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Executive Committee of
the Multilateral Fund for the
Implementation of the Montreal Protocol

Thirteenth Meeting
Montreal, 25-27 July 1994

COUNTRY PROGRAMME: BOTSWANA

This document consists of:

- Comments and recommendations of the Fund Secretariat
- Country Programme Evaluation Sheet (prepared by the Fund Secretariat)
- Transmittal Letter from the Government of Botswana
- Country Programme Cover Sheet
- Country Programme Executive Summary[1]
- Institutional strengthening project proposal

[1] Complete Country Programme was sent only to members of the Executive Committee that requested full documentation.

COMMENTS AND RECOMMENDATIONS OF THE FUND SECRETARIAT

COMMENTS

1. The Country Programme conforms to the format of the approved guidelines.

2. Consumption of ODS in Botswana is mainly in the refrigeration and air conditioning servicing sector and fire fighting. Botswana depends completely on imports of ODS from South Africa directly or through South Africa-based companies with contracts in or business links with industry in Botswana. Consequently the phase-out of ODS in Botswana has been tied to the phase-out schedule in South Africa, a non-Article 5 country. Hence, import of CFC-12 is expected to cease from 1996.

3. The phase-out of halons is expected in 2006 with demand after 1994 (phase-out in South Africa) met apparently through recycling of available halons. Current consumption of halons is likely to be higher than reported since the consumption figures did not take account of halon supplied through South African-based companies with contracts to provide and service fire fighting equipment in Botswana. With a reportedly fastest growing economy in the region this consumption could be relatively substantial.

4. Recovery and recycling of CFC-12 has been introduced into the country through voluntary procurement of CFC recycling machines. Thus the demand for CFC-12 is expected to be met in part through recycling. However, a fast phase-out under the Botswana circumstances could entail a high cost in premature replacement of refrigeration equipment. For domestic refrigerators alone this is estimated at US $5.2 million for the period 1994-1996. On the other hand a slower phase out of such CFC refrigerators would entail a lower cost estimated at US $2.8 million for 1994-2004 and US $1.6 million for 1994-2010.

5. The import of CFC-12 for servicing of existing equipment is estimated to cost US $0.6 million over a 10 year period and US $1 million for the accelerated schedule. The reason for the higher cost of CFC-12 in the latter case is, however, not apparent. It is believed that the cost of the transition to substitutes could be reduced through improved servicing procedures, e.g. using nitrogen instead of CFC-11 or CFC-12 for leak testing, system purge and recovery and recycling of CFC-12 during servicing. The intention of the Government to encourage voluntary phase-out actions could also help mitigate high cost of phase-out.

6. A list of projects intended to be developed for funding by the Multilateral Fund has been included as Annex A to the Country Programme. The institutional strengthening project has, however, been prepared and attached to the annex.

Institutional Strengthening

7. The request was considered in the light of the level and pattern of ODS consumption in Botswana, the circumstances of the ODS supply and virtually self-regulating role of ODS-using industry as well as the government's plan to encourage voluntary action by industry and consumers. Rather than one apparently high level professional and a part time assistant, full time officers should be considered. The following items were recommended :

Equipment		US $8,500
Computer, printer and software	5,500	
Photocopier	3,000	
Recurrent Expenditure		
Incentives for staff (one professional staff and one assistant)		45,000
Local travel		6,000
Office supplies and other office materials		4,500
Public awareness, information dissemination, communication, Meetings of National Working Group, etc.		18,000
Sub-total		82,000
Contingency 10%		8,200
TOTAL		90,200

RECOMMENDATIONS

The Fund Secretariat recommends as follows:

8. To approve the Botswana Country Programme. Approval of the country programme does not denote approval of projects therein or their funding levels.

9. In accordance with the Executive Committee decision on implementation of country programmes (UNEP/OzL.Pro/ExCom/10/40, para 135), to request the Government of Botswana to provide information on the progress of implementation of the country programme within one year of its approval, i.e. on 31 July 1995 and annually on 31st day of July of each subsequent year.

10. To approve the amount of US $90,200 and US $11,730 support costs subject to the comments above. The activity to be included in UNEP 1994 Work Programme.

BOTSWANA COUNTRY PROGRAMME EVALUATION SHEET

National Implementing Agency: Ozone Office, Department of Metereological Services

Status of ratification of the Vienna Convention and the Montreal Protocol

	Signature	Ratification	Entry Force
Vienna Convention (1985)		04/Dec/91	02/Mar/92
Montreal Protocol (1987)		04/Dec/91	02/Mar/92
London Amendment (1990)			
Copenhagen Amendment (1992)			

Production of controlled substances: 0 metric tonnes (mt)

Consumption of controlled substances (1993): 20.8 metric tonnes
(excluding methyl bromide) 35.9 weighted tonnes (ODP)

Substance	CFC						Halon			Solvents			M-Br
(ton)	11	12	113	114	115	Total	1211	1301	Total	CTC	MCF	Total	
ODS	0.6	12.2			3.0	15.8	4.1	0.9	5.0				
ODP	0.6	12.2			1.8	14.6	12.3	9.0	21.3				

Source: Country Programme (1994)

Distribution of ODP by substance:

CFC: 40.7% Halon: 59.3% CTC, MCF:

Distribution of ODP by sector:

Sector:	Aerosol	Foam	Halon	Refrig.	Solvent
Consumption (tonnes):			21.3	14.0	
Percent of total:			59.3%	39.0%	

Country Programme

Duration of country programme: 1994-2006

ODS phase-out target:

Complete phase out of CFC by 1996. Complete phase out of halon by 2006

Phase-out priority area:

Refrigeration sector

Cost of activities in country programme: $136,840

Strategy:

Adoption of a National Ozone Policy which ensures phase-out at least cost, consistent with continuing growth in the economy. Elements of the strategy include awareness campaigns, regulatory and fiscal measures. The strategy is highly influenced by phase-out schedule in South Africa since South Africa is the sole source of ODS imports.

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REPUBLIC OF BOTSWANA

ALL CORRESPONDENCE TO BE ADDRESSED TO THE DIRECTOR

BOTSWANA METEOROLOGICAL SERVICES
P.O. BOX 10100
GABORONE
BOTSWANA

OUR REF: MET/WMO/ORG/3045 A **10 June, 1994**

The Chief Officer
Secretariat of the Multilateral Fund
for the Implementation of the Montreal Protocol
1800 McGill College
27th Floor
Montreal, Canada HJA 3J6

Sir,

I have the honour to submit herewith the Country Programme of Botswana for the consideration and approval of the Multilateral Fund of the Montreal Protocol.

