the Fourth National Development Plan (FNDP) which is in effect until 1993. The FNDP reiterates the and builds upon the Economic Recovery Programme. All the development plans prioritize the following:

- rural development, emphasizing expansion of the production base agriculture, promotion of village and small scale industries, and the creation of infra-structural and extension facilities to benefit subsistence producers and small scale farmers;
- promotion of industrial production based on local materials;
- reduction of the disparities in the level of income between rural and urban sectors;
- expansion of educational facilities both in quantity and quality;
- adoption of more labour intensive technologies to generate employment;
- target GDP of over 5% in real GDP with reasonable price stability.

The FNDP generated two major economic policy documents: the Economic and Financial Policy Framework (EFPF), 1989-1993 and the Public Investment Programme (PIP), 1989-1993. The objectives of highest priority under the FNDP are: to increase growth in non-metal sectors promoting non-traditional exports and to reduce inflation by combined fiscal and monetary measures.

The Zambian economy is expected to continue being influenced by the development in the international economy. Decline in copper prices and a reduction in copper output is anticipated in the immediate future. The Government of Zambia faces the challenge of stabilizing the economy, especially to control inflation and create job opportunities. With the firm commitment to continue implementing the economic reforms, an assured flow of external assistance is expected for closing the financing gap. The Government is undertaking to rehabilitate and maintain the existing social and economic infrastructures that deteriorated over the past decade. Various measures including structural adjustment policies are also being implemented to stimulate investments. Increase in the number of investments including foreign investments are expected from this year. The optimistic rate of GDP growth until the year 2010 is predicted as follows:

1992:	1.2 to 2.0%
1993:	3.0 to 3.5%
1994:	3.6%
2000:	5.0 to 6.0% up to year 2010

Table 2.2 Summary of the yearly predicted consumption following the unconstrained demand

Year	GDP Growth Rate	Assumed Growth Rates foam / refrigerant	CFC-11 (foam) Consump.	CFC-11 (refrig.) Consump.	CFC-12 Consump.	Total Consump.
1991	-1.8		1.7	1.3	27.3	30.3
1992	1.2 to 2.0	20% / 3.0%	2.0	1.3	28.1	31.4
1993	3.0 to 3.5	" / 3.0%	2.5	1.4	29.0	32.9
1994	3.6	" / 3.0%	2.9	1.4	29.8	34.1
1995	3.6	" / 4.0%	3.5	1.5	31.0	36.0
1996	3.6	" / 4.0%	4.2	1.5	32.3	38.0
1997	3.6	" / 4.0%	5.1	1.6	33.6	40.3
1998	3.6	" / 4.0%	6.1	1.7	34.9	42.7
1999	3.6	" / 4.0%	7.3	1.7	36.3	45.3
2000	5.0 to 6.0	" / 6.0%	8.8	1.8	38.5	49.1
2001	5.0 to 6.0	" / 6.0%	10.5	1.9	40.8	53.2
2002	5.0 to 6.0	" / 6.0%	12.6	2.1	43.2	57.9
2003	5.0 to 6.0	" / 6.0%	15.2	2.2	45.8	63.2
2004	5.0 to 6.0	" / 6.0%	18.2	2.3	48.6	69.1
2005	5.0 to 6.0	" / 6.0%	21.8	2.5	51.5	75.8
2006	5.0 to 6.0	" / 6.0%	26.2	2.6	54.6	83.4
2007	5.0 to 6.0	" / 6.0%	31.4	2.8	57.8	92.0
2008	5.0 to 6.0	" / 6.0%	37.7	2.9	61.3	101.9
2009	5.0 to 6.0	" / 6.0%	45.3	3.1	65.0	113.4
2010	5.0 to 6.0	" / 6.0%	54.3	3.3	68.9	126.5

2.3.3 Estimation of incremental cost for the phase-out of controlled substances

Incremental costs are estimated for two different scenarios:

- (a) Accelerated phase-out through the implementation of this Country Programme which targets the phase-out at year 2000. The incremental costs are estimated based on the planned activities under the Action Plan.
- (b) Phase-out in the year 2010 in accordance with the requirements of the Montreal Protocol for countries operating under paragraph 1 of Article 5. (Freeze at 1995-1997 level by 1999; 50% reduction by 2005; 85% reduction by 2007; Complete phase-out by 2010). The consumption of the controlled substances is assumed to follow the maximum allowable consumption.

No standard method has yet been defined for estimating the incremental costs to be incurred by Article 5 countries in phasing-out the consumption of controlled substances. There are considerable uncertainties associated with regard to e.g. what costs should or should not be interpreted or included as incremental cost; the various costs associated with substitute chemicals and alternative technologies; and timing, costs and intensity of the various activities (including training, public awareness and institutional strengthening) that are needed to effectuate the phase out. The incremental cost estimation is therefore dependent upon the assumptions made which differ for every country study/programme.

The method used in the attempt to estimate the incremental costs for Zambia is a simple one, based on several simplistic assumptions. The estimation of the incremental costs are only roughly indicative and would not be comparable to the estimates for other countries due to the wide differences in the assumptions made and the methodologies for the estimation. The estimated incremental costs do not indicate the costs of the Action Plan.

Basic assumptions in this analysis that apply to all the use sectors are:

rate of the CFC-11 consumption in the foam production is assumed to be 20%. Therefore, the consumption of CFC-11 in the foam production is estimated to be 8.8 and 54 Tonnes in the years 2000 and 2010, respectively.

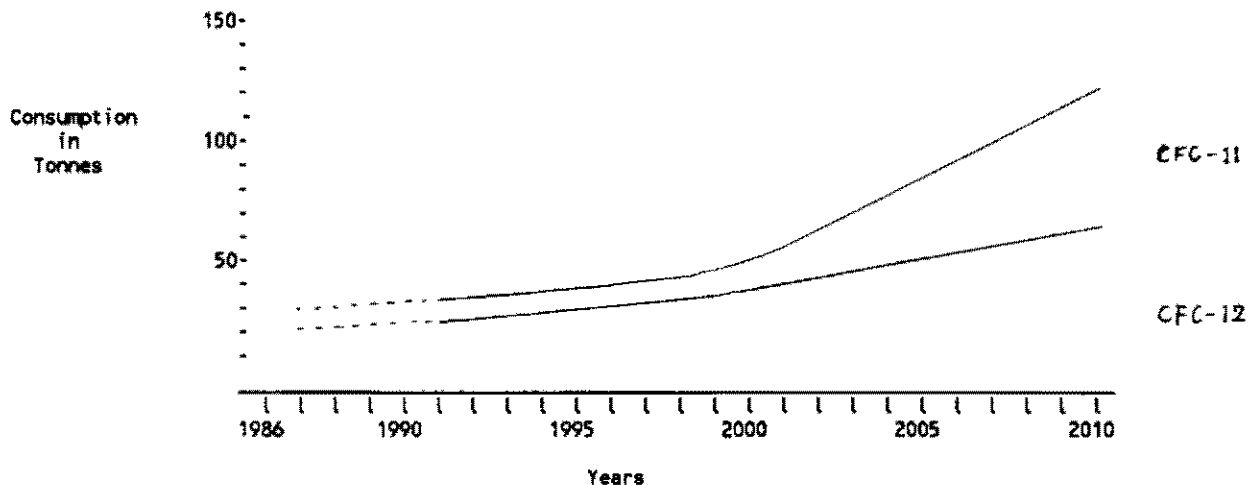
These estimated future consumptions are still lower as compared with the CFC-11 consumption in Ghana where in 1990, 55 Tonnes of CFC-11 was consumed by three manufacturers of foam products. Since then, one company switched to using methylene chloride. If this company had not undergone conversion the consumption of CFC-11 is estimated to have been more than 100 Tonnes in 1991 and about 150 Tonnes in 1992. It should be noted that the population of Ghana is twice that of Zambia and the GDP growth rate since 1983 has been about 5%. The use pattern of the controlled substances is similar in the two countries. A typical flexible foam producing industry in a developing country has the capacity to use 100 to 150 Tonnes of CFC-11.

CFC-11 is also being used in Zambia for servicing refrigeration and air-conditioning equipment, mainly for cleaning the equipment. The consumption of CFC-11 under the refrigeration and air-conditioning sector were 1, 1.4, 1 and 1.3 Tonnes in 1986, 1989, 1990 and 1991, respectively. The growth in the consumption is assumed to grow at the same pace as the CFC-12 growth: 3.0% for years 1992 to 1994, 4% for the years 1995 to 2000 and 6% for the years 2000 to 2010. Therefore, the consumption of CFC-11 in the refrigeration and air-conditioning sector in the years 2000 and 2010 would be 1.8 and 3.4 Tonnes, respectively.

The total CFC-11 consumption for the years 2000 and 2010 are estimated to be 10.6 and 57.4 Tonnes, respectively (see Table 2.2 below).

The total unconstrained demand for the controlled substances in the years 2000 and 2010 are calculated to be 48.3 and 129 Tonnes, respectively. Figure 2.3 below shows graphically the future unconstrained demand for the controlled substances.

Figure 2.1 Graph showing the unconstrained demand for each controlled substance up to year 2010



Foams sector:

Under the Industry Actions, the foam producing industries are given the opportunity to choose an appropriate substitute or alternative. Conversion should occur before the year 2000 when the importation of controlled substances will be banned. A special technical workshop and a study visit for the foam industries is planned to be organized in 1993. Through the workshop the industries will be informed of the existing and emerging substitute chemicals and alternative technologies for blowing foams and receive advice on the possible conversions for their industries. The workshop will be followed by a study visit to some of the foam industries abroad that have undergone conversions.

For the production of flexible foam, the two conversion options that do not involve use of HCFCs and are relatively cheap and simple are substitution to methylene chloride and elimination of the blowing agent altogether. Using CFC-11 as auxiliary blowing agent enables production of low density foams of 21kg per cubic meter and below.

Methylene chloride is currently the commonly used substitute for CFC-11. It is substantially cheaper than CFC-11 (methylene chloride is approximately 20% of CFC-11 price) and less of it is required as foam blowing agent as compared with CFC-11. Methylene chloride also enables production of low density foams and it is basically a drop-in substitute for CFC-11. Hence, adequately-functioning CFC-11-using equipment need not undergo retrofit. However, methylene chloride is toxic and a possible carcinogen. Occupational health safety measures must be taken when using methylene chloride. The required safety measures such as adequate ventilation systems and protective clothing may involve substantial capital investment.

When auxiliary blowing agent is eliminated from foam production, the sole blowing agent becomes the CO₂ produced through reaction between isocyanate (material that constitutes the foam) and water. Without the auxiliary blowing agent, low density foam cannot be produced without high risk of isocyanate catching fire. However, it is possible to produce foam of density 22kg per cubic meter without much fire risk. Since high density foam would require more isocyanate, the cost of foam production may increase. However, some part of the cost can be compensated by elimination of the auxiliary blowing agent and selling foam products that are denser but less thick.

For the purpose of estimating the incremental cost for the phase-out, it is assumed that the foam manufacturers will convert to using methylene chloride. Experience from large flexible foam factories in developed countries indicate that conversion to methylene chloride has led to cost savings. Although this may not necessarily be true for smaller scale factories in developing countries, it is assumed that the incremental cost is zero.

As for the manufacture of building insulation panels, there is not yet a non-HCFC substitute that enables manufacture of foams with as good an insulation effect as foams blown with CFC-11. The manufacture of rigid foams in Zambia is currently very small. The incremental cost for the conversion of rigid foam has not been included.

Refrigeration and air-conditioning sector:

The Government will encourage the use of HFC-134a equipment which are predicted to be widely available in the international market from around 1995. The price of a domestic refrigerator using HFC-134a is expected to be 10-20% more expensive than the CFC-12-using refrigerator. The Report of the Technical Options Committee on Refrigeration and Air-conditioning states that the extra costs on the HFC-134a equipment should gradually disappear in about 5 years time. For the estimation of the incremental costs it is assumed that the price of HCF-134a

- The consumption of the controlled substances will increase according to the predicted unconstrained demand until control is effected according to the Action Plan or the Montreal Protocol control measures.
- The controlled substances will be available in sufficient quantities at constant prices.
- The estimates of the incremental costs are based on 1991-1992 prices.
- A real discount rate of 10% has been used to calculate the present 1992 value of the costs. Both discounted and undiscounted figures are given.

The phase-out activities and the sector-specific assumptions are briefly described for each use sector as well as for the Government Actions. Under each use sector, the descriptions of the activities and assumptions is followed by analyses of the incremental costs that correspond to the two scenarios.

The expected consumption of the controlled substances under each of the scenarios is shown graphically below:

Figure 2.2 Graph showing the expected consumption of the controlled substances under the accelerated phase out scenario (maximum consumption under the Action Plan)

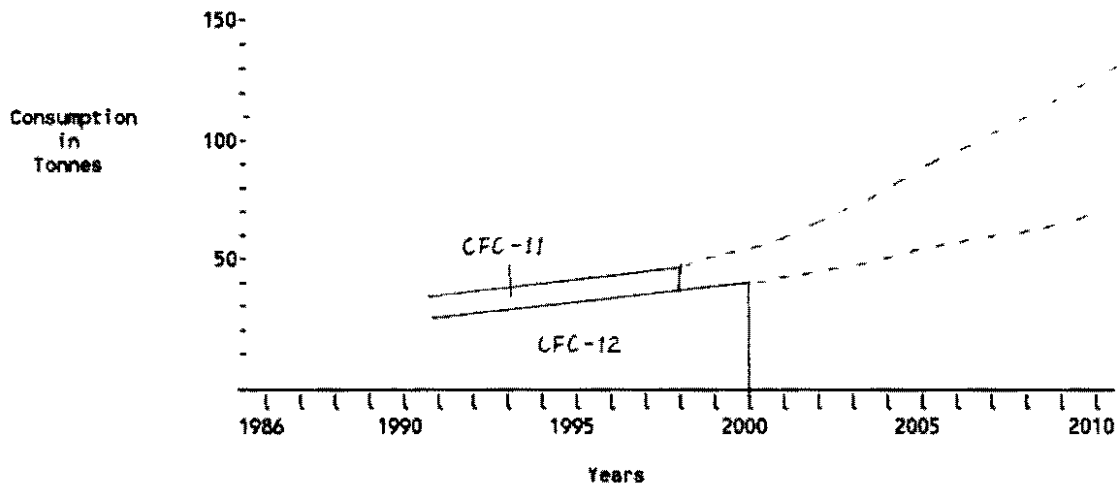
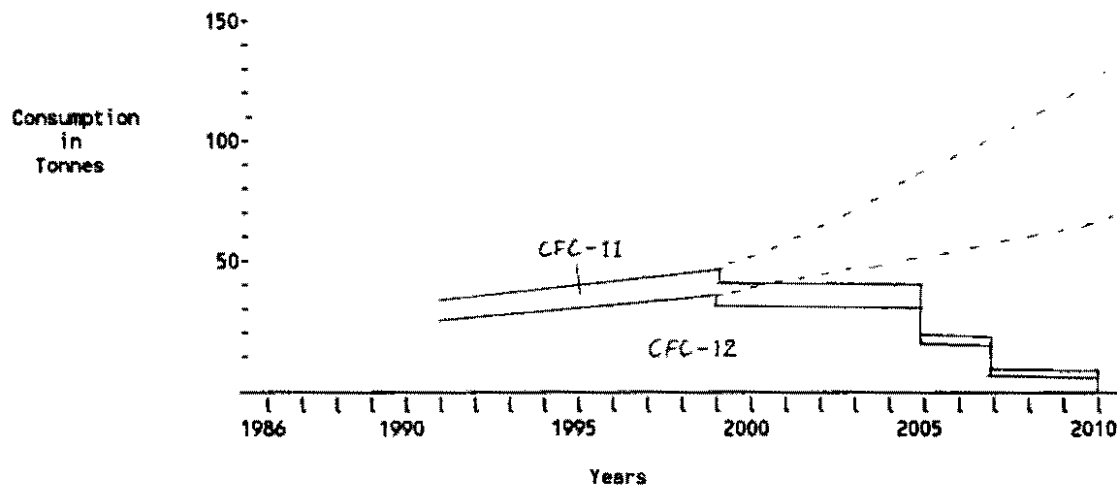


Figure 2.3 Graph showing the expected consumption of the controlled substances under the Montreal Protocol phase-out scenario (maximum allowable consumption)



cheaper. It is assumed that the cheaper operational cost would offset the investment required for the retrofit.

