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

Tenth Meeting
Montreal, 28-30 June 1993

# COUNTRY PROGRAMME: MALDIVES

This document consists of:

(a) Country Programme Evaluation Sheet (prepared by the Fund Secretariat)

(b) Country Programme Cover Sheet (prepared by the Fund Secretariat)

(c) Transmittal Letter from the Government of Maldives

(d) The Country Programme

# MALDIVES COUNTRY PROGRAMME
# EVALUATION SHEET

The Maldives Country Programme is submitted to the Tenth Meeting of the Executive Committee as document UNEP/OzL.Pro/ExCom/10/26. The document is consistent with the format included in the Procedures for Presentation of Country Programmes and Project Proposals to the Executive Committee (UNEP/OzL.Pro/ExCom/5/16)

It consists of:

- Letter of Transmittal
- Country Programme Cover Sheet (Prepared by the Secretariat)
- Executive Summary
- Introduction
- Consumption and Use of Control Substances
- Analysis of Future Demand for the Controlled Substances
- Industry Structure
- The Status of Response to the Montreal Protocol
- Institutional Framework
- Existing Policy and Operational Framework
- Strategy Statement by the Government
- Action Plan
- Summary and Budget for the Action Plan

The total ODS consumption in Maldives in 1991 was 5.0 tonnes of CFC-12, mainly in the refrigeration sector. The consumption of other substances like CFC-11, CFC-115 and Halon 1301 was negligible.

The predicted ODS consumption following the unconstrained demand is estimated at 43.1 tonnes by the year 2010.

The Government of Maldives is committed to phasing out the consumption of controlled substances by the year 2000.

Incremental cost for the phase-out of controlled substances have been estimated for two 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.

The incremental costs for the accelerated phase-out scenario and phase-out in accordance with the Montreal Protocol are US $2.26 million and US $2.32 million respectively.

To achieve the accelerated ODS phase-out the Government has developed the Action Plan based on Government and industry actions. Government actions consist of policy, legislative and incentive measures including control of importation of the controlled substances and their products, establishment of Ozone Layer Fund, labelling of ozone-friendly products, duty exemptions for recycling and recovery equipment, government subsidy at 30 per cent of cost for every recycling recovery unit, institutional strengthening programme, public awareness, information exchange and training and ODS phase-out monitoring programme.

The industry actions will consist of implementation of the following projects:

1. Recycling of refrigerants and better servicing practice
2. Retrofitting industrial refrigeration systems to use ammonia
3. Retrofitting existing commercial refrigerators.

Total budget of the Action Plan is estimated to be US $95,800.

The implementation of the government and industry action is scheduled for 1993 to 1995. It is estimated that 69 ODP tonnes of cumulative consumption will be avoided by 1999 as a result of implementation of the Country Programme.

**Recommendations**

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

1. The Country Programme be approved without approval of the indicated funding level.

2. The implementing agencies be requested to submit proposals for funding activities and projects listed therein for consideration by the Executive Committee at its following meetings.

# COUNTRY PROGRAMME COVER SHEET

Country : Maldives

Date Received : 13 May 1993

Period Covered : 1993-1995

Lead National Agency : Ministry of Housing and Urban Development

## 1. Phase-out schedule

| Substances | Current Consumption (Tonnes X ODP) in 1991 | Planned Total Consumption till Phase-out Tonnes X ODP | | Planned Year of Phase-out | |
|---|---|---|---|---|---|
| | | Article 5 schedule | Accelerated Schedule | Article 5 schedule | Accelerated Schedule |
| CFC-12 | 5.0 | 13.9[1] | 43.1 | 2010 | 2000 |
| TOTAL | 5.0 | 13.9 | 43.1 | | |

[1] The average growth rate of CFC-12 consumption is assumed to be 12% for the period 1992 to 2010 to 2010.

## GOVERNMENT ACTION PLAN

| Description of Actions | Commencement/Duration | Use sector | Estimated Cost US $ |
|---|---|---|---|
| 1. Adoption of an overall policy for the protection of the ozone layer. | January 1994 (begin preparation)<br>August 1994 (adoption) | All | |
| 2. Adoption of various regulations to control and monitor the consumption of controlled substances | October 1993 (begin preparation)<br>June 1994 (enforcement) | All | |
| 3. Establishment of Ozone Layer Fund under the Min. of Plan. and Env. for the implementation of the Country Programme | August 1993 | All | |
| 4. Designing of a logo for ozone friendly products and CFC-free environment. | January 1994 (launch) | Aerosols, refriger., foams | |
| 5. Establishment of an ODS Desk under the Min. of Planning and Environment to coordinate ODS activities. | October 1993 | All | 56,100 |
| 6. Organization of public awareness, info. exchange and training (e.g. customs officers training). adverts/announcements, etc. | To be organized as appropriate | All | |
| 7. Monitoring responsibilities of the ODS Desk | 1994 (preparations)<br>1995 (implementation) | All | |
| 8. Reporting by each industry on the import and use of controlled substances. | 1994 (preparation)<br>1995 (implementation) | All | |
| 9. Adoption of separate subheadings for each controlled substance and reporting to the ODS Sub-Unit | 1993 (preparation)<br>1994 (incorporation) | All | |
| TOTAL | | | 56,100 |

**PROJECT SUMMARY**

| Project Description | Commencement/Duration | Use Sector | Estimated Cost US $ |
|---|---|---|---|
| 1. Pilot projet to equip a resort with ozone friendly refrigeration equipment<br>**Phase I**<br>Identification of suitable resort<br>**Phase II**<br>Pre-investment study by an Implementing Agency<br>**Phase III**<br>Project implementation in the Country Programme Update | <br><br>1994<br><br>Early 1995<br><br>1966/7/8 | Refrig. | |
| 2. Pilot project to retrofit refrigeration systems at a resort<br>**Phase I**<br>Identification of suitable resort<br>**Phase II**<br>Pre-investment study by an Implementing Agency<br>**Phase III**<br>Project implementation in the Country Programme Update | <br><br>1994<br><br>Early 1995<br><br>1966/7/8 | | |
| 3. Recycling of refrigerants | January 1994 | Refrig. | 9,600 |
| 4. Training element: short course on better service practices, use of recycling units, retrofit technology (HFC-134a), etc. | Early 1994 | | 25,500 |
| 4. Retrofitting existing industrial refrigeration systems to ammonia | 1993 onwards | Refrig. | |
| 5. Training element: short course on retrofit and safety | Early 1995 | | 4,600 |
| 6. Retrofitting existing commercial refrigeration equipment to use HFC-134a<br>**Phase I**<br>Identification of suitable equipment for retrofit<br>**Phase II**<br>Pre-investment study by an Implementing Agency<br>**Phase III**<br>Project implementation in the Country Programme Update | <br><br>1993 onwards<br><br><br><br>1996/7/8 | Refrig. | |
| 7. Assistance to solvent users on substitutes | 1993 onwards | Solvents | 10,000 |
| TOTAL | | | 39,700 |

**COST**

Cost of activities and projects in the Country Programme is US $95,800.