Botswana adhered to the Protocol on 04 December 1991 and became a Party thereto on the 02 March 1992. It is classified as operating under paragraph 1 of Article 5 of the Protocol.

I would like to place on record the appreciation of the Government of Botswana of the assistance extended to it by or through the UNEP IE/PAC Ozone Action Programme for the preparation of the Country Programme which started in July 1993. I am pleased to say that the Government is committed to the implementation of the actions contained in the Country Programme.

I further assert that it is the Government's intention to monitor compliance with the Protocol. If necessary, further and different actions from those specified in the Country Programme will be taken, and the country Programme will be updated and submitted to the Executive Committe of the Multilateral Fund.

We hope that the Executive Committes will approve the request for assistance made in respect of the following actions;

a) Institutional Strengthening,

b)* Refrigeration,

c)* Halons.

NB: For (b) and (c), detailed Projects proposals to follow.

Yours sincerely,

G. K. Ramothwa

G. K. Ramothwa.
Director.

COUNTRY PROGRAMME COVER SHEET:

Country: Botswana

Lead National Agency: Department of Meteorological Services (Ozone Office)

Participating Implementing Agency: UNEP

1. Phase out Schedule

Substance	Current Consumption (1993) (ODS Tonnes)	Planned total cumulative Consumption until phase out (ODS Tonnes)		Planned year for complete phase out
		Article 5 schedule (ODP Tonnes)	Accelerated schedule	
CFC-11	0.6	22.2	2.2	1996
CFC-12	12.2	192.3	19.3	1996
CFC-115	1.2	51.4	5.5	1996
Halon 1301	9.0	121.5	65.3	2006
Halon 1211	12.3	166.2	100.1	2006
Total	35.3	553.6	192.4	

2. Government Action Plan.

Type of Action	Description	Start Date	Sector
Institutional	enhanced capacity building	1994	All
Industry	voluntary codes of conduct		Mainly refrigeration
Information	public and industry awareness		All
Customs and Excise	training and refined import monitoring practices	1994	All
Industry	bans or forced reductions	As appropriate	All
Industry	projects (to be submitted)	1994 onwards	Various

3. **Project Summary Table**

Project No.	Title	Intended Effect	Sector	Estimated Cost (US$			
				1994	1995	1996	Total
1	Institutional Strengthening	Co-ordination, control technical support, monitor	All	53,240	41,800	41,800	136,840
2	Training for Refrigeration and Air-conditioning Technicians	Training	Refrigeration and Air-conditioning				To be developed
3	Retrofitting of Commercial and Industrial Refrigeration	Retrofitting	Refrigeration				To be developed
4	Setting up of Halon Bank	Investment project	Halons				To be developed
5	Recovery and Recycling of Refrigerants	Recovery and Recycling	Refrigeration				To be developed

BOTSWANA

COUNTRY PROGRAMME FOR THE PHASE-OUT OF

OZONE DEPLETING SUBSTANCES

For Submission to the 13th Executive Committee
of the Multilateral Fund for the Implementation of the Montreal Protocol

JUNE 1994

ACKNOWLEDGEMENT

This Country Programme was prepared for the Government of Botswana by Dr Boitumelo V. Kgarebe with assistance from UNEP. The Botswana lead agency on issues related to the Montreal Protocol is the Department of Meteorological Services (DMS) under the Ministry of Works, Transport and Communications. The DMS is the convenor of a team of experts to address issues related to ozone layer protection. The National Working Group on Substances that Deplete the Ozone Layer comprises of representatives from The University of Botswana, The Department of Mines in the Ministry of Mineral Resources and Water Affairs, The Ministry of Commerce and Industry, The Ministry of Health, The Ministry of Education, The Ministry of Agriculture, The National Conservation Strategy, and representatives from NGOs.

EXECUTIVE SUMMARY

The Montreal Protocol is an international agreement to reduce the consumption of Chlorofluorocarbons (CFC's) and Halons. It was signed in Montreal, Canada in September, 1987 and has since been ratified by over 70 countries worldwide. In June 1990, the Protocol was amended to include other Ozone Depleting Substances (ODSs), namely methyl chloroform, (otherwise known as 1,1,1-trichloroethane) and carbon tetrachloride. The amended Protocol requires a complete phase-out of CFC's and Halons by 2000 but developing countries with a calculated per capita consumption below 0.3 kg (Article 5 countries) are allowed a further 10 years to phase out by 2010 as the 10 year delay provision only applies to Ozone Depleting Substances used to meet basic domestic needs. Botswana qualifies under Article 5 as the total per capita consumption is currently at 0.02 kg per head.

The Montreal Protocol (as amended in June 1990) provides in Article 10 for a financial mechanism to assist Article 5 paragraph 1 countries to comply with the control measures of the Protocol. This is been implemented as the Multilateral Fund.

As a first step towards obtaining assistance from the Multilateral Fund, the Government of Botswana has decided to submit a Country Programme to the Executive Committee of the Fund. The preparation of this Country Programme reflects commitment on the part of the Government of Botswana to fulfil its obligations as a Party to the Protocol.

Uses of ODS's in Botswana

There is no production of controlled substances in the country, and all products are imported through the Republic of South Africa (3 to 4 main distributors). The total amount imported into the country is currently (1993) estimated at 20.8 metric tonnes. This is broken down as shown in the table: (1)

Table 1. Estimated Consumption of ODSs in Botswana in 1993 by End Use

	Substance	Application	Consumption (tonnes)
Refrigeration			
- Domestic fridges and freezers, motor car air-conditioning	CFC 11	Purging	0.6
- domestic fridges and freezers, cold rooms, ice makers, chiller units, heat pumps, motor car airconditioning and commercial freezer rooms	CFC 12	Used in recharging	12.2
	CFC 115(1)	Used in recharging	3.0
Cleaning	--------Negligible Amounts -------		
Fire Fighting			
- portable extinguishers	Halon 1211	Used in fire fighting	4.1
- fixed installations	Halon 1301	Used in fire fighting and Military Use	0.9
		TOTAL	**20.8**

(1) CFC-115 is used in the composite refrigerant R-502 which consists of 49% HCFC 22 and 51% CFC-115.