The incremental cost for phasing out CFC-12 consists of following elements:

Retrofitting of commercial refrigerators

(a) Accelerated phase-out:

Estimated incremental cost: undiscounted: US \$ 273,000
 discounted: US \$ 146,162

- The average cost to the owners of commercial refrigeration equipment for retrofitting the equipment is taken to be US \$ 500. It is assumed that all the existing units will eventually be retrofitted, therefore, cost of early retirement/replacement of commercial refrigerators is not included in the calculations of the incremental costs.
- From 1995 onwards the purchasing of new HFC-134a equipment should begin and the ban on the importation of CFC-12 equipment will be effected in 1997. For the commercial refrigerators, the number estimated to have been in operation in Zambia (in 1991) is 500. The number is assumed to increase at the same rate as the growth rate for refrigerants (i.e. closely following the GDP growth rate). Hence, in 1996 there would be approximately 591 units of equipment. Out of the 91 units newly acquired since 1991, 50% (i.e. 45 units) is assumed to be HFC-134a equipment. The total number of CFC-12 equipment that will be retrofitted is therefore 546.
- It is assumed that the retrofitting would start in 1995 at yearly rate assumed as below until year 2000. The corresponding annual cost for retrofitting is also shown:

Year	% and no. of equip. retrofitted		cost US \$	discounted cost US \$
1995	5%	28	14,000	10,519
1996	10%	52	26,000	17,759
1997	15%	70	35,000	21,733
1998	20%	80	40,000	22,579
1999	30%	95	47,500	24,376
2000	50%	110	55,000	25,658
2001	the rest	111	55,500	23,538
TOTAL		546	273,000	146,162

(b) Phase-out in accordance with the Montreal Protocol:

Estimated incremental cost: undiscounted: US \$ 320,000
 discounted: US \$ 112,580

- Business will continue as usual until 1999 when the consumption of CFC-12 would have to be frozen at 1995-1997 average level. By 1998 the number of units of commercial refrigerators in Zambia is estimated to increase to 640.
- It is assumed that from 1999 the imports of CFC-12 commercial refrigerators would stop because the CFC-12 import will have to be restricted. However, limited amounts of CFC-12 will continue to be imported for servicing the equipment until the year 2010.
- The retrofitting is assumed to occur during the whole period of phase out, i.e between 1999 and 2009 (inclusive). The yearly rate at which the retrofit would occur have been assumed as below. The associated costs for retrofit is also shown:

equipment will remain constant at the level that is 10% more expensive than the CFC-12 equipment for 5 years (until the year 2000). Thereafter, the HFC-134a equipment and CFC-12 equipment is assumed to be the same price.

The issue of energy consumption of the various equipment have not been taken into account. With regard to HFC-134a equipment, energy efficiency as compared with CFC-12 equipment is uncertain. In some experimental cases, the energy efficiency was shown to improve while in other cases opposite was indicated. Any change in energy efficiency when industrial refrigeration systems are converted to ammonia has not been taken into account.

The higher cost of HFC-134a and lubricant oil for servicing has not been included in the estimation of incremental costs. HFC-134a is currently at least 5 times as expensive as CFC-12 (HFC-134a: approximately US \$ 20 per kg as compared with CFC-12: approximately US \$ 3 per kg), but less of it is necessary for the new equipment using HFC-134a. It is also difficult to predict how the cost of HFC-134a would change over the years. Some of the costs will also be recovered through recovery and recycling.

The estimated increase in the stock of various types of refrigeration equipment following the unconstrained demand is shown in Table 2.3 below. The increase in the stock of domestic refrigeration equipment is likely to be an underestimate when compared with actual trends in import for the years 1986, 1989 and 1990 (see sub-section 2.2.3, Products Containing Controlled Substances).

Table 2.3 Summary of the yearly predicted stock of refrigeration equipment following the unconstrained demand

Year	GDP Growth Rate	Assumed Growth Rate for refrigeration equipment	Domestic Refrig.	Commercial Refrig.	Cold storage
1991	-1.8		220,000	500	1,000
1992	1.2 to 2.0	3.0%	226,600	515	1,030
1993	3.0 to 3.5	3.0%	233,398	531	1,061
1994	3.6	3.0%	240,400	547	1,093
1995	3.6	4.0%	250,016	569	1,137
1996	3.6	4.0%	260,017	591	1,182
1997	3.6	4.0%	270,418	615	1,230
1998	3.6	4.0%	281,234	640	1,279
1999	3.6	4.0%	292,484	665	1,330
2000	5.0 to 6.0	6.0%	310,033	705	1,410
2001	5.0 to 6.0	6.0%	328,635	747	1,494
2002	5.0 to 6.0	6.0%	348,353	792	1,584
2003	5.0 to 6.0	6.0%	369,254	840	1,679
2004	5.0 to 6.0	6.0%	391,409	890	1,780
2005	5.0 to 6.0	6.0%	414,894	943	1,886
2006	5.0 to 6.0	6.0%	439,787	1,000	2,000
2007	5.0 to 6.0	6.0%	466,174	1,060	2,119
2008	5.0 to 6.0	6.0%	494,145	1,124	2,247
2009	5.0 to 6.0	6.0%	523,794	1,191	2,381
2010	5.0 to 6.0	6.0%	555,221	1,262	2,524

The retrofitting of industrial refrigeration has not been included in the analyses of incremental costs. It is assumed that these equipment will be retrofitted to use ammonia as refrigerant and that although some capital investment will be required for the retrofit, the operational cost would be

Domestic refrigeration: higher costs to the consumers for purchasing new equipment that do not contain CFCs or HCFCs

(a) Accelerated phase-out:

Estimated incremental cost: undiscounted: US \$ 5,625,072
 discounted: US \$ 3,498,343

- The average price of a domestic refrigeration equipment is taken to be US \$ 600. The price of such an equipment to a consumer would be US \$ 1,080 (after 50% import duty and 20% sales tax on top).
- The average price of a HFC-134a domestic refrigeration equipment is assumed to be 10% more expensive, i.e. US \$ 660 (until beginning of 2000). The price of such an equipment to a consumer would be US \$ 1,188.
- The incremental cost to a consumer for purchasing a HFC-134a equipment is therefore, estimated to be 1,188 - 1,080 = US \$ 108.
- It is assumed that all the refrigeration equipment imported from 1995 onwards will be HFC-134a equipment.
- The number of domestic refrigeration equipment that would be imported annually from 1995 to 1999 (inclusive) and the incremental cost to the consumers for purchasing the HFC-134a equipment is estimated to be:

year	no of equipment	cost US \$	discounted cost US \$
1995	9,616	1,038,528	780,262
1996	10,001	1,080,108	737,729
1997	10,401	1,123,308	697,486
1998	10,816	1,168,128	659,378
1999	11,250	1,215,000	623,488
TOTAL:	52,084	5,625,072	3,498,343

(b) Phase-out in accordance with the Montreal Protocol:

Estimated incremental cost: undiscounted: US \$ 0
 discounted: US \$ 0

- The importation of CFC-12 equipment is estimated to stop in 1999 when the consumption of controlled substances must be frozen at 1995-1997 average level. The demand is assumed to be met by HFC-134a equipment. Estimated total number of HFC-134a equipment to be imported from 2000 to 2010 is 245,188, but from the year 2000 the cost of HFC-134a is assumed to be the same as the cost of a CFC-12 equipment. Hence, incremental cost would be 0.

Domestic refrigeration: costs of forced replacement of CFC-12 equipment

(a) Accelerated phase-out

Estimated incremental cost: undiscounted: US \$ 109,408,000
 discounted: US \$ 47,110,378

- In Zambia, a life time of a domestic refrigerator is estimated to be 20-25 years, with compressor replacement occurring once every 8 years on average. The current cost to a consumer for having a compressor replaced is approximately US \$ 100. The average cost of a domestic refrigeration equipment is assumed to be US \$ 1060.
- For the purpose of estimation of incremental costs, the lifetime of a fridge is assumed to be 24 years with compressor replacement occurring twice during the life time. Hence, the total investment cost to a consumer would

Year	% and no. of equip. retrofitted	cost US \$	discounted cost US \$
1999	5% 32	16,000	8,211
2000	10% 61	30,500	14,229
2001	15% 83	41,500	17,601
2002	20% 93	46,500	17,928
2003	25% 93	46,500	16,298
2004	30% 84	42,000	13,383
2005	35% 68	34,000	9,849
2006	40% 50	25,000	6,584
2007	50% 38	19,000	4,549
2008	50% 19	9,500	2,068
2009	the rest 19	9,500	1,880
TOTAL	640	320,000	112,580

Commercial refrigeration equipment: higher costs to the consumers for purchasing new equipment that do not contain CFCs or HCFCs

(a) Accelerated phase-out

Estimated incremental cost: undiscounted: US \$ 29,500
 discounted: US \$ 18,352

- The average cost of a commercial refrigeration equipment containing CFC-12 is taken to be US \$ 5000. HFC-134a equipment is assumed to be 5% more expensive than CFC-12 equipment until the year 2000. Thereafter, the cost of HFC-134a is assumed to be the same as the cost of CFC-12 equipment.
- A ban on the importation of CFC-12 equipment will be effected in 1997. It is assumed that all the commercial refrigeration equipment that will be acquired in Zambia from 1995 will be HFC-134a equipment. The numbers of commercial refrigeration equipment that would be acquired annually between 1995 and 1999 (inclusive) are shown below with associated incremental costs.

Year	no. of equip.	cost US \$	discounted cost US \$
1995	22	5,500	4,133
1996	22	5,500	3,757
1997	24	6,000	3,726
1998	25	6,250	3,528
1999	25	6,250	3,208
TOTAL	118	29,500	18,352

(b) Phase-out in accordance with the Montreal Protocol:

Estimated incremental cost: undiscounted: US \$ 0
 discounted: US \$ 0

- The increase in the number of commercial refrigeration equipment containing CFC-12 is estimated to stop in 1999 when the consumption of controlled substances must be frozen at 1995-1997 average level. The demand is assumed to be met by HFC-134a equipment.
- It is assumed that the cost of HFC-134a equipment is assumed to decrease to become the same as the cost of a CFC-12 equipment. Hence, incremental cost from 2000 onwards would be 0.

Year	no. of equip.	cost US \$	discounted cost US \$
1999	15,000	7,800,000	4,002,634
2000	15,000	7,800,000	3,638,758
2001	20,000	10,400,000	4,410,616
2002	20,000	10,400,000	4,009,651
2003	20,000	10,400,000	3,645,137
2004	25,000	13,000,000	4,142,201
2005	25,000	13,000,000	3,765,637
2006	25,000	13,000,000	3,423,307
2007	30,000	15,600,000	3,734,516
2008	30,000	15,600,000	3,395,015
2009	21,234	11,041,680	2,184,538
TOTAL:	246,234	128,041,680	40,352,010

Recovery and recycling of refrigerants

The incremental cost for recovery and recycling is calculated to be the costs of recovery and recycling unit minus the cost savings made by the recycled CFC refrigerant until the phase out year. It is assumed that 30% of refrigerants will be recovered and recycled. Figure of 30% has been chosen because usually when a refrigeration equipment is brought for service, much of the refrigerant gas has already escaped. It is also assumed that cost saved for CFC-12 refrigerant is US \$ 1.5 per kg refrigerant. This value is approximately half of the prices of new CFC refrigerant. This is to attempt to subtract operational costs for the recovery and recycling equipment from the cost savings.

It should be noted that with recovery and recycling, HFC-134a refrigerants will also be recovered and recycled, hence, in actual fact, cost savings will be achieved through recycling of HFC-134a refrigerants. However, this has not been included in the estimation of the incremental costs.

In Zambia, recovery and recycling of refrigerants will be carried out by servicing workshops, each of which will acquire a recovery and recycling equipment. Life time of a recovery and recycling equipment has not been taken into account. The incremental cost estimation only includes costs of one time investment per servicing workshop.

(a) Accelerated phase-out

Estimated incremental cost:	undiscounted:	US \$ 220,548
	discounted:	US \$ 153,954

- The number of servicing workshops is assumed to stay at the present number of 70 until year 1997, because of the requirements under the Action Plan that every workshop would have to acquire a recovery and recycling unit. This requirement is actually likely to drive some of the smaller workshops out of business. After 1977 the number of workshops is assumed to increase at the same rate as the growth rate of refrigerants.
- It is assumed that all the servicing workshop including motor garages servicing automobile air-conditioners, will acquire a recovery and recycling equipment between 1995 and 1997.
- The average price of a recovery and recycling unit is taken to be US \$ 4,000.
- The estimation of annual savings from recycled CFC-12 has been simplified where the annual recycled amount is taken to be 30% of the CFC-12 for that year and the percentages of the total amount of CFC recycled is assumed equal to the percentage of workshops that have acquired a recovery and recycling equipment.