# MALDIVES

# COUNTRY PROGRAMME

APRIL 1993

Ministry of Planning and Environment
Republic of Maldives

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

## MEMBERS OF THE NATIONAL COUNTRY PROGRAMME TEAM

Chairman: Mr. Hussain Shihab, Director of Environmental Affairs
MINISTRY OF PLANNING AND ENVIRONMENT

Members:

1. Mr. Mohamed Manik, Deputy Director
   STATE TRADING ORGANISATION

2. Mr. Abdul Shukoor, Director
3. Mr. Ahmed Shameem, Assistant Director
   MINISTRY OF TOURISM

4. Mr. Mohamed Thaufeeq, Senior Under Secretary
   MINISTRY OF TRANSPORT AND SHIPPING

5. Mr. Ibrahim Nooraddeen, Administrator
   MALDIVES ASSOCIATION OF TOURISM INDUSTRY

6. Mr. Mohamed Ali, Deputy Director, Environmental Research
7. Ms. Mariyam Waheeda, Deputy Director, Statistics
   MINISTRY OF PLANNING AND ENVIRONMENT

8. Mr. Abdulla Saleem, Under Secretary
   MALE' MUNICIPALITY

9. Mr. Mohamed Ibrahim, Director General
10. Mr. Ali Hussain Didi, Assistant Director,
    MALDIVES AIRPORTS AUTHORITY

11. Mr. Mohamed Musthafa Hussain, Director
12. Mr. Ahmed Nazeer, Vice Chairman
    MALDIVIAN TRADERS ASSOCIATION

13. VOCATIONAL TRAINING CENTRE

14. Mr. Mohamed Fazeel, Project Officer
    MINISTRY OF TRADE AND INDUSTRIES

15. Mr. Mohamed Shareef, Deputy Collector of Customs
    CUSTOMS

UNEP IE/PAC Consultant: Megumi Seki

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# EXECUTIVE SUMMARY

## 1. Introduction

This country programme reflects the commitment of the Government of Maldives to comply with the obligations of the Montreal Protocol on Substances that Deplete the Ozone Layer, to which Maldives is a Party. It provides the framework for activities to be undertaken by Maldives to achieve the required phase out of controlled substances and forms the basis for requesting assistance from the Multilateral Fund for those activities.

The Country Programme was prepared between the period April 1992-April 1993 and it should be updated during 1995. The updated Country Programme should be implemented from 1996.

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 controlled substances and products containing controlled substances, undertaken by the Institute of Natural Resources of University of the South Pacific (Report by the Institute attached as Annex I to the Country Programme report). Data and information for the years 1986, 1989, 1990 and 1991 are contained.

(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 Maldives 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 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. 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 Ministry of Planning and Environment with technical assistance of Industry and Environment Programme Activity Centre (IE/PAC) of the United Nations Environment Programme (UNEP) and financial support from the Multilateral Fund through IE/PAC. A National Country Programme was established for the purpose of assisting and advising the Ministry of Planning and Environment in preparing the Country Programme.

The Country Programme was adopted by the Ministry of Planning and Environment and approved by the National Commission on Environment Protection and the Presidents Office. It was decided that the Country Programme should be implemented under the responsibility of the Ministry of Planning and Environment.

## 2. Consumption and use of controlled substances

Maldives is a very small consumer of controlled substances. It does not produce or export any controlled substance, but imports CFC-12 and insignificant quantities of CFC-11 and CFC-115 for servicing various refrigeration systems. An insignificant quantity of methyl chloroform is imported and used by two dry cleaners. Other information and data on methyl chloroform was not available. Carbon tetrachloride may also be used for machinery cleaning but no data were available. Insignificant quantities of Halon 1301 was imported in 1987 and 1990.

### (a) The survey

The consumption of the controlled substances and related equipment were determined through a survey of the imports and industries using the controlled substances. The survey was conducted by the Ministry of Planning and Environment (the Statistics Section and the Environment Section) with assistance of the National Country Programme Team.

Under the survey, not all the relevant industries could be identified, in particular, the small-scale industries such as small workshops that may be using solvents for electronics repairs or refrigerants for recharging refrigerators. The reasons are that: (i) not all industries are required to register with the Government; and (ii) the present record keeping on the industries does not include descriptions of the industries and their functions. Under the Action Plan, a scheme for monitoring of industries is included.

### (b) Past situation

Consumption of controlled substances as bulk chemicals:

The total consumption, calculated consumption and calculated per capita consumption for the years 1986, 1989, 1990 and 1991 of the controlled substances (mainly CFC-12) were as follows:

| Year | Consumption (Tonnes) | Calculated consumption (Tonnes x ODP) | Calculated per capita consumption (kg) |
|---|---|---|---|
| 1986 | 0.1 | 0.1 | 0.0005 |
| 1989 | 2.2 | 2.2 | 0.011 |
| 1990 | 3.6 | 4.5 | 0.021 |
| 1991 | 5.0 | 5.0 | 0.023 |

The above consumption of the controlled substances is only CFC-12 for the years 1986, 1989 and 1991. In 1990, 0.1 Tonne of halon 1301 was imported. All the CFC-12 are used by servicing workshops to refill refrigerator systems and air-conditioners (mainly automotive).

Products Containing Controlled Substances:

Maldives does not manufacture products that contain or are made with controlled substances, but almost completely rely on imported products.

Refrigeration and air conditioning equipment: There is one company that assembles a limited number of refrigerators and freezers. The materials are largely imported. Various types of refrigeration and air-conditioning equipment are imported. A number of retail shops import the equipment upon request of a customer. These shops have very few units of equipment in store because of high rate of equipment deterioration due to hot and humid climatic conditions. Hotels and resorts constitute the largest end-user sector of refrigeration and air-conditioning equipment. They usually import their own equipment and some service their own equipment. The import domestic refrigerators in 1986, 1989, 1990 and 1991 were 374, 2024, 1424 and 1542 units, respectively and the import of freezers in those years were 25, 1045, 303 and 349, respectively. The estimated numbers of refrigerators and freezers

in operation in Maldives are 9000 and 2000 respectively.

Cold rooms are also common in Maldives. Some of the cold rooms that do not require very low temperatures are cooled using air-conditioners. Almost all the room air-conditioners are split type, using HCFC-22. Number of cold rooms (using CFC-12 as refrigerant) that are in operation in Maldives is estimated to be 1000.

Several automobiles are imported with air-conditioners using CFC-12 refrigerant. It is estimated that the numbers of car air conditioners imported in 1986, 1989, 1990 and 1991 were 35, 161, 249 and 51 respectively. An estimated 400 units of car air-conditioners are being used in Maldives.

Foam products and aerosols: Demand for aerosols and foam products are met through import.

Halon fire extinguishers: Portable halon fire extinguishers are imported and used by the National Security Service which also services the Airports. The aircrafts (Air Maldives) are also equipped with halon fire extinguishers. The only other importer of halon fire extinguishers is the State Trading Organization (STO). STO imports small portable halon fire extinguishers which are bought by a number of small shops for their own use. At Dhiraagu (Telecommunications company) halon fire extinguishers of fixed type (halon 1301) as well as portable ones (halon 1211) are used. There are four fixed systems at Dhiraguu and no other fixed systems were found in Maldives. The estimated numbers of portable fire extinguishers in Maldives is 100 units.

(c) Analyses of Future Demand for the Controlled Substances

Unconstrained Demand:

The economy of Maldives performed exceptionally well during the 1980s with an average GDP growth rate of 10% per annum. The two key sectors of the national economy are fisheries and tourism which together account for around one third of the GDP. Both in tourism and fisheries, refrigeration and air-conditioning are essential. Potential for growth in the two sectors are considerable. Development plans include policies and projects to continue to seek to exploit the potential and ensure sustainable growth in these sectors. Some moderation in the GDP growth rate could be expected in the coming years.