The most important use is in refrigeration. In this sector, CFC-12 is used as a refrigerant in many applications. All domestic units are predominantly CFC-12 based.

Recommended Phase Out Strategy

The Country Programme proposes a 100% reduction of all CFC's by year 1996 and 100% reduction of all Halons by year 2006. This schedule is based on the most cost effective route to complying with the Montreal Protocol as well as taking notice of the situation in the Republic of South Africa, which is not an Article 5 country.

Action plan

The primary objective of the Action Plan is to effectively phase out the consumption of Ozone Depleting Substances in Botswana much earlier than its obligations to the Montreal Protocol under Article 5.

The principal agents in this Action Plan will be the Government of Botswana, UNEP which will provide institutional support and training assistance and UNDP which will be responsible for technical support.

The main strategic project for the country is identified as Institutional strengthening. Further projects are under preparation, although not included in the current programme. These are in the refrigeration and Halon sector.

CONTENTS

INTRODUCTION

CHAPTER 1

1. Introduction

Botswana is a landlocked country in Southern Africa, bordering the Republic of South Africa, Zimbabwe, Zambia, Namibia. It is a member of the South African Customs Union (SACU).

The principal city and capital, Gaborone, is in the South of the Country. With a population of 1.2 million, Botswana has a GDP of US$ 2000 per head, the second largest in Africa.

Much of the country includes areas of outstanding natural resource, including the Okavango Delta and the Kalahari desert.

1.0 Background:

Botswana acceeded to the Protocol on 2 March 1992 and with a per capita consumption of under 0.02 kg per capita qualifies for Article 5 status.

Botswana has been an active member of discussions surrounding the Montreal Protocol and its subsequent amendments and has drawn up this Country Programme to demonstrate its commitment to the early phase-out of ODSs in the Country.

This document shows the framework for the implementation of Botswana commitment to the Protocol, describes a project for Institutional Strengthening and provides the baseline data for monitoring progress towards phase-out.

1.1 Status

This Country Report was prepared by a local consultant, working at the Department of Meteorological Services (DMS) with the financial and technical assistance of UNEP.

1.2 Assistance Received

The Government of Botswana received assistance from the following parties:

- UNEP (Financial, information and technical)
- All the relevant Government departments, NGO's and bodies of higher education
- Industry groups, the majority of whom attended the aforementioned workshop.

CHAPTER 2 ODS CONSUMPTION AND TRENDS IN BOTSWANA

2.1 Current and Forecast Consumption of ODSs in Botswana

2.1.1 Introduction

There is no production of ODSs in Botswana. All ODSs are imported from or through South Africa. The ODSs in use in Botswana at the end of 1993 and their quantities are summarized in Table 2.

Table 2. Estimated ODS consumption of Annex A Groups 1 and 2 and Annex C Substances in Botswana in 1993

	Consumption (tonnes)	ODP Factor	Consumption (ODP tonnes)
Annex A Group 1			
- CFC - 11	0.6		0.6
- CFC - 12	12.2	1.0	12.2
- CFC - 115	3.0	1.0	1.2
		0.4	
Subtotal	15.8		14.0
Annex A Group 2			
- Halon 1211	4.1	3.0	12.3
- Halon 1301	0.9	10.0	9.0
Subtotal	5.0		21.3
Total controlled substances	20.8		35.3
Annex C Transitional Substances			
- HCFC-22	16.9	0.05	0.9

The total import of CFCs (CFCs-11 and-12) is estimated at just under 13 metric tonnes in 1993. Approximately 5 metric tonnes of Halons are imported. In terms of ODP weighted ODS consumption, the total of Annex A substances is estimated at just over 35 metric tonnes.

The figures which relate to the refrigerant substances are those quantities required by local contractors to service and maintain refrigeration equipment. The figures do not include amounts already contained in new imported fridge and air conditioners, neither do the quantities reflect the amounts brought in by outside contractors as part of their work which are indectable, but believed to be small. Quantities of new imported fridge and air conditioners, and quantities of Annex B substances are based on 1990 Trade Statistics and are given later in this document.

ODSs are not produced in Botswana, therefore, consumption of ODSs equals imports. There are no exports.

The figures of total imports have been arrived at from discussions with the main companies which use these substances. The resulting figures indicate the scale of ODS consumption in Botswana.
The main sectors using ODSs in Botswana are:

- domestic refrigeration
- commercial refrigeration
- airconditioning
- printed circuit board cleaning
- fire fighting

The quantities used in each of these sectors in 1993 are tabulated in Table 2 above. The largest single use of ODS is as a refrigerant.

Refrigeration and Air-conditioning

Most domestic fridges and freezers use CFC 12 as the refrigerant, and so do air-conditioning systems in motor cars. As there is no production of fridges or air-conditioning units in Botswana, CFC 12 demand is dictated by the amounts required for initial charging and recharging associated with compressor replacement or leakage. There are two principal reasons for repair involving recharging during the working life of a fridge:

- compressor failure. Typically, a domestic fridge may have a compressor repaired during its working life. Each time the CFC 12 present in the system is to be replaced, it is vented to the atmosphere when the old compressor is removed and the system has to be recharged once the new compressor is installed;

- leakage of the refrigerant gas. Recharging will be required once the leak is repaired.

CFC-11 is currently used as a purging gas in the repair of domestic and commercial refrigeration and airconditioning units; hence its consumption is relatively low.

Many workshops have now stopped the practice of purging with CFC-11, and use the same refrigerant gas for both purging and refilling. A domestic refrigerator has an average lifetime of about 10 - 15 years. The failure rate of fridges has also been known to be closely linked to ambient temperatures. In Botswana where temperatures are very high, in the mid-to-high thirty degrees Celcius, the failure rate could reasonably be estimated at 6-10%. Estimates indicate that there are approximately 550,000 fridge/freezer units in the country. CFC-12 is also used in commercial refrigeration in food display cabinets, bar fridges, ice-makers chillers, cold rooms and chiller units. The total requirement for CFC 12 used for servicing and recharging of units is just above 12 tonnes. (This is based on a 9% failure rate and 0.25 kg of charge).