(a) Accelerated phase-out

Estimated incremental cost: undiscounted: US \$ 605,275
 discounted: US \$ 427,160

- The costs of Government Actions is estimated for period from 1993 to 1999 (inclusive).
- The costs of Government Actions estimated for this Country Programme (the first 4 years of Action - 1993 to 1996) are US \$ 358,300. A simplistic assumption is made that the annual cost of Government Actions is the average for the four years, excluding the cost of equipment (US \$ 29,000):

$$\text{i.e. } (358,300 - 29,000)/4 = 82,325$$

- It is assumed that the equipment will be acquired in the first year of action - 1993.
- Hence, the total cost for years 1993 to 2000 is estimated to be:

Year	cost	Discounted cost (1992 value)
1993	111,325	101,205
1994	82,325	68,038
1995	82,325	61,852
1996	82,325	56,230
1997	82,325	51,118
1998	82,325	46,471
1999	82,325	42,246
TOTAL	605,275	427,160

(b) Phase-out in accordance with the Montreal Protocol:

Estimated incremental cost: undiscounted: US \$ 1,099,225
 discounted: US \$ 417,427

- The costs of Government Actions is estimated for period from 1997 (two years before the reduction in consumption must begin) to 2009 (inclusive).
- Annual cost for the Government Actions is assumed to be US \$ 82,325 and the total cost of necessary equipment is assumed to be US \$ 29,000. It is also assumed that the equipment will be acquired by the Government in 1997.

Year	cost	Discounted cost (1992 value)
1997	111,325	69,124
1998	82,325	46,471
1999	82,325	42,246
2000	82,325	38,406
2001	82,325	34,914
2002	82,325	31,740
2003	82,325	28,855
2004	82,325	26,232
2005	82,325	23,847
2006	82,325	21,679
2007	82,325	19,708
2008	82,325	17,917
2009	82,325	16,288
TOTAL	1,099,225	417,427

- Until the ban on importation of the controlled substances is effected in 2000, the importation of CFC-12 refrigerants is assumed to increase at the same rate as for the unconstrained demand.
- The estimated annual incremental costs are shown below:

Year	no. of equip.	cost of equip.	savings from recycled CFC	incremental cost	discounted cost
1995	20	80,000	3,986	76,014	57,111
1996	20	80,000	8,306	71,694	48,968
1997	30	120,000	15,120	104,880	65,123
1998	3	12,000	15,705	-15,705	- 8,865
1999	3	12,000	16,335	-16,335	- 8,383
TOTAL	76	304,000	59,452	220,548	153,954

(b) Phase-out in accordance with the Montreal Protocol:

Estimated incremental cost: undiscounted: US \$ 613,430
 discounted: US \$ 207,711

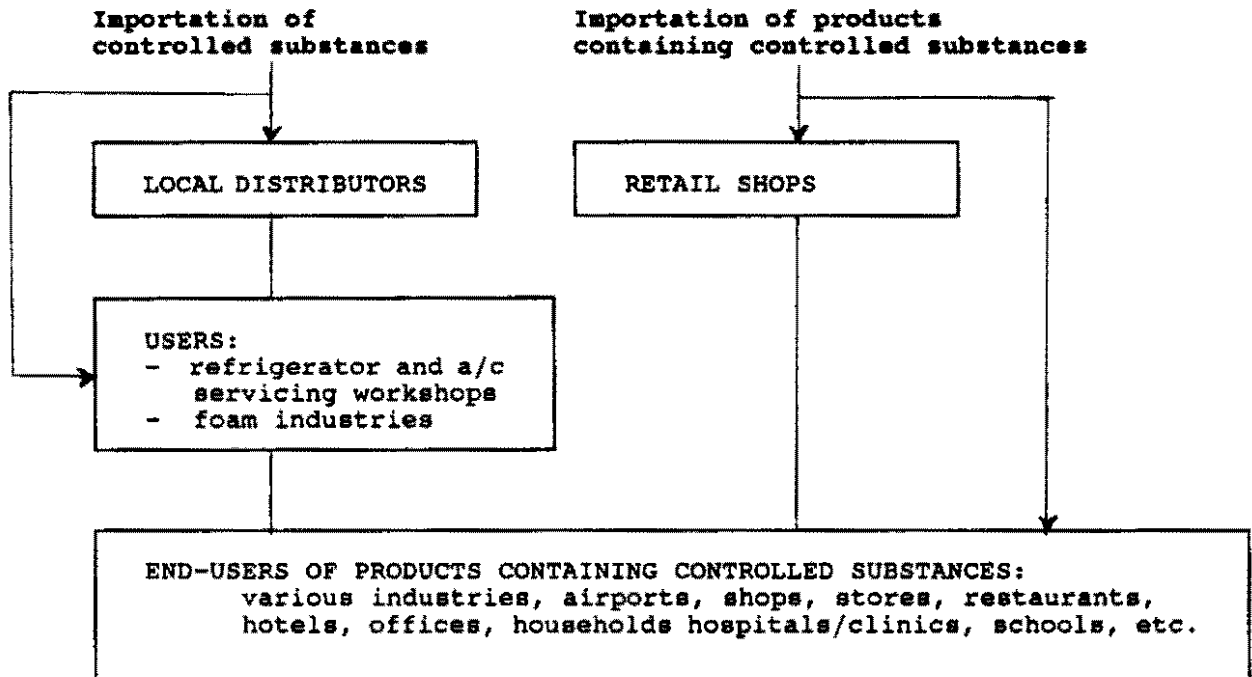
- The number of servicing workshops is assumed to grow at the same rate as the growth in demand for refrigerants. Hence, in 1998, there would be 90 servicing workshops and in 2009 there would be 169. It is assumed that the servicing workshops will acquire a recovery and recycling unit between 1999 and 2010.
- The consumption of CFC-12 is taken to be the maximum allowable consumption following the Montreal Protocol control measures for Article 5 countries. The rest of the demand for refrigerants is assumed to be met by HFC-134a.
- The estimation of annual savings from recycled CFC-12 has been simplified where the annual recycled amount is taken to be 30% of the CFC-12 for that year and the percentages of the total amount of CFC recycled is assumed equal to the percentage of workshops that have acquired a recovery and recycling equipment.
- The estimated annual incremental costs are shown below:

Year	no. of equip.	cost of equip.	savings from recycled CFC	incremental cost	discounted cost
1999	20	80,000	3,093	76,907	39,466
2000	15	60,000	5,088	54,912	25,617
2001	15	60,000	6,857	53,143	22,538
2002	15	60,000	8,436	51,564	19,881
2003	15	60,000	9,772	50,228	17,605
2004	15	60,000	10,959	49,041	15,626
2005	15	60,000	5,966	54,034	15,652
2006	15	60,000	6,057	53,943	14,205
2007	15	60,000	2,035	57,965	13,877
2008	15	60,000	2,126	57,874	12,596
2009	14	56,000	2,181	53,819	10,648
TOTAL	169	676,000	62,570	613,430	207,711

The Government Actions:

The costs of Government Actions comprise: institutional strengthening, public awareness activities and training (including training of various technicians). Only the years up to phase-out is included in the estimation of incremental costs. (Please refer to sub-section 3.2.2 for the various elements and projects under the Government Actions.)

Figure 2.4: Flow chart showing the structure of the industries that deal with controlled substances and products that contain controlled substances.



The type and estimated number of the industries are as follows:

Importers of controlled substances (as bulk chemicals):

- (a) Main importers of CFCs for local distribution: 3

The users of the bulk chemicals (all buy the controlled substances from the importers listed above):

- (a) Foam producing industry using CFC-11: 2
(b) Main refrigerator and stationary air-conditioner servicing and maintenance workshops: 15; small-scale workshops: 50 (an estimate);
(c) Motor garages and other servicing workshops that undertake automotive air-conditioner service: 5 (an estimate).

Importers of products containing controlled substances:

- (a) Main retail companies selling refrigerators and stationary air-conditioners through several branches in different cities and towns: 10-15 (including 2 State shops);
(b) Motor garages and car dealers that service car air-conditioners: (an estimate);
(c) Many larger-scale hotels and industries import their own refrigeration systems and air-conditioners;
(d) Airports, and Zambia Airways import and use halon fire extinguishers;
(e) One shop imports and sells portable halon fire extinguishers.

Conclusions:

The total incremental costs estimated for the two scenarios are as follows:

(a) Accelerated phase-out:

Undiscounted:	US \$	116,161,395	(appr. 116,200,000)
Discounted:	US \$	51,354,349	(appr. 51,400,000)

(b) Phase-out in accordance with the Montreal Protocol:

Undiscounted:	US \$	130,074,335	(appr. 130,100,000)
Discounted:	US \$	41,089,728	(appr. 41,100,000)

As mentioned in the beginning of this sub-section, the estimated incremental costs are only indicative based on the particular assumptions made for the estimation.

The comparison of the discounted costs (10% discount rate) of phase-out under the two scenarios indicates that the incremental costs are lower when the phase out schedule under the Montreal Protocol is followed. It should be kept in mind that the magnitude of seeming cost advantage in delaying the phase out is dependant upon the discount rate chosen. If a lower discount rate is chosen, the cost advantage would become smaller.

The incremental cost figures above should not lead to a conclusion that developing countries operating under paragraph 1 of Article 5 should rather follow the Montreal Protocol phase-out schedule rather than an accelerated one. In reality the controlled substances will soon become unavailable and the prices of the substances are already rising. Prolonged use of the controlled substances will result in difficulties and considerable cost increase to the consuming countries, in particular the countries that do not produce controlled substances, to meet the demand for the substances. The delayed phase-out would impose such burden to the developing countries.

Furthermore, and most importantly, the environmental benefits of less consumption, hence emission of controlled substances would far outweigh the extra costs that may be incurred in accelerating the phase-out.

The Indicative List of Categories of Incremental Costs adopted by the Parties to the Montreal Protocol at their Second Meeting in London states that the most cost-effective and efficient options for phase-out projects should be chosen to be financed through the Multilateral Fund. It is important that the evaluation of the cost effectiveness takes into consideration all the benefits and the costs such as increased cost of controlled substances that the developing countries would have to pay for.

2.4 Industry Structure

The controlled substances are imported by local chemical distributors as well as by some of the users of controlled substances. The users are the foam manufacturers and the servicing workshops for refrigeration and air-conditioning systems.

The products containing controlled substances are imported by retail shops and also by large scale end-users such as hotels and some industries.

The structure of the industries that deal with controlled substances are shown in Figure 2.1 below:

- promotion of removal of unnecessary controls on commerce and industry including exchange control
- encourage authorities to provide services to satisfactory standards including basic infrastructure and public utilities as well as to provide incentives for diversifying the economy;
- encourage local and foreign investments;
- promoting private health care and education;
- ensure dialogue between Government and business community in formulating national policies relating to economic matters.

The activities of the ZACCI include:

- Consulting and informing members about issues that affect their business operations;
- Liaising with Government and its organs on policies which influence the business environment;
- Arranging inward and outward trade missions;
- Organizing seminars, fairs and specialized exhibitions;
- Conduct market surveys.

ZACCI represents the business communities on the following national bodies:

- Commercial Farmers Bureau;
- Export Board of Zambia;
- Small Scale Industries Development Organization (SIDO);
- Zambia Agricultural and Commercial Show;
- Zambia Bureau of Standards;
- Zambia International Trade Fair;
- Zambia Iron and Steel Authority;
- Zambia National Trades Facilitation Committee.

ZACCI has international connections with International Chamber of Commerce and Industry (ICC); PTA Federation of Chambers of Commerce and Industry (PTA/ICC); and SADCC Regional Business Council. It also works closely with International Trade Centre (ITC); UNDP; UNIDO. Some of these organizations have used ZACCI to carry out investment and market surveys.

With financial support of UNDP, ZACCI has established a computer data and information service to provide valuable information on investment and trade opportunities in Zambia and abroad. ZACCI also publishes a newsletter containing topical news, as well as details of trade enquiries, investment opportunities, fairs, conferences seminars, etc. and a quarterly journal, 'Zambian Business' with articles on economic and business themes of current interest.

(b) **The Manufacturers Association of Zambia:**

This Association is a body that comprise industries that deal in manufacturing activities. Its objectives are to:

- promote and encourage the development of industries;
- promote a free market economy;
- promote and uphold the interest of member industries;
- encourage the export of products manufactured in Zambia;
- encourage dialogue between Government and members of the Association;
- observe the health care as it relates to environmental regulations;

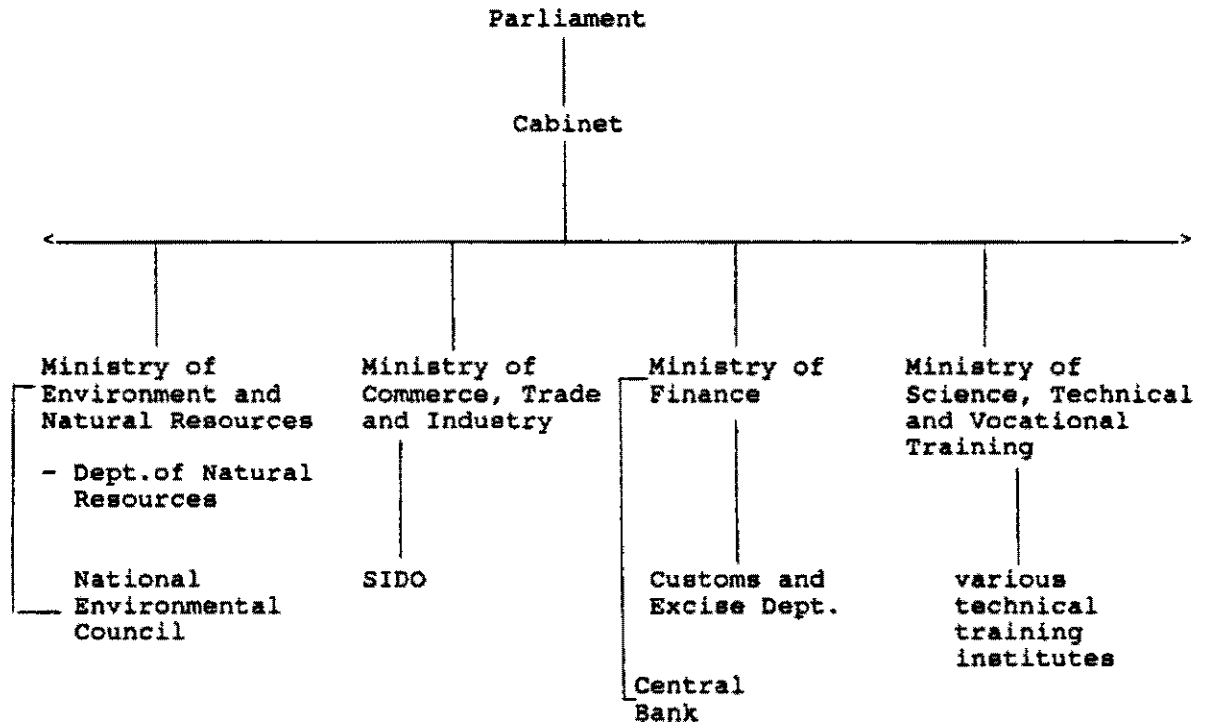
The Association collects information on:

- Production and exports of manufactured products;
- arrange for export missions for the members of the Association;
- organize workshops and seminars for the member industries

obtaining or providing supplies, raw materials or getting machinery and equipment on hire-purchase basis; identifying investment opportunities and preparing feasibility studies and business proposals; and providing various services, finance and credit.