Maldives consumes CFC-11, CFC-12, CFC-115, halon 1301 and methyl chloroform. However, only CFC-12 is consumed in significant quantity. Unconstrained demand is estimated for CFC-12 although potential for growth in consumption of other substances could be expected. The projection of future demand also does not take into account the possibilities for new use of controlled substances, for example in foam production, to be started in Maldives.

The demand for CFC-12 is projected to grow at an average rate of 12% for the period 1992 to 2010. The relevant data underlying this estimated growth rate are:

- GDP growth rate for 1990 and 1991 were 16.2 and 7.6.
- Growth in the consumption of CFC for 1990 and 1991 were 59% and 43%.
- Predicted average annual GDP growth rate of 7% for 1993-2010.
- Average annual population growth rate between 1985 and 1990 was 3.4%.
- Further growth in the fisheries and tourism is expected and the living standards are also expected to improve.

The total unconstrained demand for CFC-12 in the years 2000 and 2010 are calculated to be 13.9 and 43.1 Tonnes, respectively.

Estimation of incremental cost:

Incremental costs are estimated for two phase out scenarios:

(a) Accelerated phase-out through the implementation of this Country Programme which targets the phase-out at year 2000.

(b) Phase-out in the year 2010 in accordance with the requirements of the Montreal Protocol for countries operating under para. 1 of Article 5.

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 incremental costs. The method used in the attempt to estimate the incremental costs for Maldives 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.

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

(a) Accelerated phase-out: US $ 2,265,252 (appr. 2,270,000)

(b) Phase-out in accordance with the Montreal Protocol: US $ 2,323,609 (appr. 2,323,609)

The incremental cost figures above indicate that costs are lower for Maldives to phase out CFC-12 in accordance with the accelerated phase out schedule rather than the Montreal Protocol phase out schedule. It should be kept in mind that there are several other important factors that have not been taken into consideration in the analysis. Those factors that justify the implementation of accelerated phase out include the following:

(a) In reality the controlled substances will soon become unavailable and the prices of the substances are already rising. The price rise has not been incorporated into the analyses. 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.

(b) Furthermore, and most importantly, the environmental benefits of less consumption, hence emission of controlled substances would 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 difficulties in obtaining controlled substances and increased prices of controlled substances that the developing countries would have to pay for) that could not be accounted for in the calculations.

3. Implementing phase-out

(a) Action Plan

Government of Maldives is committed to comply with the Montreal Protocol and is prepared to go faster than the Protocol requires for phasing out the consumption of controlled substances for Article 5 countries. The Action Plan

in the Country Programme should enable Maldives to phase out the consumption of controlled substances as follows:

| | | |
|---|---|---|
| Annex A: | Group I - CFCs | 2000 |
| | Group II - Halons | 1996 |
| Annex B: | Group II - Carbon tet. | 2000 |
| | Group III - Methyl chl. | 2000 |

For the phase out schedules to be met, it is essential that the programmes and projects including 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 its Implementing Agencies under the Montreal Protocol.

The Action Plan consists of two parts: the Government Actions comprising four programmes and Industry Action comprising six phase out projects:

Government Action:

1. Policies and Regulation Programme;
2. Programme for Financial Assistance and Incentives;
3. Institutional Strengthening Programme; and
4. ODS Phase-out Monitoring Programme.

Industry Action:

1. Pilot project: equipping a resort with new refrigeration and air-conditioning systems that do not contain controlled substances;
2. Pilot project: retrofitting the refrigeration systems of an existing resort to use substitute refrigerant;
3. Recovery and recycling of refrigerant and better servicing practice;
4. Retrofitting industrial refrigeration systems to use ammonia;
5. Retrofitting commercial refrigerators (large compressors); and
6. Substitution of solvents that are controlled substances.

Brief description of the programmes, projects and elements under the Action Plan are contained in Table A. The Table also indicates the total budget for each programme or project.

Since the budgets are estimates, there may be either surpluses or shortages of funds for carrying out the planned activities. Any surplus will be accounted for in the Country Programme update (to be prepared in 1985 for implementation from 1986) and any shortage may have to be re-requested from the Multilateral Fund.

The total budget for the Action Plan is as follows:

| | |
|---|---|
| Government Actions: | US $ 56,100 |
| Industry Actions: | US $ 39,700 |
| GRAND TOTAL: | US $ 95,800 |

Table A. Summary of the programmes, projects and elements under the Action Plan

| Programmes/projects/ elements | Brief Description | Commencement/ Duration | Use sector | Budget |
|---|---|---|---|---|
| **GOVERNMENT ACTIONS** | | | | |
| Programme 1 | | | | |
| 1. policy | Adoption of an overall policy for the protection of the ozone layer. | January 1994 (begin preparation) August 1994 (adoption) | All | |
| 2. regulation | Adoption of various regulations to control and monitor the consumption of controlled substances. | October 1993 (begin preparation) June 1994 (enforcement) | All | |
| Programme 2 | | | | |
| 1. Ozone Layer Fund | Establishment of Ozone Layer Fund under the Min. of Plan.and Env. for the implementation of the Country Prog. | August 1993 | All | |
| 2. Ozone Friendly Logos | Designing of a logos for ozone friendly products and CFC-free environment. | January 1994 (launch) | Aerosols, refrig., foams | |
| Programme 3 (Inst. strengthening) | Establishment of an ODS Desk under the Min. of Planning and Environment to coordinate ODS activities. | October 1993 | All | 56,100 |
| | Organization of public awareness, info. exchange and training (e.g. customs officers training). | To be organized as appropriate | All | |
| Programme 4 | | | | |
| 1. ODS Desk | Monitoring responsibilities of the ODS Desk. | 1994 (preparations) 1995 (implementation) | All | |
| 2. Industry reports | Reporting by each industry on the import and use of controlled substances. | 1994 (preparations) 1995 (implementation) | All | |
| 3. Customs data | Adoption of separate subheadings for each controlled substances and reporting to the ODS Sub-Unit | 1993 (preparations) 1994 (incorporation) | All | |

Table 3.2 continued_/

| Programmes/projects/ elements | Brief Description | Commencement/ Duration | Use sector | Budget |
|---|---|---|---|---|
| **INDUSTRY ACTIONS** | | | | |
| 1. Project R1 | Pilot project to equip a resort with ozone friendly refr. equipment. | . | Refrig. | |
| Phase I | Identification of suitable resort. | 1994 | | |
| Phase II | Pre-investment study by an Implementing Ag. | early 1995 | | |
| Phase III | Project implementation in the Country Programme update. | (1996/7/8) | | |
| 2. Project R2 | Pilot project to retrofit refr. systems at a resort. | . | Refrig. | |
| Phase I | Identification of suitable resort. | 1994 | | |
| Phase II | Pre-investment study by an Implementing Ag. | early 1995 | | |
| Phase III | Project implementation in the Country Programme update. | (1996/7/8) | | |
| 3. Project R3 | Recycling of refrigerants. | January 1994 | Refrig. | 9,600 |
| Training element | Short course on better service practices, use of recycl.units, retrofit technology (HFC-134a), etc. | early 1994 | | 25,500 |
| 4. Project R4 | Retrofitting existing industrial refrigeration systems to ammonia. | 1993 onwards | Refrig. | |
| Training element | Short course on retrofit and safety. | early 1995 | | 4,600 |
| 5. Project R5 | Retrofitting existing commercial refrig. equipment to use HFC-134a. | . | Refrig. | |
| Phase I | Identification of suitable equipment for retrofit. | 1993 onwards (1996/7/8) | | |
| Phase II | Project Implementation in the Country Programme update. | 1993 onwards | | |
| 6. Project S1 | Assistance to solvent users on substitutes | | Solvents | |

# 1. INTRODUCTION

## 1.1 Purposes

This country programme reflects the commitment of the Government of Maldives to comply with the obligations of the Montreal Protocol on Substances that Deplete the Ozone Layer, to which Maldives is a Party. It provides the framework for activities to be undertaken by Maldives to achieve the required phase out of controlled substances and forms the basis for requesting assistance from the 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 Maldives, 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 analyze 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 Maldives 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 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 April 1992-April 1993, and contains data and information on the consumption and use of ozone depleting substances controlled under the Montreal Protocol and its London Amendment for the years 1986, 1989, 1990 and 1991. It is the first country programme prepared. No country study for Maldives has been carried out previously by any international organizations.