CFC-11 is used as a purging gas in the repair of domestic and commercial refrigeration and airconditioning units; hence its consumption is relatively low.

CFC-502 is used in commercial freezers and freezer room systems. This refrigerant gas is being gradually replaced by the transitional substance HCFC-22.

Most air-conditioning units (both split and window units) in the country use HCFC 22 as coolant. Trains also use HCFC 22.

One of Botswana's largest industries, the Botswana Meat Commission uses ammonia in its chiller plants.

The 1990 External Trade Statistics show that a total of 8.2 tonnes of these substances (Fluorinated, Brominated or Iodinated Derivatives of Acylic Hydrocarbons) were imported in bulk. This figure compares well with the totals (approximately 7.5 tonnes) derived from the questionnaires. For the refrigeration sector, the different applications comprise:

- servicing of domestic appliances and display cabinets (CFC-11 and 12)
- installation and servicing of car air-conditioners (CFC-11 and 12; CFC 11 is used for purging)
- installation and servicing of industrial refrigeration and air conditioning systems including cold stores, ice making plants, central chiller systems, freezer rooms (CFC-11,-12,-502 and HCFC-22) and
- servicing of room airconditioners and installation and servicing of medium and large sized central airconditioning systems (HCFC-22).

The Trade Statistics show that the total number of "refrigerators, freezers and other refrigerating or freezing equipment" imported into Botswana was 15,056 units. The amounts of CFCs contained in these units, based on the size of the unit, can be estimated to be as follows:

CFC-12: 14622 kg (approx. average charge is 1 kg per unit)
CFC-502: 2170 kg (approx. average charge is 5 kg per unit)

This makes the total amount of refrigerant CFCs imported in finished products to be approximately 16.8 tonnes in 1990 although these are excluded from the consumption.

Car Air-conditioning

CFC-12 is also used in car air-conditioning. Again, according to the 1990 Trade Statistics, 14,513 motor cars and other vehicles principally designed for the transport of passengers were imported into Botswana. Of these, about one third are fitted with airconditioning units which use, on average, 1kg of CFC-12 per car. Therefore, approximately 4,8 tonnes of CFC-12 comes contained in motor car airconditioning units. Amounts required for service and maintenance purposes are included in the refrigeration figures above.

Room Airconditioning

Most building airconditioning units and plants operate on HCFC-22. Only the very old units operate on CFC-12, and these are being phased out. The consumption of HCFC-22 for servicing is estimated at around 7 tonnes in 1990. These air-conditioning units are mainly used in office blocks and shops. There are relatively very few units installed in homes. The amount of charge per unit ranges from 1 to 12 kg or more depending on the size of the installation.

In terms of the service and maintenance of these appliances and units, there are service workshops in the cities, towns and larger villages. Larger users include eg. the larger hotels, Botswana Meat Commission, the Brewery, Government Departments, the Mines, Botswana Railways and use their own technicians for service and maintenance. Smaller industries, eg. shops, subcontract the maintenance work to local workshops. In a few cases, South African companies are called in to carry out maintenance and repair work.

Most vehicle airconditioning systems work on CFC-12, however, starting in 1993 a few new models, namely Mercedes Benz, BMW, VW, and Hyundai, come fitted with HFC-134a units in their latest models. Toyota, the best selling car manufacturer in Botswana, still fits CFC-12 units in all its airconditioned vehicles.

In an effort to address the ozone issue, three companies (car servicing workshops) in the country have bought CFC-12 recovery and recycling units. They are thus able to recycle. As well as limiting emissions to the atmosphere, they are also able to reduce their imports of CFC-12.

Solvents

A very small amount of carbon tetrachloride is imported into Botswana according to the External Trade Statistics compiled by the Department of Customs and Excise. Its use is predominantly as a laboratory reagent It is not used by the dry cleaning industry which uses perchloroethylene (not a controlled substance) as the cleaning agent.

The Trade Statistics classify carbon tetrachloride separately from other halogenated derivatives of hydrocarbons. The 1990 imports of carbon tetrachloride stood at 1.5 tonnes. The principal use of this solvent is for laboratory purposes and for other very minor uses eg. the Mines.

Very small quantities of methyl chloroform are used in industry for various cleaning/degreasing purposes.

Methyl chloroform is classified together with "other saturated chlorinated derivatives of acyclic hydrocarbons," so it is not possible to obtain absolute values of this solvent from Customs records.

The computer industry finds it convenient to replace rather than repair circuit boards. Small quantities of solvents are used for circuit board cleaning. There is a limited consumption of degreasing/cleaning solvents for military purposes.

This sector is not considered further as total consumption is negligible.

Fire Fighting

Halon 1211 is used in portable fire extinguishers, and Halon 1301 in fixed flooding systems. Halon 1211 continues to be popular and continues to be included in the tendering process for government offices and commercial and industrial installations despite the fact that the product will no longer be imported into South Africa (and will thus become unavailable in Botswana) after 1 January,1994.

Halons are used in fire fighting equipment. The figures available (Table 3) are those given by local Botswana-based companies. Thus, the figures do not take into account South African-based companies which have been awarded contracts to provide and service fire fighting equipment (see Table 2).

Suppliers have been informing their customers about the phase out of the halons, and have been recommending their replacement with Dry Chemical Powder or another alternative extinguishing medium eg. carbon dioxide, foam, or water. Some customers are turning to the alternatives, but Government and industry still recommend the use of Halon 1211 in new construction. There is limited import and consumption for military purposes. The process of reducing the use of halons is a slow one as alternatives are only ordered when the Halon 1211 or 1301 are used up.

Table 1 above summarises the estimated consumption of ODSs in Botswana in 1993 by end use.

Table 3 below, provides data on the consumption of Annex A Groups 1 and 2 ODSs by substance by year. These figures were compiled from the questionnaires sent out. Thus they relate only to the amounts imported by local companies.

Table 3. Amounts of Annex A, Groups 1 and 2 substances used to service existing equipment.

(Amounts are in tonnes.)