Figure 2.2 below shows the existing institutional framework of Governmental bodies that are directly relevant to the consumption and use of controlled substances in the country.

Figure 2.5: Flow chart showing the institutional framework of Governmental bodies that are directly relevant to the consumption and use of controlled substances



Industry associations:

Industry associations and related organizations in Zambia that include member industries that use controlled substances:

(a) **Zambia Confederation of Industries and Chambers of Commerce (ZACCI):**

ZACCI is a national body for Chambers of Commerce (in each region), industries and specialized trade associations. Its objectives are to:

- promote the national interest in the areas of commerce and industry;
- bring about improvements and commitment to high standards of business ethics, professionalism and customer service;
- ensure compliance with law and maintain order;
- promote free market economy, competition, privatization of parastatals and abolition of monopolies;
- ensure fair, rational, and well administered systems of national and local taxation;

- Luanshya Technical Training Institute:
 - * Automobile mechanics course (certificate);
- Zambia Air Services Training Institute:
 - * Aeronautical electronic technology (certificate)
 - * Aircraft maintenance (diploma)
 - * Meteorological assistance (certificate)
 - * Rescue fire services (certificate);
- Lukashya Technical Training Institute:
 - * Automobile mechanics (certificate)
 - * Carpentry and joinery (certificate);
- Lusaka Technical Training Institute:
 - * Automobile mechanics (certificate)
 - * Machining craft (certificate)
 - * Electrical craft (certificate)
 - * Carpentry and joinery (certificate);
- Mansa Technical Training Institute:
 - * Carpentry and joinery (certificate)
 - * Electrical craft (certificate)
 - * Plumbing and sheet metal work (certificate);
- Nkumbi International College:
 - * Agriculture (certificate)
 - * Mechanics (certificate);
- Choma Technical Training Institute:
 - * Automobile mechanics (certificate)
 - * Carpentry and joinery (certificate)
 - * machining craft (certificate)
 - * Electrical craft (certificate)
- Evelyn Hone College:
 - * Environmental health (diploma)
 - * Medical laboratory (diploma)
 - * Pharmacy (diploma)
 - * Physiotherapy (diploma)
 - * Radiography (diploma);
- Kabwe Technical Training Institute:
 - * Agricultural mechanics (certificate)
 - * Automotive electrical (certificate)
 - * Automotive mechanics (certificate)
 - * Heavy equipment repair (advanced certificate)
 - * Vehicle body repair (advanced certificate)
 - * Metal fabrication (advanced certificate);
- Livingstone Technical Training Institute:
 - * Agricultural mechanics (certificate)
 - * Automobile mechanics (certificate)
 - * Carpentry and joinery (certificate)
 - * Plumbing and sheet metal works (certificate);
- Northern Technical College:
 - * Automotive technician (advanced certificate)
 - * Automotive technology (diploma)
 - * Heavy equipment repair (advanced certificate)
 - * Refrigeration and air-conditioning craft (advanced certificate)
 - * Refrigeration and air-conditioning technology (advanced certificate)

The refrigeration and air-conditioning courses organized under the Northern Technical College is a three year course. The credential issued is Craft Certificate. The programme includes the following elements: refrigeration workshop operations; principles of refrigeration equipment gas and electrical arc welding and cutting; preventive maintenance; receiving instruction and initiating on-site action; trouble-shooting; repairing of refrigeration and electrical equipment; mathematics, communication skills, political education, science and entrepreneurship (for self-employment).

2.6 Existing Policy and Operational Framework

The policies and operational framework for environmental issues, trade and industries are explained below.

2.6.1 Environmental Legislation

Until 1990 there was no comprehensive environmental legislation. Separate enactments relating to environment existed and were administered by different Ministries and Departments. The relevant acts are:

- Natural Resources Conservation Act Cap.315 of 1970 administered by the Department of Natural Resources mainly restricts practices that could lead to natural resources degradation;
- The Water Act Cap.312 of 1964 administered by the Department of Water Affairs covers abstraction and discharge of water into natural water without prescribing mandatory abatement;
- The Local Administration Act Cap.480 of 1980 through District Councils has tried to introduce water pollution standards but enforcement has been, in most cases, weak;
- The Forest Act Cap.311 of 1973 administered by the Forestry Department covers issues of forestry development in Zambia;
- The National Parks and Wildlife Act Cap.316 of 1968 administered by the Department of National Parks and Wildlife, provides for the allocation of areas for national parks and game management areas to conserve wildlife and ecological units and to control wildlife harvesting;
- The Town and Country Planning Act Cap.475 of 1962 provides for the appointment of planning authorities and preparation, approval and revocation of development plans for the control of development and subdivision of land;
- The Fisheries Act Cap.314 of 1974 provides for the supervision and management of the major fisheries through the Fisheries Department which enforces the Act through licensing and net size control;
- The Industrial Development Act of 1974 provided for regulation of resource extraction such as mining.

The Environmental Protection and Pollution Control Act of 1990 was formulated in order to strengthen the efforts to protect the environment and facilitate the implementation and the enforcement of the fragmented legislations related to the environment. The Act provided for the creation of the National Environmental Council (NEC) as the umbrella body to coordinate the activities related to the environment, to promote policies for sustainable development and to enforce laws and regulations related to environment protection and management. The Act provides for regulating and controlling water and air quality; waste disposal; manufacture, distribution and use of pesticides and toxic substances; noise pollution and ionizing radiation; and conservation of natural resources, through establishment of inspectorate, adoption of regulations, standards and licensing procedures as well as conducting of Environmental Impact Assessments.

There are no specific laws and regulations that have yet been enacted in Zambia for the reduction and phase out of the consumption of controlled substances.

The general policy and operational framework and regulations specifically relevant to trade and industries are explained below:

2.6.2 Trade

Import licenses and export documents are issued by the Ministry of Commerce, Trade and Industry. All commodities imported must be licensed. The imported commodities are checked by the Customs and Excise Department against the

import licenses and invoices. Upon checking, the Department issues a Bill of Entry, a copy of which is required to be submitted to the Central Statistical Office. The Central Statistical Office is responsible for record keeping.

Each importer applies for an import license through the Commercial Banks. The approval of the license is granted by the Central Bank of Zambia which also has the mechanism (SGS Department) which checks that the prices against the quality and quantity of the imports.

Trades Licensing Act Cap. 707 provides for the establishment of local trades and businesses under classified licenses. The licensing authorities are normally local authorities. The Act provides under section 15, for the principles relating to the issue of licenses and gives the licensing authorities the discretion to refuse to issue licenses for:

- (i) applicant under 21 years of age;
- (ii) commodities and operations that would result in nuisance or annoyance to a person residing or occupying premises in the neighborhood;
- (iii) operations and commodities that conflict with any law in force in Zambia, town planning scheme or public interest.

The Minister of Commerce, Trade and Industry is empowered to direct and guide local authorities or other licensing authorities on what is public interest.

The Trades Licenses define certain conditions for the traders. For example, a license will define the class or classes of goods that can or cannot be sold under that license and the permitted area for selling the goods. Offenses and penalties under the Act include fines and forfeiture.

Control of Goods Act Cap.690 provides for the powers of the President to control, when necessary, imports and exports of any goods, distribution, disposal, purchase and the sale of any commodity or animal. The President can issue regulations under statutory instruments and empower the Ministry of Commerce, Trade and Industry to make specific orders in accordance with the regulations. The regulations and orders may include denial of licenses to import particular commodities. Offenses and penalties under the Act includes forfeiture of goods, commodities or animals which are the subject matter of an offence.

The Ministry of Finance decides on the tariffs (duties and taxes) which are set out in the Customs and Excise Act Cap. 662. The tariffs are reviewed annually and approved by the parliament. The Act provides for the imposition, collection, and management of customs, excise and other duties, the licensing and control of warehouses and of premises for the manufacture of certain goods, the control and prohibition of imports and exports and for the customs and trade agreements. Section 40 provides for the prohibitions of certain goods and section 41 provides for the restriction of imports of certain goods and equipment which can only be imported with written permission of the Minister.

2.6.3 Industries

The records on industries are kept by the Ministry of Commerce Trade and Industries under the Register of Companies and Business Names. In accordance with the Companies Act and Business Names Act, all industries and businesses (including small ones) must register with the Ministry. The companies must also report on the general activities of their business which is recorded under List of Objects of the Companies. Whenever the companies change their business they are required to submit updated information to the Ministry.

The Factories Act Cap.514 provides for safety, health and welfare of persons employed in factories and other similar places. In accordance with the Act, the factories must maintain standards and conditions related to cleanliness,

general ventilation, emissions of dust or fumes and the requirement to provide protective clothing for the worker. The Act requires safety and examination of certain types of machinery and plants within the factories and also controls the use and storage of explosives or highly inflammable materials in the factories.

The Investment Act, No.19 of 1991 provides for promotion of investments and investment incentives. It establishes the Investment Center and Board.

2.7 The Status of Response to the Montreal Protocol

2.7.1 The Government Response

Zambia acceded to the Vienna Convention for the Protection of the Ozone Layer and its Montreal Protocol on Substances that Deplete the Ozone Layer on 24 January 1990. Both the Convention and the Protocol entered into force for Zambia on 24 April 1990.

The Government of Zambia assigned the responsibility of implementation of the Vienna Convention and the Montreal Protocol to the Ministry of Environment and Natural Resources. The Ministry is also the focal point to UNEP on the issues of ozone layer protection.

In 1989 during the preparation for accession to the Montreal Protocol, the Department of Natural Resources attempted to carry out a survey on the consumption of the controlled substances in Zambia. The consumption figures for the controlled substances were estimated from the data on imports kept by the Central Statistical Office and information from the main importers and users of controlled substances. During the same year, background papers and reports were prepared on 'CFC compounds and halons' and 'Chlorofluorocarbons and the ozone layer'.

In 1991, in order to comply with the reporting requirement of the Protocol (Article 7) the Department of Natural Resources conducted a survey through the Central Statistical Office, on the importation of the controlled substances. The results were reported to the Ozone Secretariat.

Zambia has participated with interest in the various meetings convened under the Vienna Convention and the Montreal Protocol.

The Ministry of Environment and Natural Resources organized several radio and television programmes as well as newspaper articles featuring various issues on the environment, sometimes focusing on the problem of ozone layer depletion and the international efforts being made to protect the ozone layer. Furthermore, a National Workshop on the Protection of the Ozone Layer will be organized as a part of preparation of this Country Programme, in order to increase public awareness about the ozone layer issue and to inform the industries as well as the public regarding the implementation of the Country Programme. The Workshop is planned to be convened in early December.

The Parties to the Montreal Protocol are required to phase out the consumption of controlled substances by the year 2000 (year 2005 for methyl chloroform). Although Zambia, as a developing country operating under paragraph 1 of Article 5, is entitled to delay the phase out by 10 years, it will not await the elapse of the grace period before phasing out its consumption of the controlled substances. The Government has already begun to take actions to pursue the goal to phase out as soon as possible. With timely and efficient provision of the necessary financial and technical support from the Multilateral Fund under the Montreal Protocol, and effective technology transfer and implementation of the Country Programme, Zambia could meet its goal to phase out the consumption of the controlled substances in the year 2000, 10 years earlier than the Protocol requires for Article 5 countries.

2.7.2 The Industry Response

It became apparent during the survey that the local industries' awareness on the problem of ozone layer depletion is generally low. Little actions have so far been taken by the industries to reduce the use of controlled substances.

Specific examples of actions that have so far been taken include manufacturers of aerosol spray (insecticides and air fresheners) have converted to hydrocarbon propellants. These manufacturers are affiliates of multinational companies, hence had an advantage in terms of acquiring information and technologies for conversion.

3. IMPLEMENTING PHASE OUT

3.1 Strategy Statement by the Government

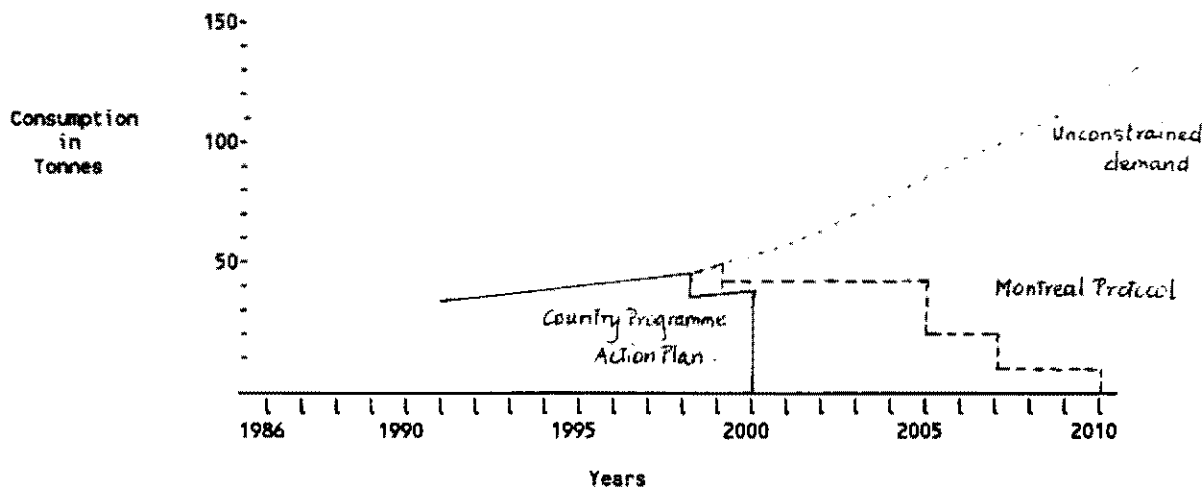
Zambia is a Party to the Montreal Protocol, operating under paragraph 1 of Article 5, hence is required to phase out the consumption of CFCs, halons and carbon tetrachloride controlled under the Montreal Protocol by the year 2010 and methyl chloroform by the year 2015, 10 years later than the phase-out years for non-Article 5 countries. Government of Zambia, as a Party to the Montreal Protocol, is committed to take every possible action to ensure compliance and is prepared to go faster than the Protocol requires for the phasing out the consumption of controlled substances.