In the survey of industries using controlled substances, it has not been possible to identify all the relevant industries, in particular, the small-scale industries such as small workshops that may be using solvents for electronics repairs or refrigerants for recharging refrigerators. The reasons are that: (i) not all industries are required to register with the Government; and (ii) the present record keeping on the industries does not include descriptions of the industries and their functions. Under the Action Plan, a scheme for monitoring of industries is included.

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

The Action Plan of Maldives 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 1995 and it consists of various programmes and projects categorized under Government Actions 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 for the implementation. These budgets would be refined when the projects are further developed, before implementation, into project proposals for submission to the Fund Secretariat/Executive Committee. Assistance of appropriate Implementing Agency would be required for developing the project proposals. The timetable for the implementation of the Action Plan reflects the prioritization of the programmes and projects.

The existing institutional framework for dealing with the issues under the Montreal Protocol is recorded. The Action Plan includes plans 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 projects for 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 1995 and the updated Country Programme should be implemented from 1996.

### 1.2.1 Preparation and Adoption of the Country Programme

The country programme was prepared under the responsibility of the Ministry of Planning and Environment 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 to assist the Ministry of Planning and Environment in directing the survey, to facilitate the collection of data under the survey and to participate and advise on the Action Plan and review of the report. The Team consisted of representatives of the following bodies: Ministry of Tourism, Maldives Association of Tourism Industry, Ministry of Trade and Industries, Maldives Traders Association, Customs, State Trading Organization, Post and Telecommunication, National Security Service (Fire Department), Airports Authority, Vocational Training Centre, Male Municipality and Ministry of Planning and Environment (Environment Section and Statistics Section).

The survey was undertaken by the Statistics Section and the Environment Section of the Ministry of Planning and Environment, with advice and assistance from the National Country Programme Team.

The Ministry of Planning and Environment and the National Country Programme Team, with assistance from UNEP IE/PAC consultant, decided upon the strategy and Action Plan for the phase out and reviewed and adopted the report. The report was then submitted to the National Commission for Protection of the Environment which also approved the report and recommended it for adoption by the Minister for Planning and Environment.

The final approval of the report was given by the Minister for Planning and Environment. It was decided that Maldives should implement the country programme under the responsibility of the Ministry of Planning and Environment.

### 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) Ministry of Planning and Environment and its Environment Section:

Took the leadership in the preparation of the country programme and conducted 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 appropriate inputs from the National Country Programme Team and IE/PAC; reviewed and adopted the report; and recommended it for consideration, approval and final adoption by the Government. The Statistics Section also assisted the Environment Section in conducting the survey of the consumption, use, imports and exports of the controlled substances and the products that contain controlled substances as well as in analyzing the data and information collected through the survey.

(b) National Country Programme Team:

Advised on the conducting of 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; and assisted in the development of the strategy and the Action Plan for phasing out the consumption of the controlled substances.

(c) National Commission for the Protection of the Environment:

Reviewed the report and advised on the Action Plan for the Phase out. Recommended the report for adoption by the Minister for Planning and Environment.

(d) 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;
(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 industry cooperated and supported the survey by providing the necessary data and information for the survey. The bodies and the data and information they provided are as follows:

Governmental bodies:

(a) **Customs:** provided most of the information on imports and exports of controlled substances and equipment containing controlled substances (various refrigerators, air-conditioners, aerosols, and fire extinguishers);

(b) **Ministry of Tourism:** provided data on the hotels and resorts that use controlled substances and equipment containing controlled substances;

(c) **Ministry of Trade and Industries:** provided information on industries;

(d) **Ministry of Transport and Shipping:** provided data on the importation of vehicles and the existing number of vehicles in Maldives with information on the mobile air-conditioners, as well as data on the existing companies that operate ships;

(e) **National Security Service, Fire Section:** provided data on the use of halon fire extinguisher systems in Maldives and on servicing of the halon fire extinguishing equipment;

(g) **Vocational Training Centre:** provided information on the existing training facilities in Maldives.

Industries

(a) **Individual industries and companies:** provided data on the consumption and use of the controlled substances in their own companies, as well as information known about the general situations in Maldives with regard to the use concerned. (A full list of the relevant industries and companies is attached as Annex I to this report.)

## 2. CONSUMPTION AND USE OF CONTROLLED SUBSTANCES

### 2.1 The Consumption of Controlled Substances in 1986, 1989, 1990 and 1991

Maldives is a very small consumer of controlled substances. It does not produce any controlled substance, but imports CFC-12 for servicing various refrigeration systems and insignificant quantities of CFC-11 and CFC-115 (as a part of refrigerant R-502 for recharging some freezers and ice machines).

Another major ODS imported is HCFC-22. This country programme does not include data on HCFCs.

An insignificant quantity of methyl chloroform is imported and used by two dry cleaners. Other information and data on methyl chloroform was not available. Carbon tetrachloride may also be used for machinery cleaning but no data were available.

Insignificant quantities of Halon 1301 was imported in 1987 and 1990.

No other controlled substances have been found imported as bulk chemicals.

#### 2.1.1 The Consumption of Each Controlled Substance (as bulk chemicals)

The consumption of each controlled substance (substances under Annex A of the Montreal Protocol and Annex B of the London Amendment), calculated level of consumption as well as calculated per capita consumption for the years 1986, 1989, 1990 and 1991 are shown in Table 1.

Tables A.1 - A.4 in Annex II of this report show the production, imports, exports and consumption of each of the controlled substances for the four years separately. The Tables are in the form that is ready for submission to the Ozone Secretariat to fulfill the reporting requirements of Article 7 of the Protocol.

### 2.1.2 Consumption of Each Controlled Substance by Use Sectors

**Refrigeration and air-conditioning sector:** All the CFC-12 imported are used as refrigerants in refrigerator systems and automotive air-conditioners for servicing of refrigeration systems. The negligible amount of CFC-115 imported as part of a refrigerant mixture R-502 is used for recharging some freezers and ice machines.

**Solvents sector:** Two dry cleaners use imported methyl chloroform. It is suspected that carbon tetrachloride and methyl chloroform may be used by some industries for cleaning machinery. However, data and information on this was not available.

**Halons:** The only type of halon imported since 1986 is halon 1301 for recharging fixed fire extinguisher systems.

### 2.1.3 Products Containing Controlled Substances

Maldives does not manufacture products that contain or are made with controlled substances, but almost completely rely on imported products. There is one company that assembles a limited number of refrigerators and freezers. The materials are largely imported.