	1986	**1987**	**1988**	**1989**	**1990**	**1991**	**1992**	**1993**
CFC-11	0.2	0.3	0.3	0.3	0.5	1.3	0.8	0.6
CFC-12	2.0	3.2	2.2	5.0	5.6	8.6	10.0	12.2
CFC-115	0.7	0.7	0.7	1.2	1.4	1.7	2.0	3.0
Total	2.9	4.2	3.2	6.5	7.5	11.6	12.8	15.8
HCFC-22	2.8	4.2	3.9	6.1	6.6	6.6	12.2	16.8
Halon 1211	0.1	0.1	0.3	0.9	3.7	0.3	0.2	4.1
Halon 1301	0.8	0.8	0.8	0.8	1.3	1.0	0.9	0.9
Halon Total	0.9	0.9	1.1	1.7	5.0	1.3	1.1	5.0

2.1.2 Forecast Consumption

In order to assess the net incremental costs to Botswana of the Montreal Protocol, it is necessary to forecast ODS demand up to the year 2010 as if the Montreal Protocol did not exist. It is therefore assumed that ODSs are not regulated, and that unconstrained quantities of controlled substances continue to be available from existing sources, at current prices.

The unconstrained demand for ODSs is derived from the demand for products that contain ODSs and from the need for servicing of refrigeration and airconditioning equipment which in turn is determined using such factors as

- population growth rate
- income growth rate/ economy growth rate
- present state of market saturation for consumer goods.

Another approach to determine the unconstrained demand for ODSs is to use the non-mining GDP growth rate forecast, given as 6.4% in 1990, 5.9% in 1991, and 6% per annum from 1992 onwards in the Botswana National Development Plan 7 (NDP 7: 1992-1997). The base year used in calculating demand figures is 1990 because the Trade Statistics for that year are the most recent available.

This schedule incurs less incremental cost than following a different accelerated schedule for which CFCs have to be imported from further afield. This minimum cost phase-out pace is therefore set by the availability of technology and minimisation of costs. For Halons, the phase-out is achieved steadily until 2006 when no more halons will be imported. For the purposes of this report, the base year for the accelerated phase-out schedule is taken to be 1990.

Refrigeration and Airconditioning Sector

By far the largest use of ODSs is in the Refrigeration and Airconditioning Sector. The demand rate for refrigerators and airconditioned transport in Botswana is based on the non-mining economic growth rate of 6% between 1992 and 2010. From the figures in Table 3, there was a 49% increase in the demand for refrigerant gases for use in the installation, servicing and maintenance of domestic and commercial refrigeration equipment from 1990-1991. From 1991-1992 the increase is 13%, and 1992-1993 the increase is 26%. These rather high figures are in keeping with the growth rates in the economy.

These figures are arrived at by forecasting, using the above-mentioned non-mining economic growth-rates, the Country's requirements of CFC 12 refrigerators, the demand for CFCs 11,12, and 502 for recharge purposes, and the demand for CFC 12-using-airconditioned transport.

Other Sectors

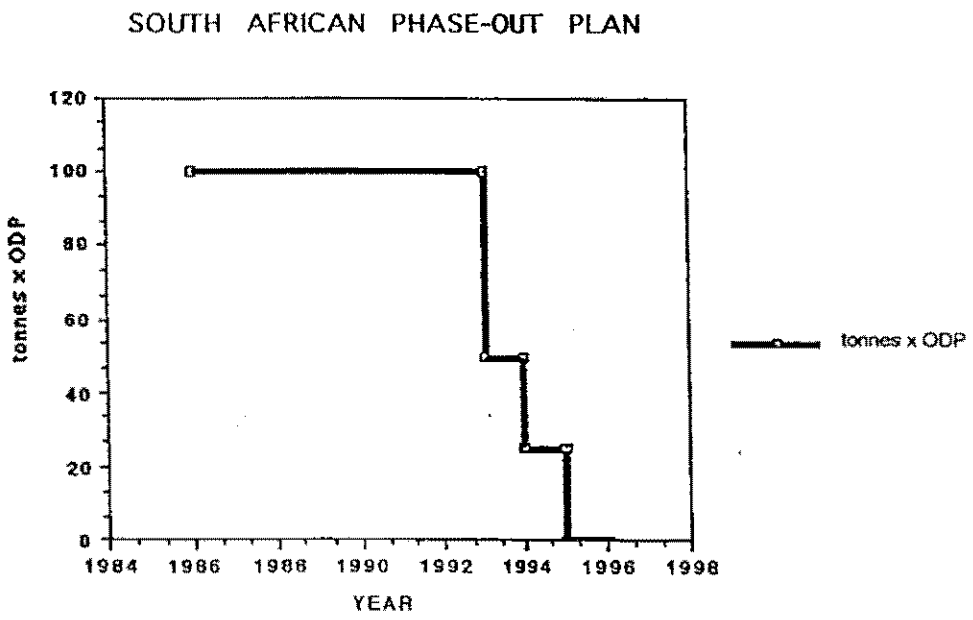
For other sectors, consumption is negligible, and is thus, not considered further. In the case of Halon fire extinguishers, the consumption will drop because these substances can no longer be obtained on the world market.

The two phase-out scenarios proposed are:

(i) The allowable phase-out, i.e. a scenario that postpones ODS phase-out until the latest possible date while keeping the country within the limits of the Montreal Protocol.

(ii) Accelerated phase-out strategy. This plan is directly linked to the phase-out strategy of South Africa because Botswana imports all its CFCs from South Africa. The South African phase-out plan for Annex 1 substances is shown in Figure 1:

FIGURE 1



2.2 Industry Structure

This section outlines each of the major industry sectors that use or handles ODSs in Botswana. The businesses involved are direct importers and, in the case of solvents, distributors of these products. With the exception of the Government Department of Electrical and Mechanical Services, all of the companies involved with ODSs in Botswana are in the private sector. All users appear technically competent and seem to be fairly conversant on ozone layer depletion problems (this excludes retailers of finished products such as fridges, airconditioners etc). In Botswana, most of the importers themselves are the users of ODSs (eg. servicing workshops).

The industries that use ODS technology in Botswana are aware of the problems caused by these substances, and also of the constraints and implications of the Protocol. They have up-to-date literature supplied to them regularly by their South African Suppliers. Since no laws or regulations exist to enforce the Protocol, the initiatives of industry have largely been self driven and also largely influenced by South Africa's response to the Protocol.