The Action Plan outlined in section 3.2 should enable Zambia to phase out the consumption of controlled substances as follows:

Annex A.	Group I - CFCs:	2000
	Group II - halons:	1995
Annex B.	Group II - carbon tetrachloride:	2000

The steps for reduction up to complete phase-out of consumption for each group of substances are presented graphically in Figures 3 below:

Figure 3 Graph showing the expected consumption of the controlled substances following the Government strategy for the phase-out as compared with the phase-out in accordance with the requirements of the Montreal Protocol for Article 5 countries



For the above phase out schedules to be met, it is essential that the programmes and projects including feasibility and pre-investment studies under the Action Plan are carried out in an effective and timely manner, with the necessary financial and technical support from the Multilateral Fund (and the Interim Multilateral Fund) under the Montreal Protocol.

Although the consumption of the controlled substances in Zambia is very small at present, substantial growth in demand for the substances and products containing controlled substances can be anticipated. Institutional strengthening, public awareness programmes, training and information exchange and dissemination are the four aspects that would play a crucial role in changing the demand for the controlled substances and associated products to ozone friendly substitutes and alternatives at an early stage. Investments in these areas now would prevent future growth in demand and avoid greater investments to be made at a later stage to tackle the problem. For the success of this Country Programme implementation, institutional strengthening is of paramount importance in setting up the necessary basis for the implementation.

The experience in tackling the problem of ozone layer depletion and in complying with the Montreal Protocol would be valuable in dealing with other environmental issues and international agreements to which Zambia has become a Party (Climate and Biological Diversity Conventions). Institutional strengthening, public awareness and training aspects of the Action Plan are vital not only to protect the ozone layer but also in building the necessary capabilities for tackling other global environmental problems. Assistance in institutional strengthening, public awareness, training and information acquisition and dissemination would therefore benefit both Zambia as a recipient country and the donor countries in the long run. The Government requests such long-term views to be taken into consideration by the Multilateral Fund's Executive Committee when approving funding for the implementation of the Country Programme.

Under the Action Plan several training projects are contemplated. Assistance from the Implementing Agencies, in particular, UNEP IE/PAC as a clearing house under the Multilateral Fund and UNDP as the main agency responsible for training and demonstration project, in identifying appropriate experts to undertake the training and teaching would be essential.

3.2 Action Plan

The Action Plan for phasing out the controlled substances consists of:

- (i) the Government Actions comprising various programmes;
- (ii) Industry Actions comprising a number of phase out projects.

The programmes under the Government Actions will either require or otherwise create an incentive for actions to be taken by the industries. At the same time, the Government Actions will assist in the implementation of the Industry Actions through providing the necessary framework to, for example, initiate and coordinate the projects; obtain and disburse the necessary funds that are obtained from the Multilateral Fund; ensure the convening of appropriate training programmes; as well as monitor the implementation of the Industry Action.

Furthermore, the Government Actions will include elements that are essential for effective phase-out. Those elements include institutional strengthening, efforts to increase public awareness, and providing for means to disseminate information to the various community sectors within the country as well as to exchange information between Zambia and International Communities.

The elements that comprise the Government Actions and Industry Actions are described under sub-sections 3.2.2 and 3.2.3, respectively.

3.2.1 Key Assumptions Made under the Action Plan

Under this country programme, there are a total of six projects under Industry Actions. Four of them are in the refrigeration sector, the largest use sector in Zambia. A critical assumption for the projects under the refrigeration sector is that the refrigerators containing HFC-134a and the refrigerant HFC-134a itself will be widely available in international markets by around the year 1995.

The incremental cost for purchasing and using HFC-134a has not been included in this Country Programme. Currently HFC-134a is approximately 3 times as expensive as CFC-12, hence the incremental cost would be substantial. Since new equipment using HFC-134a would only start being imported and purchased from 1993, it is assumed that servicing and refilling would be negligible during the implementation of this Country Programme. However, for the retrofitting of commercial refrigerators to use HFC-134a considerable amount of HFC-134a is likely to be required. Project R4 under Industry Action takes into account the incremental cost of HFC-134a.

To date, research in the developed countries for domestic refrigerators has concentrated on development of new non-CFC refrigerants and new equipment that use new refrigerants. The technology for retrofitting domestic refrigerators has not yet been developed because in developed countries, people can afford to replace their refrigerators with a new one when the equipment breaks down. The demand for retrofitting domestic refrigerators is close to being nil, hence, the industries have not been motivated to invest in research in retrofit technology. However, experts (of the Technical Options Committee on Refrigeration and Air-conditioning, Technology and Economics Assessment Panel under the Montreal Protocol) are hopeful that such technology would be developed during late 1990s. (Refer to sub-section 3.3.4, Possible Future Projects.)

With regard to conversion of flexible foam production, existing information indicates that switching to methylene chloride or eliminating the use of auxiliary blowing agent (just using water) altogether are generally cheaper than using CFC-11. In the former case methylene chloride is cheaper than CFC-11. However, since methylene chloride is toxic, adequate safety precautions would be necessary which may incur extra costs. When foam is blown with just water (and CO₂) the density of the foam is increased hence more isocyanate is required. However, the cost increase from increased amount of isocyanate can be offset by the elimination of the CFC-11.

With regard to conversion of rigid foam production for insulation, there is not yet a non-CFC or HCFC substitute blowing agent that will give the same insulation effect to the foam product.

3.2.2 Government Actions

Six programmes constitute the Government Actions for phase-out of the controlled substances:

PROGRAMME 1: Policies and Legislation Programme

Element 1: Government Policies for the Protection of the Ozone Layer

Adoption by the Government of an overall policy strategy, 'Government Policies for the Protection of the Ozone Layer' that outlines the intentions of the Government with regard to compliance with the Montreal

Protocol and the implementation of the Country Programme.

The preparation of the Policy Strategy should begin in January 1993 for adoption and release by around July of 1993.

The Policy Strategy will include:

- The target year for phasing out the consumption of controlled substances in Zambia;
- The intention of the Government to introduce legislations to control the importation of the controlled substances and their products as well as descriptions of those legislations;
- Announcement that refrigerators and air-conditioners service workshops will be required by law to have a recovery and recycling unit;
- Description of incentives to be given to the industries that import/use controlled substances and their products;
- The plans for organizing various public awareness activities for industries as well as for the public;
- The plans for organizing various training and educational activities in the field of use of controlled substances for technicians and for general public.

Element 2: Legislation

The Ministry of Environment and Natural Resources with assistance of the National Environmental Council, will amend the Environmental Protection and Pollution Control Act of 1990, to include provisions for ozone layer protection. The provision for ozone layer protection will include the following regulations:

- A ban from the year 1994, on the importation and installation of halon fire extinguishers except for essential uses which will include uses in aircrafts, airports, and defence facilities. The licenses for importing the halon fire extinguishers for essential uses will be issued by the National Environment Council as is done for other hazardous and toxic substances.
- A ban on the importation of vehicles that incorporate automotive air-conditioners that contain controlled substances and importation of such automotive air-conditioner units for installations from the year 1995.
- A ban on the importation of any refrigeration and central/room air-conditioning equipment (including compressors) that contain or are made for CFCs from year 1997.
- A ban on the importation of controlled substances (as bulk chemicals) from the year 2000.
- Requirement for every refrigeration and air-conditioning workshops (including motor garages that undertake refilling of automobile air-conditioners) to be equipped with a recovery and recycling unit. Such units must be able to recover and recycle CFC, HCFC and HFC refrigerants.
- Adjustments of the Customs and Excise Department's coding system to allow for monitoring of each substance controlled under the Montreal Protocol, and a requirement for the Customs and Excise Department to submit a copy of the importation license and invoice to the National Environmental Council which will further pass on the information to the Department of Natural Resources (ODS Unit).
- Requirements for every industry or company that deal with controlled

substances to annually report on the imports/consumption of the controlled substances and/or the production of products containing/using controlled substances to the National Environmental Council which will then pass the information to the Department of Natural Resources (ODS Unit).

- Licensing system for establishment or operation of new industries or companies that would deal with controlled substances. The licenses will only be issued upon approval of the National Environmental Council.

The following laws and regulations will be included under existing legislations as appropriate:

- Import duty exemption from 1995 to 1996 (inclusive) for domestic and other refrigeration equipment (including compressors) that do not contain or use CFCs or HCFCs.
- Import duty exemption for the recycling and recovery units for refrigerants. The equipment must be able to recycle CFC, HCFC as well as HFC refrigerants from 1995 to 1996.
- Requirement for industries having ammonia refrigeration systems to operate with appropriate code for safety and good practices.

The preparation of the amendment should begin in January 1993. The amended legislation should be passed in late 1993 for the implementation to start in 1994.

PROGRAMME 2: Programme for Financial Assistance and Incentives

Element 1: Establishment of Ozone Fund

The Government of Zambia will receive funds, through the Ministry of Finance, from the Multilateral Fund for the implementation of the Country Programme. An Ozone Fund (OF) will be established under the Ministry of Environment and Natural Resources for financing the various programmes and projects under the Country Programme.

The Department of Natural Resources will coordinate the programmes and projects under the Country Programme. It will draw up a budget annually for the Country Programme activities and the necessary funds will be allocated to the OF on annual basis according to the budget.

The Ozone Fund should be established soon after this Country Programme is approved by the Executive Committee. This is envisaged to be in early 1993.

Element 2: Ozone Friendly Logo

A logo will be designed by the Ministry of Environment and Natural Resources in cooperation with the National Environmental Council to indicate that a product is ozone friendly. The manufacturers of aerosol sprays and foam products can imprint the logo on their products if the products do not contain or are not made using controlled substances or HCFCs.

For imported products, the retail shops will be authorized to imprint the logo on the aerosol products, refrigerators and air-conditioners that they

import and sell if these products do not contain or are not made using controlled substances. Places such as hotels, stores and shops may use the same logo in their advertisements or promotion if no controlled substances or HCFCs are used in any of the products or equipment they are dealing with.

HCFCs are not yet controlled under the Montreal Protocol but are ozone depleting although to a much lesser degree as compared with the controlled substances. The Government will only allow the ozone friendly logo to be used on products and equipment that are truly ozone friendly, i.e. those that have nothing to do with controlled substances or HCFCs. The National Environmental Council's inspectorate will check on the relevant manufacturers and retail shops to ensure correct utilization of the logo.

The logo will be designed in the latter half of 1993 and should be launched in January 1994. The Minister for Environment and Natural Resources will hold a press conference on the launch of the logo (see Programme 6, Information Exchange and Public Awareness Programmes; Element 2, Public Awareness Programmes).

Budget:

Cost of using a professional graphics artist to print the designed logo:
US \$ 300.

Element 3: Duty exemptions

- The import duty exemption on the equipment for recovery and recycling is coupled with the requirement by law for the servicing workshops to be equipped with such a unit. Duty exemption should also provide an incentive. Relevant laws will be adjusted (see Programme 1, Policy and legislation programme).
- Import duty will be exempted for new domestic and other refrigeration equipment that do not contain controlled substances or HCFCs. The duty exemption will be implemented for the initial period of two years from January 1995. The purpose is to provide incentives for industries/companies and the public to purchase equipment that do not contain controlled substances or HCFCs at an early stage (see 3.2.3, Industry Actions, Project R4).

PROGRAMME 3: Institutional Strengthening Programme

The existing institutional framework needs to be strengthened in order to ensure that the Country Programme is implemented effectively. The Institutional Strengthening Programme will consist of following elements:

Element 1: Ministry of Environment and Natural Resources

Establishment of an ODS Unit within the Department of Natural Resources under the Ministry of Environment and Natural Resources. The ODS Unit will coordinate, monitor and follow-up on the implementation of the Country Programme in cooperation with the National Environmental Council and other Governmental and non-Governmental institutions as well as industries/companies that will be involved in the implementation of the various programmes, projects and elements under the Action Plan.

In 1993, all the preparatory work that are required for the implementation of the Action Plan including the setting up of the ODS Unit will be

undertaken by the Department of Natural Resources. For 1993, a lump sum allowance fee has been allocated for the officers in the Natural Resources Department who will be undertaking the preparatory work. The setting up of the Unit will involve purchasing and installing the necessary equipment and starting the recruitment process. The Unit should become operational from 1 January 1994.

The specific functions and responsibilities of the ODS Unit will include:

- (a) providing assistance to and cooperating with the National Environmental Council in drawing up the Government Policy on the Protection of the Ozone Layer, and in formulating the legislation (Programme 1, Policy and Legislation Programme);
- (b) designing the ozone friendly logo (Programme 2, Financial Assistance and Incentives);
- (c) monitor and record (as database) the consumption and use of the controlled substances and report the data and information as necessary (Programme 4, ODS Monitoring Programme);
- (d) organize and coordinate various training projects (Programme 5, Training Programme) and public awareness programme (Programme 6).

Personnel requirements for the ODS Unit is as follows:

- Three officers:

- (a) one technical officer - should have some technical knowledge in ODS and their use and also have knowledge in computers especially data bases;
- (b) one information officer - should be a professional with experience in the field of information and public affairs with good writing skills and knowledge in computers (including word processing and graphics); and
- (c) one general officer - should be a professional with policy and legal knowledge.

- One secretary

- The administrative work including fund management will be taken care of by the Department of Natural Resources. Some allowance will be allocated for the coordinating work to be undertaken by the Director of the Natural Resources Department.

The necessary equipment for the ODS Unit in order to be able to efficiently and effectively carry out its task are as follows:

- (a) A personal computer (with computer softwares for word processing, data base and graphics and the necessary equipment to enable connections to the OzonAction database) and a printer to ensure information gathering (e.g. through OzonAction Data Base being developed by IE/PAC)n production of information pamphlets and newsletters as well as for record keeping and monitoring of relevant industries and the consumption of the controlled substances;
- (b) A fax machine;
- (c) A heavy duty photocopier; and
- (d) A vehicle (In Zambia, transport situation is difficult. The ODS Unit would require easy access to a vehicle in order to be able to organize and coordinate various training projects and public awareness programmes. Transportation will also be essential in order to closely coordinate the activities with the National Environmental Council and other Institutions. The maintenance and fuel costs will be covered by the Government.).