Maldives imports various refrigerators, air-conditioners, aerosols, fire extinguishers and foam products such as mattresses and cushions. For refrigerators and air-conditioners there are a number of retail shops that import the products upon request of a customer. These shops have very few units of equipment in store because of high rate of equipment deterioration due to hot and humid climatic conditions. Hotels and resorts constitute the largest end-user sector of refrigeration and air-conditioning equipment. They usually import their own refrigeration and air-conditioning equipment and some service their own refrigeration and air-conditioning systems.

Cold rooms are also common in Maldives. Some of the cold rooms that do not require very low temperatures are cooled using air-conditioners. Almost all the room air-conditioners are split type, using HCFC-22.

The average life time of a refrigerator is 6-8 years. The climatic conditions makes the metals corrode fast and fluctuations of the electrical power also contribute to shorten the life time of the equipment.

Portable halon fire extinguishers are imported and used by the National Security Service which also services the Airports. The aircrafts (Air Maldives) are also equipped with halon fire extinguishers. The only other importer of halon fire extinguishers is the State Trading Organization (STO). STO imports small portable halon fire extinguishers which are bought by a number of small shops for their own use. At Dhiraagu (Telecommunications company) halon fire extinguishers of fixed type (halon 1301) as well as portable ones (halon 1211) are used. Two fixed systems (each containing 115 kg halon 1301) were installed in 1987 and two more (each containing 184 kg halon 1301) were installed in 1990. Dhiraagu is by far the major user of halons in Maldives.

Available data on the types of products imported, the quantities of each type of product imported, and information on the main countries from which the products were imported are shown in Table 2.1. Estimates of the numbers of various equipment containing controlled substances that were in operation in Maldives in 1991 are shown in Table 2.2. The table also shows the type of controlled substances contained in each category of equipment and approximation of the total quantity of the controlled substances.

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

| Substances | 1986 | | 1989 | | 1990 | | 1991 | |
|---|---|---|---|---|---|---|---|---|
| | cnsp | calc | cnsp | calc | cnsp | calc | cnsp | calc |
| **ANNEX A** | | | | | | | | |
| Group I | | | | | | | | |
| CFC 11 | - | - | - | - | - | - | - | - |
| CFC 12 | 0.1 | 0.1 | 2.2 | 2.2 | 3.5 | 3.5 | 5.0 | 5.0 |
| CFC 113 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| CFC 114 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| CFC 115 | - | - | - | - | - | - | - | - |
| Sub-total | 0.1 | 0.1 | 2.2 | 2.2 | 3.5 | 3.5 | 5.0 | 5.0 |
| Group II | | | | | | | | |
| Halon 1211 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Halon 1301 | 0 | 0 | 0 | 0 | 0.1 | 1 | 0 | 0 |
| Halon 2402 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sub-total | 0 | 0 | 0 | 0 | 0.1 | 1 | 0 | 0 |
| **TOTAL** | **0.1** | **0.1** | **2.2** | **2.2** | **3.6** | **4.5** | **5.0** | **5.0** |
| **ANNEX B** | | | | | | | | |
| Group I | | | | | | | | |
| 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 |
| Sub-total | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Group II | | | | | | | | |
| Carbon tet | - | - | - | - | - | - | - | - |
| Group III | | | | | | | | |
| Methyl chl | - | - | - | - | - | - | - | - |
| **TOTAL** | - | - | - | - | - | - | - | - |
| Population | 186,000 | | 206,000 | | 213,000 | | 220,000 | |
| per capita consmp. Kg. (calcul.) | Annex A: 0.0005<br>Annex B: - | | Annex A: 0.011<br>Annex B: - | | Annex A: 0.021<br>Annex B: - | | Annex A: 0.023<br>Annex B: - | |

Notes:

(a) cnsp = consumption in Tonnes
calc = calculated consumption (Tonnes x ODP)

(b) Population for 1986, 1989, and 1991 have been estimated from the statistics given in "National Development Plan 1991-1993, Volume 1"

Table 2.1 Importation of products containing controlled substances

| TYPE OF PRODUCT | QUANTITY IMPORTED 1986 | 1989 | 1990 | 1991 | MAJOR SOURCE COUNTRIES |
|---|---|---|---|---|---|
| (A) REFRIGERATION AND AIR-CONDITIONING | | | | | |
| refrigerators (domestic) | 374 | 2,024 | 1,424 | 1,542 | Singapore, S. Korea |
| freezers | 25 | 1,045 | 303 | 349 | 〃 |
| ice machines | 3 | 4 | 23 | 12 | 〃 |
| automotive a/c | 10 | 80 | 180 | 45 | |
| ( cars | 35 | 161 | 249 | 51 ) | |
| (B) FIRE EXTINGUISHERS (HALONS) | | | | | |
| portable | - | - | - | - | |
| fixed systems | 0 | 0 | 2 | 0 | - |

Table 2.2 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 |
|---|---|---|---|
| (A) REFRIGERATION AND AIR-CONDITIONING | | | |
| domestic refrigerators | 9,000 | CFC-12 | 1.3 Tonne |
| freezers | 2,000 | CFC-12 | 1 Tonne |
| cold rooms | 1,000 | CFC-12 | 5 Tonnes |
| ice machines | 100 | CFC-12 | |
| automotive a/c | 400 | CFC-12 | 0.4 Tonnes |
| (B) FIRE EXTINGUISHERS (HALONS) | | | |
| portable | 100 | Halon 1211 | 1 Tonne |
| fixed systems | 4 | Halon 1301 | 0.6 Tonnes |

## 2.2 Analyses of Future Demand for the Controlled Substances

### 2.2.1 The Economy

The Republic of Maldives is an archipelagic State in the Indian Ocean. Its area is 900,000 square kilometer of which major part consists of the sea. 1,190 small coral islands grouped into 19 groups or 'atolls', constitute the Republic. Only a few of the islands exceed one square kilometer in area with an average elevation of 1.6 meters above mean sea level. 200 of the islands are inhabited and only 4 of these have populations of over 4000 people. The country extends from the equator to 8 degrees north. It has a tropical climate.

The economy of Maldives performed exceptionally well during the 1980s with an average GDP growth rate of 10% per annum. The two key sectors of the national economy are fisheries and tourism which together account for around one third of the GDP. The high rate achieved can be largely attributed to liberal policies pursued by the Government, which stimulated investments in tourism and fisheries. These sectors also provide, directly and indirectly, employment and income for the majority of the population.

Maldives, with its rich coral gardens and profusion of marine life, is regarded as one of the three most important locations for scuba diving. Potential for tourism is still largely untapped. The country has about 70 resorts and 3 hotels and only 2 of the 19 Atolls have been developed for tourism on a significant scale. About half of the resorts were developed within the last 3-4 years when the Ari Atoll was opened for development as tourist resort. There are plans to open up other areas for tourism in the next few years.