The CFC user industry (with the exception of the halon industry) continues to supply customers with equipment that relies on CFC technology. Though they do sometimes advise potential customers on the imminent phase-out, there is no obligation on the supplier to disclose to the customer that there may be legislation in force at some future stage which renders current CFC-using equipment obsolete. It is presently up to the customer to make his own enquiries regarding the status of any equipment purchased. The customer will, in turn, rely very heavily on national publicity campaigns.

In the refrigeration and airconditioning industry, three companies (servicing workshops) nationwide have purchased CFC-12 (and HFC-134a) reclaim units at a cost of approximately US$7500 per unit. The other users still vent the used CFCs to the atmosphere. Companies like the Breweries which have been using CFC-502 plants for the liquefaction of CO_2 are actively looking at using alternative technologies like a switch to using an ammonia R717 system or SUVA^R HP 80, 81, or 62 as the substitute. The Botswana Meat Commission (BMC) uses ammonia as a refrigerant.
Some of the Mines have Environmental Management Programmes which address the use of ODSs.

Note on the use of Transitional Substances

HFC-22 is used mainly in air-conditioning units in buildings and in commercial walk-in fridges. The figures in Tables 1 and 2 are estimates given by Botswana based companies, and these are the imports required to service and maintain installed equipment. Thus, the figures do not take into account South African-based companies which have been awarded contracts to provide and service airconditioning units.

The 1990 Customs Statistics show that 10,743 airconditioning units were imported from South Africa, U.S.A., United Kingdom, France, Japan, Italy, Netherlands, Zambia and Zimbabwe. Of these, 9,694 were self-contained window or wall types containing a charge of approximately 1kg each. 1049 were units used in airconditioning plants with charges ranging from 2 kg to 12 kg per unit. This gives a total of 17.1 tonnes of HCFC 22 contained in the units.

2.3 Institutional Framework

At present, the Department of Meterological Services (DMS) under the Ministry of Works, Transport and Communications is the key department charged with the assessment of the extent of the use of ODSs in Botswana. As the national policy regarding the use of these substances unfolds, other groups and organisations will be invited to participate. The department has no enforcement powers itself, but will act by giving recommendations to other Government Ministries and bodies. So far, the department has formed a National Working Group on ODSs which serves as an advisory body in the formulation of policy issues.

Relevant Governement Ministries and Non Governmental Organisations will include:

- Finance, especially as regards fiscal incentives/disincentives
- Transport, especially mobile air-conditioning;
- Trade and Industry, effect on industry, trade and competitiveness,
- Customs and Excise, imports and monitoring.

2.4 Policy Framework

Botswana became independent in 1966. To date, the country has been very stable politically with a democratic government.

2.4.1 Economic Situation

The economy of the country has been very sound, and has been the fastest growing economy in the region with the exception of the Republic of South Africa. As mentioned earlier, Botswana is largely a consumer country, whose principal trading partner is the Republic of South Africa. Botswana's main exports are diamonds, beef, copper nickel, and, recently, soda ash products.

2.4.2 Taxation

A sales tax of 10% is charged on all goods imported from countries within the Customs Union. For goods imported outside the Customs Union, a tariff ranging between 10 and 100% is charged. Exemptions from import tax may be granted for equipment necessary to facilitate the phasing-out of ODSs. This decision would have to be taken by the Ministries of Finance and Development Planning and Commerce and Industry based on the recommendation of the Department of Meterological Services.

2.5 Government and Industry Responses to the Protocol

2.5.1 Government Response

Botswana's date of accession to the Montreal Protocol was 2 March 1992 and a National Working Group on ODSs has been appointed to oversee the preparation of the Country Programme. As yet a specific Governement Agency has not been charged with the responsibility of implementing the responses to the Protocol.

With the preparation of this Country Programme, policies, strategies and action programmes will be formulated to achieve the objectives of the Protocol. The first strategies to be implemented will be publicity and awareness campaigns. Assistance on these and other related strategies will be sought from UNEP.

Presently, there are no laws or regulations to curb the importation/use of ODSs.

2.5.2 Industry Response

Industries that use ODS technology in Botswana are generally aware of the problems caused by these substances, and also of the constraints and implications of the Protocol. With regard to the training of service personnel, little has been done, and this is identified as a priority for action.

There is a specific situation in Botswana with respect to the fact that the majority of ODS's are imported through South Africa. As Botswana represents only a small market for South African traders (who are committed to early phase out as South Africa is not an Article 5 country), then the interests of companies in Botswana are not well represented. Thus phase out in Botswana is being driven by market pressures arising from the changes in South Africa.

CHAPTER 3 IMPLEMENTING PHASE-OUT

3.1 Strategy Statement by Government

The Governemnt of Botswana is committed to a phase-out strategy that is consistent with continuing industrial development. The chosen strategy will form part of a National Ozone Policy and will be a least cost route, consistent with continuing growth in the economy.

The Governement of Botswana encourages the adoption of alternative technologies and the training of local personnel for the effective reduction of the use of ODS's.

The Country Programme proposes a 100% reduction of all CFC's by year 1996 and 100% reduction of all Halons by year 2006. This schedule is based on the most cost effective route to complying with the Montreal Protocol as well as taking notice of the situation in the Republic of South Africa, which is not an Article 5 country.

As a key part of the implementation of this strategy, the Governement of Botswana will:

- encourage capacity building within the relevant Governmental and Non Governmental Organisations, with increased financial and technical resources;

- develop the role of the National Working Group on susbstances that deplete the ozone layer to provide guidance on policy and implementation issues

- facilitate the development and implementation of projects aimed at reducing the use of ODS's within Botswana

- develop an awareness campaign to persuade users and consumers of ODSs to voluntarily reduce consumption

- consider the use of regulatory and/or fiscal measures, where approriate, in order to ensure that phase out targets are met.

3.2 Action Plan

3.2.1 Government Actions

Given that the market is forcing major changes on users and consumers of ODS's Government actions have to be carefully considered in order to enure that any regulatory measures act in tandem with, rather than against, such changes.

The first task of the National Working Group, following the set up of the Ozone Office, will be to consider the measures that the Government might usefully take to further encourage phase-out and ensure targets are met.

Such measures may include:

- bans or fiscals disincentives to using ODS's
- better and more up to date information on the import and use of ODS's within Botswana (for example enhanced Customs procedures)
- widespread publicity about the Protocol and the availability of alternative technologies

3.2.2 Industry's Actions

Most responsible manufacturers are ceasing to order plants and equipment that uses CFCs from the end of 1992, with the exception of the domestic refrigerator industry and motor manufacturers, where development problems have not been fully resolved by all manufacturers.