Budget (in US \$):

	1993	1994	1995	1996	Total
Personnel cost					
3 officers	6,300	6,600	6,600	6,800	26,300
1 secretary	1,500	1,600	1,600	1,600	6,300
Allowance 1/	5,000	-	-	-	5,000
Allowance 2/	-	1,100	1,100	1,100	3,300
Equipment					
1 computer, printer	7,000	-	-	-	7,000
1 fax machine	2,000	-	-	-	2,000
1 photocopier	5,000	-	-	-	5,000
Accessories	5,000	2,000	2,000	2,000	11,000
Vehicle	15,000	-	-	-	15,000
Local travels (3 officers: 20 days)	3,600	3,600	3,600	3,600	14,400
Miscellaneous (stationary, commun., equipmt. maintenance, etc.)	5,000	5,000	5,000	5,000	20,000
Sub-total	55,400	19,900	19,900	20,100	115,300
contingency (10%) 3/	5,600	2,000	2,000	2,100	11,700
GRAND TOTAL	61,000	21,900	21,900	22,200	127,000

- Notes: 1/ Allowance for the staff of the Department of Natural Resources undertake the preparatory work in 1993 for the implementation of the Action Plan.
2/ Allowance for the Director of the Department of Natural Resources to undertake the coordinating work of the ODS Unit.
3/ Rounded up to the nearest hundred.

Element 2: National Environmental Council

The Council's responsibilities will include the protection of the ozone layer in accordance with the amendment to the Environment Protection and Pollution Control Act. The main tasks of the Council will be to draw up the policies and legislations in cooperation with the Department of Natural Resources (ODS Unit) and to enforce the legislations and ensure compliance by the industries/companies.

The costs that will be incurred by the Council for its part of the implementation of the Country Programme is uncertain at this stage. Such costs will be covered by the Council until the costs can be worked out.

PROGRAMME 4: ODS Phase-out Monitoring Programme

Monitoring of the consumption of the controlled substances and the implementation of the Country Programme will be undertaken by the National Environmental Council as well as the ODS Unit. The National Environmental Council will primarily be responsible for ensuring compliance with the reporting requirements and the required bans on the imports of the controlled substances and related products. The ODS Unit will monitor the overall consumption of the controlled substances in order to monitor and evaluate the effectiveness of the Action Plan and also be responsible for compiling data for reporting to the Ozone Secretariat to fulfil the reporting requirement under Article 7 of the Montreal Protocol. The following monitoring arrangements will be implemented:

Element 1: Monitoring the consumption and use of the controlled substances

When the legislation under Programme for Policies and Legislation programme is enacted, each of the industries/companies dealing with controlled substances or HCFCs (those listed under Annex C of the London Amendment to the Montreal Protocol) will be required to report on the consumption and use of the substances annually to the National Environmental Council. The Council will request the necessary data from each industry/company using the reporting format to be designed by the ODS Unit. The Council will also provide copies of the data received to the ODS Unit.

When new industries that would deal with controlled substances, HCFCs and/or their products apply for license to operate, the Ministry of Commerce, Trade and Industry will seek approval of the National Environmental Council. The information on establishment of such industries will be communicated to the ODS Unit.

When new industries that would deal with importation of controlled substances, HCFCs and/or their products apply for import license, the Ministry of Commerce, Trade and Industry will seek approval of the National Environmental Council. The Bill of Entry issued by the Customs and Excise Department upon entry of the goods will be copied to the National Environmental Council which in turn will inform the ODS Unit.

The ODS Unit will establish a database on the controlled substances and the industries dealing with controlled substances. The imports of controlled substances as well as consumption and use of the substances by each industry/company will be recorded in the database.

Element 2: Import data

The Customs and Excise Department's coding system will be adjusted to include classification code (sub-headings) for each controlled substance listed in Annex A of the Montreal Protocol, in accordance with the recommendation of the Customs Cooperation Council (see section 2.1, the Survey and Current Situation with Regard to Monitoring and Record Keeping). This will enable monitoring of importation of individual controlled substance. Customs and Excise Department will report the relevant importation data to the National Environmental Council on quarterly basis which in turn will inform the ODS Unit.

The coding system will be adjusted for implementation from 1 January 1994. Appropriate training of the Customs Officers will take place in early 1993 (see Programme 5, Training; Project 5.3).

PROGRAMME 5: ODS and Substitutes Training Programme

This programme will consist of training projects which are essential for the successful implementation of the Country Programme. The projects will be organized and coordinated by the Department of Natural Resources.

Project 5.1: Existing courses on refrigeration and air-conditioning

In 1993, the Natural Resources Department, in consultation with technicians and engineers from the Engineers Association of Zambia, will examine the existing curricula on refrigeration and air-conditioning and

consider improvements to be made. For example strengthening the recycling aspects, incorporating teaching on substitutes and alternatives as well as use and safety aspects of ammonia.

The members of the Engineering Association as well as the teachers of the refrigeration and air-conditioning courses will be invited to the short training courses for refrigeration technicians (Project 5.2 below).

Any improvements will be incorporated into the curricula from 1995.

Project 5.2: Short training course for refrigeration technicians

A short training course will be organized in 1993 and 1995 for the technicians that deal with various refrigeration systems. The motor garages that deal with refilling of automobile air-conditioners will also be invited. The courses will include:

- (i) teaching of better practices for servicing refrigerators in order to minimize the emission of the refrigerant gases into the atmosphere (1-2 days);
- (ii) demonstrations on the use of recycling units (1-2 days);
- (iii) lecture on the substitutes and new equipment (1 day); and
- (iv) training on the retrofitting of CFC-using commercial refrigeration equipment (with large compressors) to use HFC-134a refrigerant (3 days);
- (v) training to service HFC-134a equipment (1-2 days).

The short courses will be organized in three places: Lusaka Copperbelt and Livingstone at suitable premises.

Appropriate experts (2 experts: one on better practices and substitutes and new equipment; one on retrofitting) in the field of refrigeration will be invited from abroad to teach the courses. The invited experts will spend about one month in Zambia.

For the demonstration on recovery and recycling equipment, a number of companies manufacturing such equipment will be contacted. The company that would be willing to cover the cost for its expert to undertake the demonstration will be invited. This company will benefit from promoting its equipment.

If the technology for retrofitting domestic refrigeration systems become available before the implementation of the updated Country Programme, this project will be adjusted to include training of technicians on the technology. The necessary funds for this has been included in the budget.

Budget:

	1993	1995
Fee for three experts:	10,000	11,000
Travel for three experts:	12,000	13,000
Daily Subsistence Allowance:	17,000	18,000
Advertising:	500	600
TOTAL	39,500	42,600

GRAND TOTAL US \$ 82,100

Project 5.3: Training of Customs and Excise Department officers

Training of appropriate Customs Officers will be organized. The Customs Officers will be trained on the new coding system, how to identify the controlled substances imported, their trade names and how to categorize them under the coding system for each controlled substance.

Officers in the Department of Natural Resources, together with two experts from the National Country Programme Team that actively participated in the preparation of the Country Programme will undertake the training. The experts from the National Country Programme Team will be hired as consultants. The consultants will prepare appropriate documents which will form the basis for the training. The documents should also serve as a manual to be used by the Customs and Excise Department.

The training will be conducted once in mid-1993. The new coding system will be implemented from 1994. The trained officers will train other officers as necessary.

Budget:

Consultant fee (2 experts) 15 working days each US\$ 3,000

Project 5.4: A training course on the safety measures for industrial refrigeration systems using ammonia

A one-week course will be conducted every six months in 1995 and 1996 for training industrial refrigeration technicians on the safety precautions for operating ammonia systems. The course will also train the technicians to teach the other staff in the industry on measures to be taken to ensure safety.

Existing international code of good practice for ammonia systems will be used and an appropriate expert in the field will be invited from abroad to teach the course.

All industrial refrigeration technicians will be urged to take the course.

Budget:

	1995	1996
Consultancy fee for the expert:	4,200	4,300
Travel for the expert:	6,000	6,100
Daily Subsistence Allowance:	2,000	2,100
TOTAL	12,000	12,500

GRAND TOTAL: US \$ 24,500

Project 5.5: A special technical workshop and study visits for the foam industry (flexible and rigid foam) to convert from using CFC-11 to methylene chloride or other substitutes and alternative technology

PART I: Technical workshop

In 1994, a special one-week technical workshop, including visits to local industries, will be organized for the foam industry owners and workers on substitution to methylene chloride or other substitutes and alternatives. Safety precautions for using methylene chloride or other substitutes and

alternatives will be incorporated.

Appropriate foams experts (3) will be invited from abroad as resource persons.

The technical workshop will give an overview of the available substitutes and alternatives to CFC-11 in flexible foam production. The industries will choose the substitute chemical (HCFC will not be encouraged) or alternative technology for conversion.

The foam industries will be required to convert from using CFC-11 by the year 2000 at the latest when the ban on importation of controlled substances will come into effect.

Budget:

Fees for the three resource persons: US \$ 6,300
Travel and Daily Subsistence Allowance: US \$ 15,000

TOTAL: US \$ 21,600

PART II: Study visits

Two officers from the Government and four experts from the foam industry will visit the foam industries abroad that have undergone conversion from using CFC-11 to other substitutes and alternatives. Different substitution should be seen by the group. The visit is estimated to take 10 days.

Budget:

Travel for six experts: US \$ 24,000
Daily Subsistence Allowance: US \$ 15,000

TOTAL: US \$ 39,000

PROGRAMME 6: Information Exchange and Public Awareness Programme

Element 1: Acquisition and dissemination of information on new technologies and products

- In 1993, the Natural Resources Department will collect information on the new refrigeration equipment that do not contain CFCs or HCFCs and issue pamphlets and notices in the newspapers and encourage the consumers to buy such new products. The chemical distributors and servicing workshops will be encouraged to start importing and using HCF-134a. Information on exemption of duty (to be effected from 1994) and other incentive/refunding schemes will also be disseminated. The pamphlets will be distributed to all retail shops that sell refrigeration equipment, all servicing workshops (through industry associations) and to local distributors of controlled substances. The pamphlets should be made available to the end-users of equipment through retail shops and servicing workshops. The pamphlets should be released during the last quarter of 1993. The pamphlets will be updated biennially.
- The ODS Unit will establish a link to the UNEP IE/PAC's OzonAction Data Base which contains up-to-date information on substitutes, new technologies and products, contacts to producer industries, and other activities in the field of protection of the ozone layer. Information will also be gathered from other sources such as through direct contacts with manufacturing industries abroad.

The ODS Unit will disseminate information to the industries and public through issuing of a quarterly newsletter which will include information on the substitutes/alternatives and new products as well as international and national activities in the field of ozone layer protection.

Budget:

Estimated annual budget (stationery, printing and communication):
US \$ 8,000
Total estimated cost for the 4 year period: US \$ 32,000

Element 2: Public awareness programmes

- The National Environmental Council with necessary assistance of the Department of Natural Resources will undertake the following public awareness campaigns:
 - (a) Arrange for TV and radio programmes on ozone layer depletion, ozone depleting substances, international efforts being made to protect the ozone layer and the Zambia Country Programme to be implemented. Copies of various video films on the ozone layer issue will be requested from UNEP for broad casting in Zambia. The films will be shown from 1993 at suitable intervals.
 - (b) Release notices on the new policies and legislations through TV and radio announcements as well as on newspapers.
 - (c) Make announcements on TV, radio and newspapers on the launching of the Ozone Friendly logo.

Budget:

Total Estimated cost for 4 year period: US \$ 10,000

- Two press conferences will be arranged for the Minister of Environment and Natural Resources to announce:
 - the adoption of the Zambia Country Programme; and
 - the launch of the Ozone Friendly Logo.
- The Department of Natural Resources will organize a 1-day workshop for the media in 1993, to inform them of the issue of depletion and protection of the ozone layer and on the Zambia Country Programme.

Budget:

Total estimated cost, including rental of premises, honorarium for the speakers and hospitality: US \$ 2,000

- The University of Zambia's Energy and Environment Group (EEG) will organize in cooperation with the Natural Resources Department (ODS Unit):
 - (a) A series of popular articles featuring the problem of depletion of the ozone layer and focusing on efforts being made to protect the ozone layer. The articles will also highlight the progress on the implementation of Zambia Country Programme. Scientific experts will be hired as consultants to prepare articles on the issue. On average, six articles will be prepared each year from 1993 to 1996.

Budget:

US \$ 200 per article
Total estimated budget: US \$ 4,800

- (b) Public lectures on the ozone layer: depletion and its impacts, and measures for protection. One lecture will be held every year from 1993 to 1996 at the University.

Budget:

US \$ 1,000 per lecture including honorarium for the speakers, hospitality and advertisements
Total estimated budget: US \$ 4,000

- The industry associations, in cooperation with the ODS Unit will organize industry seminars each year from 1993 to 1996 on the importance of the protection of the ozone layer and the implementation of the Zambia Country Programme. Available and emerging substitute chemicals and equipment, and how to best spread this information will also be discussed.

Budget:

US \$ 2,000 per seminar including rental of premises, honorarium for the speakers and hospitality.
Total estimated budget: US \$ 8,000

- T-shirts will be printed with ozone layer protection and environment protection illustrations. The printed T-shirts will be sold at non-profit making price to ODS-using industries. The general public will also be able to purchase the T-shirts from the Natural Resources Department, through various shops, the University, colleges and training institutes.

Three thousand T-shirts will be printed in 1994. The Natural Resources Department will use the contingency fund under the budget for ODS Unit to cover the initial cost of printing the T-shirts. The costs will be recovered through sale of the T-shirts.

3.2.3 Industry Actions

The Industry Actions will consist of 5 projects which are categorized by use sectors.

SECTOR: Refrigeration and Air-conditioning

Project R1: Recycling of refrigerants and better servicing practice

To exempt import duty on the recycling and recovery equipment as well as to provide financial assistance to local companies (excluding the multinational companies) for purchasing such equipment. 20% of the cost of an equipment will be provided to the company as financial assistance. The equipment should be able to recycle CFC, HCFC and HFC refrigerants. The cost of financial assistance is requested to be covered by the Multilateral Fund. The project will be implemented for an initial trial period of two years starting from 1 January 1995.

The mechanism for the provision of financial assistance, including criteria for receiving such assistance, will be established in 1994. It is expected that the workshop owners will purchase the equipment and upon presentation of the receipt, 20% of the price paid will be refunded to the workshop.

Any eligible company which purchases the equipment before 1995 can claim the refund in 1995.

Budget:

Total estimated cost: US\$ 56,000

Assumptions for the estimation:

- The number of workshops (including motor garages servicing automobile air-conditioners) that will purchase a recycling and recovery unit is assumed to be the total number of workshops existing in the country: 70
- The price of one unit equipment is assumed to be US\$ 4,000.

US \$ 22,400 is requested from the Multilateral Fund for the two years (1995 and 1996). This is 40% of the estimated total cost of the project.