The annual GDP growth rate from 1986 to 1992 (at 1985 constant prices) were as follows:

| | |
|---|---|
| 1986: | 8.6 |
| 1987: | 8.9 |
| 1988: | 8.7 |
| 1989: | 9.3 |
| 1990: | 16.2 |
| 1991: | 7.6 |
| 1992: | 6.3 |

For the National Development Plan period of 1991-1993, some moderation in the GDP growth rate was expected. Although the Government policies were to continue to seek to exploit the enormous potential in tourism, the growth is partly dependent on the sending countries some of which are in economic recession. The growth in fisheries sector was also uncertain due to unreliable data on levels of sustainability of exploitation, stock migration patterns and prices of fish in the export markets. Stagnation in these two sectors, especially tourism, would negatively affect several other sectors such as construction, transport and trade. Target for the GDP growth rate for the period was 8%. It can be assumed that the average annual GDP growth rate from 1992 to 2010 would be 7.0%.

### 2.2.2 Projection of Demand for Controlled Substances: Unconstrained Demand

Basic Assumptions:

Maldives consumes CFC-11, CFC-12, CFC-115, halon 1301 and methyl chloroform. However, only CFC-12 is consumed in significant quantity. With regard to the other substances, the quantities found were negligible. For solvents, data could not be obtained. Hence the unconstrained demand is estimated only of CFC-12 although potential for growth in consumption of other substances could be expected. The projection of future demand also does not take into account the possibilities for new use of controlled substances, for example in foam production, to be started in Maldives.

The future demand for the controlled substances is estimated assuming that the Montreal Protocol did not exist.

Projection of demand of CFC-12:

CFC-12 is used entirely for installation, refilling and servicing of refrigeration and automobile air-conditioning equipment.

The demand for CFC-12 is projected to grow at an average rate of 12% for the period 1992 to 2010. The relevant data underlying this estimated growth rate are:

- GDP growth rate for 1990 and 1991 were 16.2 and 7.6.
- Growth in the cosumption of CFC for 1990 and 1991 were 59% and 43%.
- Predicted average annual GDP growth rate of 7% for 1993-2010.
- Average annual population growth rate between 1985 and 1990 was 3.4%.
- Further growth in the fisheries and tourism is expected and the living standards are also expected to improve.

The total unconstrained demand for CFC-12 in the years 2000 and 2010 are calculated to be 13.9 and 43.1 Tonnes, respectively (see Table 2.3 below). Figure 2.1 below shows graphically the future unconstrained demand for the controlled substances.

Figure 2.1 Graph showing the unconstrained demand for CFC-12 up to year 2010

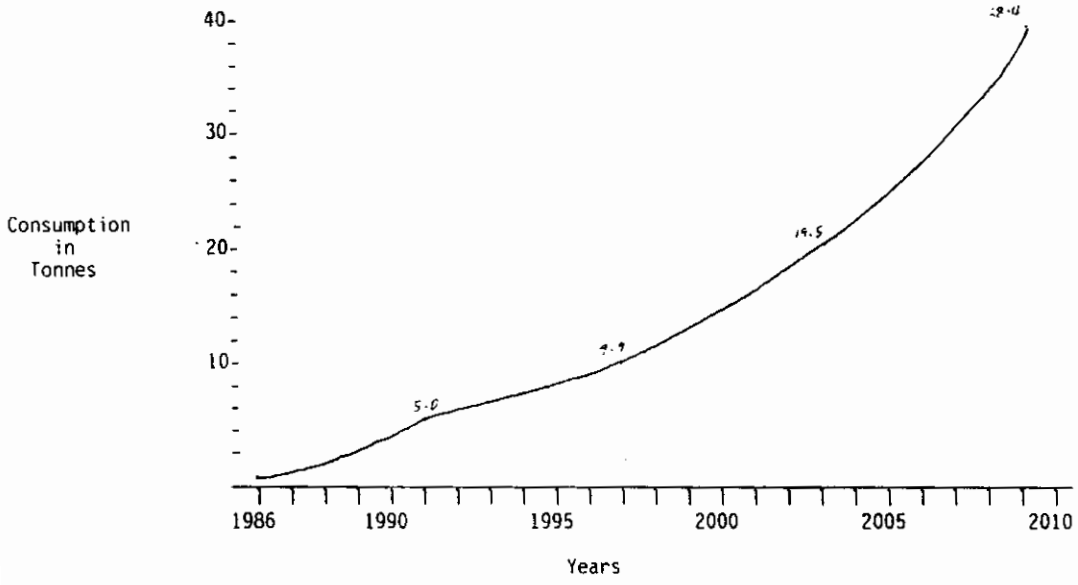


Table 2.3 Summary of the yearly predicted consumption of CFC-12 following the unconstrained demand

| Year | Estimated GDP growth rate % | Assumed Growth Rate | CFC-12 Consump. |
|---|---|---|---|
| 1991 | | | 5.0 |
| 1992 | 7 | 12% | 5.6 |
| 1993 | 7 | " | 6.3 |
| 1994 | 7 | " | 7.0 |
| 1995 | 7 | " | 7.9 |
| 1996 | 7 | " | 8.8 |
| 1997 | 7 | " | 9.9 |
| 1998 | 7 | " | 11.1 |
| 1999 | 7 | " | 12.4 |
| 2000 | 7 | " | 13.9 |
| 2001 | 7 | " | 15.5 |
| 2002 | 7 | " | 17.4 |
| 2003 | 7 | " | 19.5 |
| 2004 | 7 | " | 21.8 |
| 2005 | 7 | " | 24.4 |
| 2006 | 7 | " | 27.4 |
| 2007 | 7 | " | 30.7 |
| 2008 | 7 | " | 34.3 |
| 2009 | 7 | " | 38.4 |
| 2010 | | " | 43.1 |

### 2.2.3 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.

In estimating the incremental costs to the economy of the country, there are some uncertainties. For example: (i) the change over the coming years in the costs associated with substitute chemicals and alternative technologies; (ii) the period for which the operational costs could be accounted; and (iii) 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 Maldives 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.

As for the unconstrained demand analysis in sub-section 2.2.3 above, the incremental costs for the phase out is estimated only for CFC-12. The basic assumptions in the analyses are:

- The consumption of CFC-12 will increase according to the predicted unconstrained demand until control is effected according to the Action Plan or the Montreal Protocol control measures.
- CFC-12 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 CFC-12 under each of the scenarios is shown graphically below:

Figure 2.2 Graph showing the expected consumption of CFC-12 under the accelerated phase out scenario (maximum consumption under the Action Plan)