There has been considerable progress made overseas in the conversion of CFC-12 and CFC-11 plants to replacement substances, but so far little action has been taken in South Africa. Assuming that CFCs and the associated technology are available to the end of December 1995, if conversions are left too late, it will not be possible to keep pace with the decline in CFC availability, it is estimated that shortages in South Africa will start to be felt in 1994. This will impact directly on the availability and prices of ODSs in Botswana. The South African 1994 quota of CFCs that can be produced or imported by that country stands at 3125 tonnes, and shortages will certainly be felt by that country's trading partners.

With the exception of a few special applications, developed technology exists today to accomplish a complete phase-out of ODSs over a period of 3-4 years. However, some of the alternatives are not yet available in commercial quantities, and continued use of ODSs in the short-term, especially in the service and maintenance sector, is recommended in order to limit the cost of scrapping machinery befoe the end of its useful life.

Servicing of Domestic Refrigerators

The preferred substitute refrigerant for the manufacture of new domestic refrigerators is HFC-134a, and most refrigeration manufacturers are in the process of switching to this substance. HFC 134a has an ODP of zero, but can not be regarded as a drop-in substitute because lubricants, compressors,hoses, O-rings, etc. have to be changed for the equipment to be compatible with the substitute. There is also concern that given the progressive change of CFC-12 systems to HFC-134a accelerating through to 1995 if the

South African scenario is followed, there will be a worldwide shortage of HFC-134a by 1995. If an accelerated phase-out plan is to be followed, then it is critical that as many systems are converted early rather than delayed to the end of the period. There is also the practical consideration of an existing shortage of skills in the industry.

A serious limitation is the cost of the conversion. If, for example, Botswana were to follow the South African protocol, for the period 1994-2010, the cost of phasing out CFC fridges would be US$ 5.2m. This figure is based on a replacement pattern of 50% replacement with HFC-134a refrigerators in 1995 and 100% replacement by 1996. To put in the substitute will cost approximately US$ 6 per fridge, at 1994 prices, and the cost of replacement parts for compatibility is an additional 1%. A real discount rate of 6% is used in all the calculations to annualise capital costs over the period 1990-2010 and discount future cash flows to comparable present values. This rate is given by the Ministry of Finance and Development Planning in its Planning And Project Appraisal Exercises. If, on the other hand, a slower phase-out, but still keeping within the Montreal Protocol, were followed, and CFC-12 fridges were phased-out at the rate of 10% a year from 1994-2004, the cost to the country would be US$2.8m. If the phase-out were carried out over ten years as allowed by the Protocol, the cost would be US$1.6m.

To import CFC-12 for the maintenance and service of existing equipment will cost US$0.6m over a ten-year period, and US$ 1 million for the accelerated schedule.

To minimise the costs of transition, it would be useful to improve the servicing procedures for refrigerators. For example, nitrogen or HCFC-22 could replace both CFC-11 and CFC-12 for purging systems and leak testing. In addition, CFC-12 could be recovered and recyled during service.

Commercial Refigeration

For display cabinets in supermarkets that use CFC-12, the refrigerant technology is the same as that used for domestic appliances. For equipment using CFC-502, either SUVA HP-80 or ammonia can be used as the refrigerant. SUVA HP-80 has an ODP of 0.02 compared to CFC-502 which has an ODP of 0.34. Ammonia has an ODP of zero. SUVA HP-80 has a composition by weight of HFC-125 : 60%, HC-290 : 2%, AND HCFC-22 : 38%. The most attractive advantage of using the replacement refrigerant is the low capital cost. The disadvantages include:

- a high refrigerant cost
- problems with plant down time
- the need for material compatibility and lubricant
- the fact that the technology is new and as yet unproven
- the fact that being a transitional substance, it would ony be a temporary solution.

On the other hand, conversion to ammonia would present the following advantages:

- the technology is known and has no risk
- there are compatible oils with a proven history
- the low cost of ammonia
- good plant efficiencies
- ammonia is a robust industrial refridgerant with minimum down time.

The disadvantages are:

- the high capital cost
- the need to modify existing compressors
- the need to replace piping and heat exchangers.

To replace equipment that uses CFC-502, the cost will be US$1.0m under the Protocol period, and US$1.7m under the accelerated phase-out.

Industrial Refrigeration

For equipment using CFC-12 technology, the refrigerant technology is the same as that used for domestic appliances. For equipment using CFC-502, either SUVA HP-80 or ammonia can be used as described above. Alternatively, CFC-502 plants may be converted to HCFC-22, since many CFC-502 compressors are designed to work with HCFC-22 as well. However, in some cases change from one to two stage compression may be needed.

Vehicle Air-conditioning

Just as for domestic use, HFC-134a is replacing CFC-12 in new vehicle air-conditioners. The cost and efficiency of retrofitting existing systems are still being analysed.

Large Industrial Chillers

Large Industrial Chillers designed to use CFC-11 may be converted to use HCFC-123 or HCFC-141b. Concern has been expressed that both HCFC-123 and 141b, being transitional substances, will eventually be replaced. This does not justify deferring the conversion CFC-11 systems, as HCFCs will be available in sufficient quantities to meet demand for all plant use until well into the next century, and for new plants until 2010. This should give time for development of new refrigerants to be completed. If the Protocol schedule is followed, the cost to the country stands at US$42000, and US$81400 under the accelerated phase-out.

Fire Extinguishers

For portable halon 1211 fire extinguishers, a number of alternatives are available; namely dry chemical powders, foam, carbon dioxide, and water. Inergen, water or foam have been suggested as replacements in fixed flooding systems presently using halon 1301. Since the manufacture of halons has been completely phased-out, halon supplies for essential use may be procured from halon banks.

3.2.3 Projects

The following project has been identified as the key priority in Botswana:

- Institututional strengthening for the phase-out of Ozone Depleting Substances (US$ 136,840).

In addition the Government also identifies two further projects in the refigeration sector and with Halons, and these will be submitted after approval of the Country Programme.

The list of projects is given in Annex A.