Project R2: Retrofitting industrial refrigeration systems to use ammonia

Since it is cheaper to operate industrial refrigeration systems with ammonia, the industries will be required to retrofit their systems to use ammonia at their own cost. If the industries wish to retrofit their refrigeration equipment with substitutes other than ammonia or HCFCs, they can submit proposals to the ODS Unit for consideration of financing incremental cost. The retrofitting should occur before the year 2000 when importation of controlled substances will be banned.

The refrigeration technicians of the relevant industries will be required to attend the training course on safety for ammonia refrigeration systems (Project 5.4 under Programme 5, Training Courses Programme).

Project R3: Retrofitting existing commercial refrigerators (with large compressors)

When a commercial refrigeration equipment needs a compressor replacement or other major repairs the equipment will be retrofitted to use HFC-134a refrigerant. This project will be implemented first on a trial basis for two years, starting on 1 January 1995. The incremental cost to the servicing workshops or in some cases the owners of the equipment, for purchasing HFC-134a compressors, HFC-134a refrigerant, replacement lubricant oil and other refrigerator components are requested to be covered by the Multilateral Fund.

The purchase of HFC-134a compressor will be exempted from import duty (see Government Actions, Programme 2, Element 3 and Industry Actions, Project R4). The owner of a commercial refrigeration system, after having retrofitted their equipment, will submit appropriate receipts to the ODS Unit. The receipts may be either: (i) invoice and Bill of Entry for the importation of HFC-134a, ester oil and components necessary for the retrofit as well as receipt for the labour; or (ii) detailed receipt from a servicing workshop that undertook the retrofitting. The incremental cost (any extra cost for having the equipment retrofitted instead of undergoing required service under normal circumstances) will be worked out and the owner of the equipment will be refunded the incremental cost.

Budget:

Total estimated cost of the project for the initial trial period: US \$ 40,000.

Assumptions for the estimate:

- There are an estimated total of 500 (upper estimate) commercial refrigeration systems that are currently in operation in Zambia. By the end of 1996 an estimated 591 units of equipment will be in operation, out of which 546 are estimated to be CFC-12 equipment. It is assumed that 80 units of equipment would be retrofitted in the two years (1995 and 1996).
- Retrofitting may involve either: (i) compressor replacement which would necessitate replacement of other components such as expansion valve, dessicator and nostrils; or (ii) thorough cleaning out and replacement of the CFC-12 with HFC-134a and lubricant oil. The HFC-134a is currently about 50% more expensive than the CFC-12 and the replacement oil (ester oil) is also expensive. The cost for the retrofit is dependant upon the age, size and the construction of the equipment being retrofitted hence, difficult to estimate. The average incremental cost of retrofitting a commercial refrigeration equipment is taken to be US \$ 500.

Project R4: Purchasing of new equipment (domestic fridges and freezers) that do not contain CFCs or HCFCs

Any purchase of new HFC-134a refrigeration equipment (domestic and others including compressors) will be exempted from import duty. The loss of revenue to the Government is requested to be covered by the Multilateral Fund. The project will be implemented for the initial trial period of two years beginning in 1995.

A HFC-134a refrigerator, with import duty exemption, would be considerably cheaper than a CFC-12 refrigerator, thus providing the necessary incentive to the public to purchase HFC-134a equipment. In the strict interpretation of the incremental cost, the cost for providing incentives would not be covered by the Multilateral Fund. However, providing sufficient incentive for the public to purchase HFC-134a equipment would save the costs of retrofitting and/or early retirement of the CFC-12 equipment that would occur at a later stage. The question is how much cheaper should an HFC-134a equipment be as compared with CFC-12 equipment in order to create the necessary incentive. The Government suggests that total exemption of import duty be implemented for the trial period which is an important stage in the phase-out the use of CFC-containing equipment. However, under the continuation of the project in the future, the duty exemption will be reconsidered and replaced by duty reduction.

The following information may be useful to the Executive Committee in considering this project:

- The cost of a CFC-12 refrigerator of US \$ 600 at the time of import would be priced at US \$ 1,080 on the local market (with 50% import duty, an additional 20% sales tax and without including profit) where as an HFC-134a equipment of US \$ 660 (assuming that it would be 10% more expensive than the CFC-12 equipment) would be priced at US \$ 1,188. Hence the incremental cost to a purchaser would be US \$ 108 per equipment.

Budget:

Total estimated cost of the project for the initial period: US \$ 6,000,000.

Assumptions for the estimation of the cost:

- The cost estimation has been based on the revenue from import duty on domestic refrigerators only.

- It is assumed that 20,000 domestic refrigerators and freezers using HFC-134a will be imported in the two years, 1995 and 1996.
- Average current price of domestic refrigerators and freezers imported to Zambia (before duty and tax) of US \$ 600 is taken.
- The Government revenue from import duty on 10,000 refrigerators (at 1992 prices) would be approximately US \$ 3 million (50% import duty per unit equipment).
- The cost of the project is estimated on the basis of 1992 prices.

SECTOR: **Foams**

Project F1: Converting the existing CFC-using flexible and rigid foam industry to use alternatives

After the special technical workshop and study visit on substitutes and alternatives for CFC-11 in the production of foam (Programme 5, Training Programme, Project 5.5), the industries will conduct any further research necessary and decide on the conversion.

In the flexible foam production, if conversion to methylene chloride is chosen, the industries will cover any necessary capital costs for the conversion. If the industries choose other alternatives that are more expensive than CFC-11 method, the industries will submit a proposal (including detailed indications of the costs) for the conversion to the ODS Unit for consideration for financial assistance. The proposal should be submitted during early 1996 so that if incremental costs are justifiable, it will be incorporated into the Country Programme update for implementation in 1997). This plan will be communicated to the industries during the special technical workshop.

As mentioned under sub-section 3.2.1, Key Assumptions Made under the Action Plan, an appropriate substitute for CFC-11 in the production of rigid insulating foam is still a difficult issue. Nevertheless, the technical workshop and study visit will include consideration of CFC-11 substitution in rigid foam production.

There is a possibility that the Government may adopt a policy or legislation restricting the use of toxic substances which may include methylene chloride. Should this happen, the foam industries will be informed and more environmentally safe substitute would have to be chosen.

3.3.4 Future Developments in the Action Plan

As explained under sub-section 3.2.1 (Key Assumptions Made under the Action Plan), project that takes into account the incremental cost for servicing refrigeration equipment with HFC-134a refrigerant and lubricant oil has not been included under this Country Programme. An appropriate project may be developed for the Country Programme update to be implemented from 1997.

Under the Industry Actions, no project for domestic refrigeration sector has been included at this stage. As mentioned under the sub-section 3.2.1 (Key Assumptions made under the Action Plan), the technological developments in the field of domestic refrigerators are ongoing at a rapid pace. Due to the fact that in developed countries, people are able to easily afford new refrigerators, research in the field of retrofitting existing domestic refrigerators containing CFCs to use HFC-134a has been minimal.

The ODS Unit will keep abreast of the developments in the field of retrofitting of domestic refrigerators. In the update of the Country Programme, projects for dealing with CFC-containing domestic refrigeration systems will be

included for implementation from 1997 when the ban on importation of equipment containing or are made for CFCs (including compressors that are made for CFCs) will be effected.

In 1996, before deciding on the projects, feasibility studies will be requested to be carried out by one of the Implementing Agencies (UNDP, UNEP or the World Bank). One of the important concerns is the economic implications for retrofitting domestic refrigerators. Due to the fact that the energy efficiency of the current equipment is up to four times greater than the older models, retrofitting refrigerators manufactured prior to 1990 projects may not be economical. However, this would also depend upon the energy efficiency of the HFC-134a equipment.

The two foreseeable options of domestic refrigeration project are briefly described below:

(a) Replacing old domestic refrigerators and freezers

If technology for retrofitting domestic refrigerators are not sufficiently developed in the world for introduction into Zambia by 1997, the domestic refrigerators and freezers that need compressor replacement from 1997 onwards will be scrapped. Such retrofitting technology would have to be available by 1996 in order to allow time for the technicians in Zambia to be trained.

The incremental cost to the consumers of forced replacement of refrigeration equipment will be requested from the Multilateral Fund. The replacement will be calculated on the basis of 'annual value' of the equipment (i.e. the total cost of the equipment divided by the expected life time of the equipment) and the remaining life time of the equipment.

The old refrigerators and freezers should be deposited with a branch of the state shop with proof from a refrigeration workshop that the compressors need to be replaced. Upon deposit of the old equipment, the state shop will provide the depositor with a 'deposit fee'. This fee should equal the replacement cost explained in paragraph above.

Some means of disposal of the scrapped refrigerators will also be included in the project. A part of the cost for this may also be requested from the Multilateral Fund.

(b) Retrofitting domestic refrigerators and freezers

If the technology for retrofitting CFC-using refrigerators and freezers are developed in the world for introduction into Zambia by 1997, the domestic refrigerators and the freezers will be retrofitted. The training programmes under this Country Programme will be adjusted in 1996 to incorporate training on the retrofitting techniques for domestic refrigerator systems.

The incremental costs for retrofitting the refrigerators will be requested from the Multilateral Fund.

3.3 Timetable for the Implementation of the Action Plan and Consumption Implications

The planned time schedule for the programmes and projects under the Action Plan is shown in Table 3.1. The time schedule reflects the priorities for the funding in terms of when the funds would be required.

3.4 Summary and Budget for the Action Plan

3.4.1 Implications of the Action Plan on the Consumption of Controlled Substances

The programmes, projects and elements under the Action Plan are summarized under Table 3.2 with indications of direct implications on the consumption of controlled substances. The implications are expressed in terms of the estimated quantity of controlled substances reduced during the duration of the project under this Country Programme.

Most of the activities do not have direct and measurable implication on the consumption of controlled substances, but are obviously essential in enabling effective and successful phase-out. Institutional strengthening is crucial in implementing the Country Programme. (See also section 3.1, Strategy Statement by the Government.)

The expected total cumulative consumption of the controlled substances under the Country Programme (until complete phase-out) is 262 Tonnes. The expected cumulative consumption under the Montreal Protocol phase-out schedule and unconstrained demand are compared below:

Cumulative consumption (Tonnes)

Country Programme:	262	(1992-1999, inclusive)
Montreal Protocol:	463	(1992-2009, inclusive)
Unconstrained demand:	1,060	(1992-2009, inclusive)

3.4.2 Budget for the Action Plan

The budget for the Action Plan is shown in Table 3.3. The Table also shows the use sector affected by the programme or project and where relevant, shows the implication on the consumption of controlled substances.

The Natural Resources Department (ODS Unit) will annually submit an account to the Secretariat for the Multilateral Fund. Since the programme and project budgets are estimates, there may be either surplus or shortage of funds to carry out the planned activities. Any surplus would be accounted for in the Country Programme update and shortage would have to be re-requested from the Multilateral Fund.

Table 3.1 Planned time schedule for the implementation of the Action Plan

Programmes/projects	1993	1994	1995	1996
	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D
GOVERNMENT ACTIONS				
Programme 1				
1. policy	<----P-----> A			
2. legislation	<-----P-----> A	<-----Implementation----->		
Programme 2				
1. Ozone Fund	E			
2. Ozone Friendly Logo	<-----P----->	L		
Programme 3				
1. ODS Unit	<-----P----->	<-----Implementation----->		
Programme 4				
1. Customs coding system	<-----P----->	<-----Implementation----->		
2. Industry reports	<-----P----->	<-----Implementation----->		
Programme 5				
1. Project 5.1	<-----P----->		<-----Implementation----->	
2. Project 5.2			X	
3. Project 5.3	X			
4. Project 5.4			X	X
5. Project 5.5		X		
Programme 6				
1. Pamphlet/newsletter		RnRp Rn Rn RpRn	RnRp Rn Rn RpRn	RnRp Rn Rn RpRn
2. Public awareness				
- notices, programmes and announcements				
- press conferences	X	X		
- media workshop				
- public lectures				
- popular articles		X	X	X
- industry workshops	<-----Implementation----->			
- T-shirts	X	X	X	X
		<-----P----->R		
INDUSTRY ACTIONS				
1. Project R1			<-----Implementation----->	
2. Project R2				
3. Project R3			<-----Implementation----->	
4. Project R4			<-----Implementation----->	
5. Project F1				<-proposals->
Feasibility study				
- domestic refrigeration				<---study-->

KEY: P = preparation L = launch X = event A = adoption R = release n = newsletter p = pamphlet

Table 3.2 Summary of the programmes, projects and elements under the Action Plan with indications of the implications on the consumption

Programmes/projects/elements	Brief Description	Commencement/ Duration	Use sector	Implications on consume.
GOVERNMENT ACTIONS				
Programme 1				
1. policy	Adoption of an overall policy for the protection of the ozone layer.	January 1993 (begin preparation) July 1993 (adoption)	All	
2. legislation	Amendment of existing legislations to include various laws to control and monitor the consumption of controlled substances.	January 1993 (begin preparation) December 1993 (adoption)	All	
Programme 2				
1. Ozone Fund	Establishment of Ozone Fund under the Dept.of Natural Resources for the implementation of the Country Programme.	January 1993	All	
2. Ozone Friendly Logo	Designing of a logo for ozone friendly products.	January 1994 (launch)	Aerosols, refrig., foams	
Programme 3				
1. ODS Unit	Establishment of an ODS Unit under the Dept.of Natural Resources	January 1993	All	
Programme 4				
1. Customs coding system	Adoption of separate subheadings for each controlled substances and reporting to the National Env.Council.	January 1993 (begin preparations) January 1994 (implementation)	All	
2. Industry reports	Reporting by each industry on the import and use of controlled substances.	1993 (preparations) January 1994 (implementation)	All	
Programme 5				
1. Project 5.1	Upgrading of existing courses on refrigeration and a/c.	1993-1994 (preparations) 1995 (incorporation)	Refrig.	
2. Project 5.2	Training course for refrigeration and a/c technicians.	June 1993 October 1995	Refrig.	
3. Project 5.3	Training of customs officers.	May 1993	All	
4. Project 5.4	Training of technicians on safety measures when operating ammonia refrigeration systems in industries.	Feb & Aug 1995 Feb & Aug 1996	Refrig.	
5. Project 5.5	Special technical lecture on the conversion of CFC-11 using foam industries to methylene chloride (including safety aspects for the workers).	May 1994	Foams	