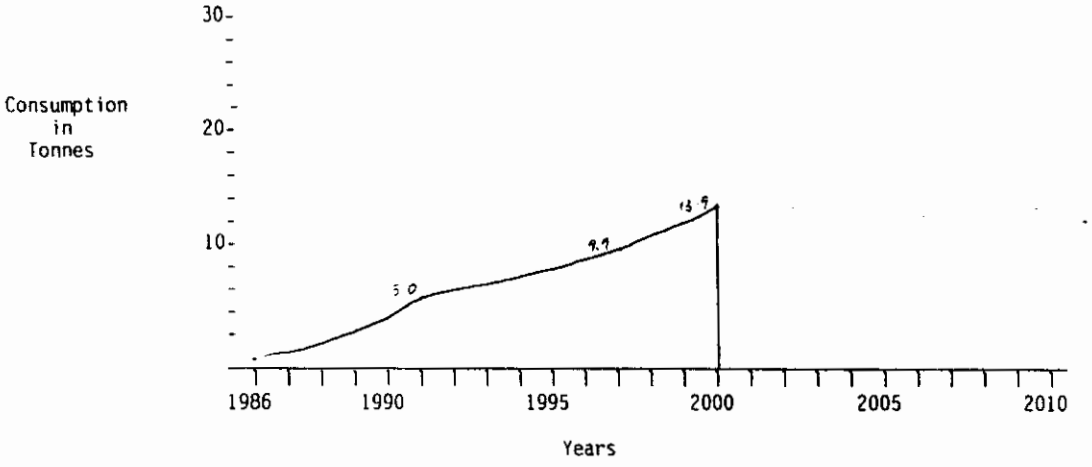
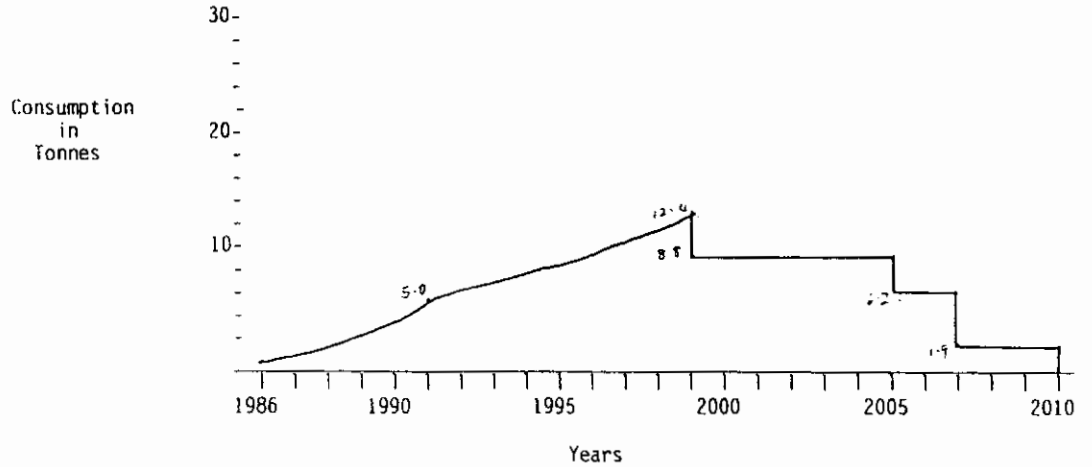



Figure 2.3 Graph showing the expected consumption of CFC-12 under the Montreal Protocol phase-out scenario (maximum allowable consumption)



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 (in 1997).

At present, the incremental costs for purchasing new equipment that do not contain controlled substances is not eligible for funding through the Multilateral Fund. If such incremental costs can be funded, the consumers will be purchasing new equipment at an early stage. Without the incremental costs being funded, it would not be easy to convince/motivate the consumers to purchase the more expensive new equipment until the prices of the new equipment become comparable to those of CFC-equipment. Hence, the consumers will continue to purchase the CFC-equipment which would have to be replaced when the controlled substances become unavailable. This incurs costs for early, forced replacement of equipment. It is expected that this issue will further be discussed by the Executive Committee, and a decision will be taken as to whether incremental costs for purchasing new equipment should be covered by the Multilateral Fund.

For the estimation of the incremental cost, it is assumed that the consumers will continue to purchase domestic refrigeration equipment containing controlled substances until a ban on importation of such equipment is effected.

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 of HFC-134a.

The retrofit currently encouraged for industrial refrigeration systems is to ammonia. The incremental costs for the retrofit varies considerably depending on the type, size and state of the equipment. Furthermore what operational costs and for how long these should be accounted for in the estimation of incremental costs is unclear.

For the purpose of estimation of the incremental cost, only the domestic refrigerators and freezers are considered, since these by far would be the main equipment that would be in operation in Maldives. The estimated increase in the stock of domestic refrigerators and freezers is shown in Table 2.4 below.

Table 2.4 Summary of the yearly predicted stock of refrigeration equipment following the unconstrained demand

| Year | Estimated GDP Growth Rate | Assumed Growth Rate for refrig. equipment | Domestic Refrig. | Freezers |
|---|---|---|---|---|
| 1991 | | | 9,000 | 2,000 |
| 1992 | 7 | 12% | 10,080 | 2,240 |
| 1993 | 7 | 12% | 11,290 | 2,509 |
| 1994 | 7 | 12% | 12,645 | 2,810 |
| 1995 | 7 | 12% | 14,162 | 3,147 |
| 1996 | 7 | 12% | 15,861 | 3,525 |
| 1997 | 7 | 12% | 17,765 | 3,948 |
| 1998 | 7 | 12% | 19,897 | 4,422 |
| 1999 | 7 | 12% | 22,284 | 4,952 |
| 2000 | 7 | 12% | 24,958 | 5,546 |
| 2001 | 7 | 12% | 27,953 | 6,212 |
| 2002 | 7 | 12% | 31,307 | 6,957 |
| 2003 | 7 | 12% | 35,064 | 7,792 |
| 2004 | 7 | 12% | 39,272 | 8,727 |
| 2005 | 7 | 12% | 43,984 | 9,775 |
| 2006 | 7 | 12% | 49,262 | 10,947 |
| 2007 | 7 | 12% | 55,174 | 12,261 |
| 2008 | 7 | 12% | 61,795 | 13,732 |
| 2009 | 7 | 12% | 69,210 | 15,380 |
| 2010 | 7 | 12% | 77,515 | 17,226 |

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

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

(a) Accelerated phase-out

Estimated incremental cost: undiscounted: US $ 5,273,840
discounted: US $ 2,068,912

- In Maldives, a life time of a domestic refrigerator is estimated to be 8 years, with compressor replacement occurring once during its life time. 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 $ 700. Hence, the total investment cost to a consumer would be 600 + 100 = US $ 700. Therefore, 'annual value' of a domestic refrigeration equipment to a consumer is estimated to be US $ 88.
- Cost of forced replacement is assumed to be remaining life time of an equipment multiplied by the 'annual value (US $ 88)'.
- It is assumed that the forced replacement of equipment would start in 1997 when the ban on importation of equipment using controlled substances (including compressors) will be effected.
- By 1996, the stock of domestic refrigeration equipment (refrigerators and freezers) is estimated to have increased to 19,386.
- The equipment acquired before 1989 would not qualify for replacement cost. The estimated number of such equipment is 8,000. Therefore, the number of equipment that would qualify for replacement cost is 19,386 - 8,000 = 11,386.
- The importation of controlled substances will be banned from the year 2000, but CFC-12 would be available thereafter through recovery and recycling.
- The average remaining life time of the equipment being replaced is assumed to be 5 years.
- The yearly number of forced replacement is assumed as below. The associated incremental costs are also shown:

| Year | no. of equip. | cost US $ | discounted cost US $ |
|---|---|---|---|
| 1997 | 500 | 220,000 | 136,623 |
| 1998 | 500 | 220,000 | 124,184 |
| 1999 | 800 | 352,000 | 180,632 |
| 2000 | 800 | 352,000 | 164,211 |
| 2001 | 1,000 | 440,000 | 186,623 |
| 2002 | 2,000 | 880,000 | 339,278 |
| 2003 | 2,400 | 1,320,000 | 462,652 |
| 2004 | 3,386 | 1,489,840 | 474,709 |
| TOTAL: | 11,386 | 5,273,840 | 2,068,912 |

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

Estimated incremental cost: undiscounted: US $ 7,583,840
discounted: US $ 2,145,394