3.3 Roles in Implementing the Strategy

The lead agency in the preparation of the Country Programme has been the Department of Meteorological Services, supported by the National Working Group, which contains representatives of other relevant Government Departments. The representatives of the National Working Group will be consulted on the appropriate reporting mechanisms.

Implementing Agencies will include:

- World Bank (investment projects)
- UNDP (technical assistance and demonstrations)
- UNEP (institututional support, information and training)
- UNIDO (small scale investment)

Arrangements will be made to ensure that project funds are propperly channeled and that projects are monitored for compliance.

3.4 Time Table and Consumtion Implications

The two phase-out scenarios described earlier were used to identify the phase-out schedule with the lowest incremental cost. For each scenario , the following were considered:

- the present value of the total incremental cost of ODS substitution over the period 1990-2010.

- the total accumulated ODS use (1990-2010).

Accelerated phase-out following the South African schedule is the most cost-effective and appropriate.

3.4.1 Incremental Costs

Incremental costs will be incurred in three sectors in Botswana:
- the ODS user industries
- at the level of final consumers
- in the Government sector.

The method used was one that identifies the costs where they first arise, thus ignoring the fact that most of the additional costs in the manufacturing sector will eventually be passed onto the consumer of the product in the form of higher prices.

User Costs

The incremental costs incurred by Botswana in the ODS user sector will primarily include the following:

- the capital costs of conversion of existing facilities and of new equipment such as recovery and recycling machines
- costs of retraining of personnel
- cost of technical assistance and engineering support.

Consumer Costs

The costs incurred directly by the final consumers result from:

- forced early replacement of fridges, which cannot be recharged because of nonavailability of ODSs (here, it is assumed that CFC-12 is available for servicing up to 2010, but none is available thereafter)
- extra cost of buying CFC-free fridges instead of CFC-12 fridges.

Government Costs

The Government will incur economic costs in complying with the Montreal Protocol, eg. for strengthening institutions to implement the necessary laws and regulations, in monitoring ODS use, in carrying out information dissemination etc.

All incremental costs are calculated on the basis of existing economic and industrial policies in Botswana.

3.4.2 Timetable

Based on a comparison of incremental costings it is clear that an early phase-out (broadly in line with South African phase-out) is by far the most cost effective.

This will see complete phase out of CFC 11,12, and 115 by 1996 and Halons by 2006.

3.5. Budget and Financing Programme

One priority project for Botswana is the setting up of an ozone office to coordinate and manage phase-out activities.

The costs of this project are estimated as follows:

1994	1995	1996	Total
US$ 53,240	US$ 41,800	US$ 41,800	US$ 136,840

This office will initially be managed through the Department of Meteorological Sciences, with assistance from UNEP as the implementing agency.

3.6 Monitoring Arrangements

Monitoring activities will be coordinated through the Ozone office, which will report to tht National Working Gorup on a regular basis;

It may be proposed that customs officials attend a regional workshop on ozone issues to assist with the identification of chemicals.

In practice, however, the greatest information will come from users of ODS in Botswana, who will voluntarily report consumtpion on a regular basis. Details of the majority of users are already stored on a data base for this purpose.

The Government of Botswana proposes to submit further projects in the near future and these will be monitored for technical and financial efficiency using normal commercial practices.

Projects

The monitoring of projects will be the primary responsibility of the Government of Botswana, through whom all funding will be channeled.

ANNEXE A

PROJECT PROPOSALS

PROJECT		YEAR	REMARKS
1.	Training for Refrigeration and Air-Conditioning Technicians	1995-96	To be developed
2.	Recovery and Recycling of Refrigerants	1995-96	To be developed
3.	Reftrofitting of commercial and Industrial Refrigeration	1995-96	To be developed
4.	Setting-up of Halon Bank	1995-2006	To be developed later
5.	Institutional Strengthening	1994/95-1996/97	Submitted herewith

The following project budget is proposed.

CAPITAL EXPENDITURE:

Office Equipment	1994/95 (US$)
Computer	3000
Laser Printer	2500
Software	1400
Photocopier	3000
Total	9900

RECURRENT EXPENDITURE:

	1994/95	1995/96 (US$)	1996/97
Staff Incentives			
Manager	22000	22000	22000
Assistant (Part time)	8000	8000	8000
Materials;			
Communications	3000	2500	2500
Travel expenses (local)	4000	4000	4000
Other office expenditure	1500	1500	1500
(Capital)	9900		
TOTAL:	48400	38000	38000
Contingencies (10%)	4840	3800	3800
ANNUAL TOTAL:	53240	41800	41800

The Ozone Office will be administered by an individual with relevant technical and communications skills. He/She will have reporting to him, a Part-time assistant with computer skills. All the costs are nominal current prices. No attempt has been made to incorporate the impact of inflation.

PROJECT COVER SHEET

COUNTRY:	BOTSWANA
PROJECT TITLE:	Institutional strengthening for the phase out of ozone depleting substances and the establishment of an Ozone Office.
SECTOR COVERED:	All sectors.
ODS CONSUMPTION:	20.8 metric tonnes and 35.3 ODP weighted tonnes.
PROJECT DURATION:	3 Years.
PROJECT IMPACT:	ODS phase out per year as per Country Programme.
TOTAL INCREMENTAL COSTS (US$):	US$ 136,840
IMPLEMENTING AGENCY:	UNEP
NATIONAL IMPLEMENTING AGENCY:	Department of Meteorological Services.

PROJECT DESCRIPTION:

The Government of the Republic of Botswana realises the importance of consistently adhering to the commitment as laid out in the Country Programme. There are however, very limited institutional capacity within the Department of Meteorological Services to fully support and coordinate the implementation of the Country Programme Action Plan.

It is in this regard that a dedicated office is being proposed for the successful implemetation of the Montreal Protocol.

The Ozone Office will serve as a focal point for communication and coordination with the Fund Secretariat and the Implementing Agencies as well as serving as a secretariat for the National Working Group.

The functions and roles of the Ozone Office as carried out by members of staff will be to;-

- collect and process data and information to act as a national information exchange and a resource centre;

- disseminate and exchange relevant information to users, other parties and organisations on the phase out process;

- launch public awareness campaigns on all Ozone issues;

- monitor all activities related to ODS's and advise on the requirements of the Montreal Protocol;

- receive, appraise and write up additional projects for Multi-Lateral Fund consideration;