Table 3.2 continued_/_

Programmes/projects/elements	Brief Description	Commencement/ Duration	Use sector	Implications on consump.
Programme 6				
1. Pamphlet and Newsletter	Issuing of half yearly pamphlets and quarterly newsletter.	November 1993 (launch pamphlet) March 1994 (launch newsletter)	All	
2. Public awareness - notices, programmes and announcements	TV/radio/newspaper programmes/notices/articles/advertisement etc. on ozone layer issues and Zambia Country Programme.	1993-1996	All	
- press conferences	For the adoption of the Country Programme and launch of Ozone Friendly Logo.	January 1993 (country prog.) January 1994 (logo)	All	
- media workshop	Workshop to sensitize the media.	May 1993	All	
- public lectures - popular articles - industry seminars	On the protection of the ozone layer and the Country Programme.	1993-1995	All	
- T-shirts	Selling of T-shirts with ozone layer protection prints to increase public awareness.	January 1994 (begin preparations) June 1994 (release)	All	
INDUSTRY ACTIONS				
1. Project R1	Recycling of refrigerants.	1995-1996	Refrig.	
2. Project R2	Retrofitting existing industrial refrigeration systems to ammonia.	Before 2000	Refrig.	2-4 Tonnes
3. Project R3	Retrofitting existing commercial refriger. equipment to use HFC-134a.	1995-1996	Refrig.	1-2 Tonnes
4. Project R4	Purchasing of new equipment that do not contain CFCs or HCFCs.	1995-1996	Refrig.	
5. Project F1	Conversion of flexible and rigid foam industries from using CFC-11 to substitutes.	1996 (submission of proposals by industries)	Foam	

Table 3.3 Budget for the various programmes and projects under the Action Plan

Programmes and projects	1993	1994	1995	1996	TOTAL
GOVERNMENT ACTIONS					
Programme 2					
1. Ozone Friendly Logo	300	-	-	-	300
Programme 3					
1. ODS Unit	61,000	21,900	21,900	22,200	127,000
Programme 5					
1. Project 5.2	39,500	-	42,600	-	82,100
2. Project 5.3	3,000	-	-	-	3,000
3. Project 5.4	-	-	12,000	12,500	24,500
4. Project 5.5	-	60,600	-	-	60,600
Programme 6					
1. Pamphlet and newsletter	8,000	8,000	8,000	8,000	32,000
2. Public awareness					
- notices, programmes announcements	2,500	2,500	2,500	2,500	10,000
- media workshop	2,000	-	-	-	2,000
- popular articles	1,200	1,200	1,200	1,200	4,800
- public lectures	1,000	1,000	1,000	1,000	4,000
- industry seminars	2,000	2,000	2,000	2,000	8,000
SUB-TOTAL	120,500	97,200	91,200	49,400	358,300
INDUSTRY ACTIONS					
1. Project R1	-	-	22,400	-	22,400
2. Project R2	-	-	?	?	?
3. Project R3	-	-	40,000	-	40,000
4. Project R4	-	-	3,000,000	3,000,000	6,000,000
5. Project F1	-	-	-	-	-
SUB-TOTAL	-	-	3,062,400	3,000,000	6,062,400
GRAND TOTAL	120,500	97,200	3,153,600	3,049,400	6,420,700

ANNEX I

The Names and Addresses of Industries/Companies Using Controlled Substances

NAME OF COMPANY

CONTACT PERSON

DISTRIBUTORS

M & M Enterprises
P.O. 20229
KITWE

M. Geloo
Managing Director

ICI Zambia Limited
P.O. Box 33342
LUSAKA

Mr. Santy Kaura
Operation Manager

Chempro Zambia Limited (Hoechst)
P.O. Box 32055
LUSAKA

Sales Manager

REFRIGERATION AND AIR CONDITIONING

Drake and Gorham
P.O. Box 31776
LUSAKA

Mr. Jos Thomas, Contracts Manager
Mr. V. Dessia Ass. Contracts Manager

Zambia Oxygen Limited
P.O. Box 70252
NDOLA

S. Yenga
Production Manager

Cold Plan/Vortex Refrigeration Co. Ltd.
P.O. Box 34131/34492
LUSAKA

Mr. N. Valand
Managing Director

KRES Limited
P.O. Box 837
KITWE

Alex Mofya
C/Director

ZCCM Limited Power Division
P.O. Box 20819
KITWE

-

Scheweppea
P.O. Box 22096
KITWE

Managing Director
based in Lusaka

Chilimunda Enterprises
P.O. Box 21539
KITWE

Mr Chisafa

Zambia Cold Storage Corporation Ltd
P.O. Box 31915
LUSAKA

David D. Vinyi
Engineering Manager

Roan Refrigeration and Electrical Ltd
P.O. Box 90478
LUANSHYA

Mr. M. Patel
Manager

Zambia Pork Products SME
P.O. Box 31405
LUSAKA

B. L. Walmscey
Technical Manager

Band 2 Refrigeration
P.O. Box 90591
LUANSHYA

Mr. P. W. Banda

Philips Electrical Zambia Limited
P.O. Box 31878
LUSAKA

Mr. J. Banda

Sunquick Bottles
P.O. Box 36135
LUSAKA

Samuel Isaiah Sikazwe
Maintenance Manager

Copperbelt Bottling Co. Limited
P.O. Box 20275
KITWE

A. M. Mwembeshi
Technical Manager

Vision Hire Limited
P.O. Box 72006
NDOLA

M. Desai
Managing Director

Chambeshi Refrigeration and
Electrical Service
2255 Zambezi Way Riverside
KITWE

Mr. Chisulo
Technician

Steweb Refrigeration Services
P.O. Box 21344
KITWE

Webstone M. Chiwi
Manager

H. C. Refrigeration
P.O. Box 824
KITWE

Rubert Chime
Manager

Joeboas Electrical
P.O. Box 20572
KITWE

Joseph Chalwe
Manager

A. S. Refrigeration
P.O. Box 71397
NDOLA

Mr. A. S. Simpanzye
Managing Director

K & J Electrical Contractors Ltd.
P.O. Box 21161
KITWE

K. B. Chaunam
Manager

Able Refrigeration Service
P.O. Box 8/52
KITWE

Mr. A. P. Chilebela
Managing Director

Philfrost Enterprises
P.O. Box 22064
KITWE

Mr Chisanga
Managing Director

Cold Show Refrigeration
P.O. Box 21228
KITWE

Mr. C. Musonda
and J. Sinyangwe

Parkham Limited
P.O. Box 22422
KITWE

V. Parkinson
Director

Ndola Refrigeration Limited
P.O. Box 70395
NDOLA

Iobal Kachry
Manager

Finotto Electrical Co. Limited
P.O. Box 73534
NDOLA

Mr. Ermes Finotto
Managing Director

Dairy Produce Board
P.O. Box 30124
LUSAKA

Alex Mapulanga
Plant Engineer

Zambia Breweries Limited
P.O. Box 70091
NDOLA

Mr. W. C. Kabonso
Materials Manager

Rowlee Company Limited
P.O. Box 22270
KITWE

Mr. J. M. Patel
Managing Director

Business Machine Services (Z) Ltd
P.O. Box 70879
NDOLA

Mr. J. Kunda/Chief
Accountant/Mr C Shilling
Workshop Manager.

Athol Plastic (PTY) Limited
P.O. Box 20518
KITWE

P. Sakala

FOAMS

Foam Plastics Limited
P.O. Box 21686
KITWE

Mr. E. I. Kabambanya
Chemist (Supervisor)

Vitafoam Zambia Limited
P.O. Box 70815
NDOLA

A. B. Muryima
Technical & Production
Director

HALONS

Colgate Palmolive Zambia Limited
P.O. Box 71584
NDOLA

Mr. K. Maumba
Production Manager

Ndola Fire Brigade
P.O. Box 70197
NDOLA

Petson Chitalu
Station Officer
(Training and Research)

Zambia Airways Corporation Limited
Ndeke House
P.O. Box 30272
LUSAKA

Mr. M. Mukubesa
Technical Director

Roan Air
P.O. Box 30127
LUSAKA

Mr. Tembo

Kitwe City Council
P.O. Box 22495
KITWE

P. I. Sakala
Chief Fire Officer

Fire Safety and Manufacturing Services
P.O. Box 21885
KITWE

Mr. Kettu Wrigus
General Manager

Rokana Fire Brigade

Chief Fire Officer

CARBON TETRACHLORIDE

Nitrogen Chemicals (Z) Limited
P.O. Box 360226
KAFUE

Mr. I. M. Liayo
General Manager

ANNEX II

Table A.1 Production, imports, exports and consumption of controlled substances in 1986

Tonnes Substances	Prod.	Imports	Exports	Consume.	ODP	Calcul. Consume.
ANNEX A						
<u>Group I</u>						
CFC 11	0	5.5	0	5.5	1.0	5.5
CFC 12	0	29.0	0	29.0	1.0	29.0
CFC 113	0	0	0	0	0.8	0
CFC 114	0	0	0	0	1.0	0
CFC 115	0	0.1	0	0.1	0.6	0.06
<u>Sub-total</u>	0	34.6	0	34.6		34.56
<u>Group II</u>						
Halon 1211	0	0	0	0	3.0	0
Halon 1301	0	0	0	0	10.0	0
Halon 2402	0	0	0	0	6.0	0
<u>Sub-total</u>	0	0	0	0		0
TOTAL	0	34.6	0	34.6		34.56
ANNEX B						
<u>Group I</u>						
CFC 13	0	0	0	0	1.0	0
CFC 111	0	0	0	0	1.0	0
CFC 112	0	0	0	0	1.0	0
CFC 211	0	0	0	0	1.0	0
CFC 212	0	0	0	0	1.0	0
CFC 213	0	0	0	0	1.0	0
CFC 214	0	0	0	0	1.0	0
CFC 215	0	0	0	0	1.0	0
CFC 216	0	0	0	0	1.0	0
CFC 217	0	0	0	0	1.0	0
<u>Sub-total</u>	0	0	0	0		0
<u>Group II</u>						
Carbon tet	0	?	0	?	1.1	?
<u>Group III</u>						
Methyl chl	0	0	0	0	1.0	0
TOTAL	0	?	0	?		?

Table A.2 Production, imports, exports and consumption of controlled substances in 1989

Tonnes Substances	Prod.	Imports	Exports	Consum.	ODP	Calcul. Consum.
ANNEX A						
<u>Group I</u>						
CFC 11	0	3.7	0	3.7	1.0	3.7
CFC 12	0	18.5	0	18.5	1.0	18.5
CFC 113	0	0	0	0	0.8	0
CFC 114	0	0	0	0	1.0	0
CFC 115	0	0.1	0	0.1	0.6	0.06
<u>Sub-total</u>	0	22.3	0	22.3		22.26
<u>Group II</u>						
Halon 1211	0	0	0	0	3.0	0
Halon 1301	0	0	0	0	10.0	0
Halon 2402	0	0	0	0	6.0	0
<u>Sub-total</u>	0	0	0	0		0
TOTAL	0	22.3	0	22.3		22.26
ANNEX B						
<u>Group I</u>						
CFC 13	0	0	0	0	1.0	0
CFC 111	0	0	0	0	1.0	0
CFC 112	0	0	0	0	1.0	0
CFC 211	0	0	0	0	1.0	0
CFC 212	0	0	0	0	1.0	0
CFC 213	0	0	0	0	1.0	0
CFC 214	0	0	0	0	1.0	0
CFC 215	0	0	0	0	1.0	0
CFC 216	0	0	0	0	1.0	0
CFC 217	0	0	0	0	1.0	0
<u>Sub-total</u>	0	0	0	0		0
<u>Group II</u>						
Carbon tet	0	?	0	?	1.1	?
<u>Group III</u>						
Methyl chl	0	0	0	0	1.0	0
TOTAL	0	?	0	0		?

Table A.3 Production, imports, exports and consumption of controlled substances in 1990

Tonnes Substances	Prod.	Imports	Exports	Consum.	ODP	Calcul. Consum.
ANNEX A						
<u>Group I</u>						
CFC 11	0	3.1	0	3.1	1.0	3.1
CFC 12	0	35.6	0	35.6	1.0	35.6
CFC 113	0	0	0	0	0.8	0
CFC 114	0	0	0	0	1.0	0
CFC 115	0	0.2	0	0.2	0.6	0.12
<u>Sub-total</u>	0	38.9	0	38.9		38.82
<u>Group II</u>						
Halon 1211	0	0	0	0	3.0	0
Halon 1301	0	0	0	0	10.0	0
Halon 2402	0	0	0	0	6.0	0
<u>Sub-total</u>	0	0	0	0		0
TOTAL	0	38.9	0	38.9		38.82
ANNEX B						
<u>Group I</u>						
CFC 13	0	0	0	0	1.0	0
CFC 111	0	0	0	0	1.0	0
CFC 112	0	0	0	0	1.0	0
CFC 211	0	0	0	0	1.0	0
CFC 212	0	0	0	0	1.0	0
CFC 213	0	0	0	0	1.0	0
CFC 214	0	0	0	0	1.0	0
CFC 215	0	0	0	0	1.0	0
CFC 216	0	0	0	0	1.0	0
CFC 217	0	0	0	0	1.0	0
<u>Sub-total</u>	0	0	0	0		0
<u>Group II</u>						
Carbon tet	0	?	0	?	1.1	?
<u>Group III</u>						
Methyl chl	0	0	0	0	1.0	0
TOTAL	0	?	0	?		0

Table A.4 Production, imports, exports and consumption of controlled substances in 1991

Tonnes Substances	Prod.	Imports	Exports	Consum.	ODP	Calcul. Consum.
ANNEX A						
<u>Group I</u>						
CFC 11	0	3.0	0	3.0	1.0	3.0
CFC 12	0	19.0	0	19.0	1.0	19.0
CFC 113	0	0	0	0	0.8	0
CFC 114	0	0	0	0	1.0	0
CFC 115	0	0.2	0	0.2	0.6	0.12
Sub-total	0	22.2	0	22.2		22.12
<u>Group II</u>						
Halon 1211	0	0	0	0	3.0	0
Halon 1301	0	0	0	0	10.0	0
Halon 2402	0	0	0	0	6.0	0
Sub-total	0	0	0	0		0
TOTAL	0	22.2	0	22.2		22.12
ANNEX B						
<u>Group I</u>						
CFC 13	0	0	0	0	1.0	0
CFC 111	0	0	0	0	1.0	0
CFC 112	0	0	0	0	1.0	0
CFC 211	0	0	0	0	1.0	0
CFC 212	0	0	0	0	1.0	0
CFC 213	0	0	0	0	1.0	0
CFC 214	0	0	0	0	1.0	0
CFC 215	0	0	0	0	1.0	0
CFC 216	0	0	0	0	1.0	0
CFC 217	0	0	0	0	1.0	0
Sub-total	0	0	0	0		0
<u>Group II</u>						
Carbon tet	0	0	0	0	1.1	0
<u>Group III</u>						
Methyl chl	0	?	0	?	1.0	?
TOTAL	0	?	0	?		?