- Business will go on as usual with regard to importation of domestic refrigeration equipment until 1998. It is assumed that the importation of equipment will stop in 1999 and the replacement would begin.
- The total number of CFC-12 equipment in existence in 1998 is estimated to be 27,236.
- The equipment acquired before 1983 would not qualify for replacement cost. The number of equipment imported prior to 1991 is estimated to be 9,000. Hence, the number of refrigerators that would have to be replaced is 27,236 - 10,000 = 17,236.
- The yearly number of forced replacement is assumed as below. The associated incremental costs are also shown:

| Year | no. of equip. | cost US $ | discounted cost US $ |
|---|---|---|---|
| 1999 | 500 | 220,000 | 112,895 |
| 2000 | 500 | 220,000 | 102,632 |
| 2001 | 800 | 352,000 | 149,282 |
| 2002 | 1,000 | 440,000 | 169,639 |
| 2003 | 1,000 | 440,000 | 154,217 |
| 2004 | 1,700 | 748,000 | 238,336 |
| 2005 | 2,000 | 880,000 | 254,905 |
| 2006 | 2,000 | 880,000 | 231,732 |
| 2007 | 2,000 | 880,000 | 210,665 |
| 2008 | 2,500 | 1,100,000 | 239,392 |
| 2009 | 3,236 | 1,423,840 | 281,699 |
| TOTAL: | 17,236 | 7,583,840 | 2,145,394 |

Recovery and recycling of refrigerants

The incremental cost for recovery and recycling is calculated to be the costs of recovery and recycling units 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 accounted for in the calcualtions.

In Maldives, recovery and recycling of refrigerants will be carried out by servicing workshops. Estimated number of 20 workshops is assumed to 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 $ 73,527
discounted: US $ 47,299

- The number of servicing workshops is assumed to stay at the present estimated number of 20 until year 1997. After 1997 the number of workshops is assumed to increase at 6%.
- It is assumed that the 20 servicing workshops will acquire a recovery and recycling equipment between 1995 and 1997.
- The average price of a recovery and recycling unit is 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 consumption 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.
- 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 | 6 | 24,000 | 1,067 | 22,933 | 17,230 |
| 1996 | 6 | 24,000 | 2,376 | 21,624 | 14,770 |
| 1997 | 8 | 32,000 | 4,455 | 27,545 | 17,103 |
| 1998 | 1 | 4,000 | 4,995 | - 995 | - 562 |
| 1999 | 2 | 8,000 | 5,580 | 2,420 | - 1,242 |
| TOTAL | 23 | 92,000 | 18,473 | 73,527 | 47,299 |

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

Estimated incremental cost: undiscounted: US $ 51,534
discounted: US $ 32,254

- The number of servicing workshops is assumed to grow at half the rate as the growth in demand for refrigerants from 1997. Hence, in 1998, there would be 21 servicing workshops and in 2009 there would be 40. It is assumed that the servicing workshops will acquire a recovery and recycling units 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 |
|---|---|---|---|---|---|
| 1998 | 6 | 24,000 | 1,427 | 22,573 | 12,742 |
| 1999 | 6 | 24,000 | 3,044 | 20,956 | 10,754 |
| 2000 | 6 | 24,000 | 4,691 | 19,309 | 9,008 |
| 2001 | 4 | 16,000 | 6,130 | 9,870 | 4,186 |
| 2002 | 4 | 16,000 | 7,540 | 8,460 | 3,262 |
| 2003 | 2 | 8,000 | 8,775 | - 775 | - 272 |
| 2004 | 2 | 8,000 | 9,810 | -1,810 | - 577 |
| 2005 | 2 | 8,000 | 10,980 | -2,980 | - 863 |
| 2006 | 2 | 8,000 | 12,330 | -4,330 | -1,140 |
| 2007 | 2 | 8,000 | 13,815 | -5,815 | -1,392 |
| 2008 | 2 | 8,000 | 15,435 | -7,435 | -1,618 |
| 2009 | 2 | 8,000 | 17,280 | -9,280 | -1,836 |
| TOTAL | 40 | 160,000 | 100,277 | 51,534 | 32,254 |

The Government Actions:

The costs of Government Actions comprise: institutional strengthening, public awareness, information exchange and training activities. The costs for training of technicians under the industry projects have been included in this part of incremental cost estimation. The incremental costs are estimated for the period up to phase-out (section 3.2, Action Plan).

(a) Accelerated phase-out

| | | |
|---|---|---|
| Estimated incremental cost: | undiscounted: | US $ 211,531 |
| | discounted: | US $ 149,041 |

- The costs of Government Actions is estimated for period from 1993 to 1999 (inclusive).
- The costs of Government Actions (and training elements) estimated for this Country Programme (the first 3 years of Action - 1993 to 1995) are US $ 95,800. A simplistic assumption is made that the annual cost of Government Actions is the average for the three years, excluding the cost of equipment (US $ 9,000):

  i.e. (95,800 - 9,000)/3 = 28,933

- 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 | 37,933 | 34,485 |
| 1994 | 28,933 | 23,912 |
| 1995 | 28,933 | 21,738 |
| 1996 | 28,933 | 19,762 |
| 1997 | 28,933 | 17,965 |
| 1998 | 28,933 | 16,332 |
| 1999 | 28,933 | 14,847 |
| TOTAL | 211,531 | 149,041 |

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

| | | |
|---|---|---|
| Estimated incremental cost: | undiscounted: | US $ 385,129 |
| | discounted: | US $ 145,961 |

- 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 $ 28,933 and the total cost of necessary equipment is assumed to be US $ 9,000. It is also assumed that the equipment will be acquired by the Government in 1997.

| Year | cost | Discounted cost (1992 value) |
|---|---|---|
| 1997 | 37,933 | 23,553 |
| 1998 | 28,933 | 16,332 |
| 1999 | 28,933 | 14,847 |
| 2000 | 28,933 | 13,497 |
| 2001 | 28,933 | 12,270 |
| 2002 | 28,933 | 11,155 |
| 2003 | 28,933 | 10,141 |
| 2004 | 28,933 | 9,219 |
| 2005 | 28,933 | 8,381 |
| 2006 | 28,933 | 7,619 |
| 2007 | 28,933 | 6,926 |
| 2008 | 28,933 | 6,297 |
| 2009 | 28,933 | 5,724 |
| TOTAL | 385,129 | 145,961 |

Conclusions:

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

(a) Accelerated phase-out:

| | | | |
|---|---|---|---|
| Undiscounted: | US $ | 5,558,898 | (appr. 5,560,000) |
| Discounted: | US $ | 2,265,252 | (appr. 2,270,000) |

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

| | | | |
|---|---|---|---|
| Undiscounted: | US $ | 8,020,503 | (appr. 8,000,000) |
| Discounted: | US $ | 2,323,609 | (appr. 2,323,609) |

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 magnitude of the incremental costs (discounted) is also highly dependant upon the discount rate chosen. In this analysis 10% discount rate has been chosen.

The incremental cost figures above indicate that costs are lower for Maldives to phase out CFC-12 in accordance with the accelerated phase out schedule rather than the Montreal Protocol phase out shedule. It should be kept in mind that there are several other important factors that have not been taken into considertion in the analysis. Those factors that justify the implementation of accelerated phase out include the following:

(a) In reality the controlled substances will soon become unavailable and the prices of the substances are already rising. The price rise has not been incorporated into the analyses. 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.

(b) Furthermore, and most importantly, the environmental benefits of less consumption, hence emission of controlled substances would 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 difficulties in obtaining controlled substances and increased prices of controlled substances that the developing countries would have to pay for) that could not be accounted for in the calculations.

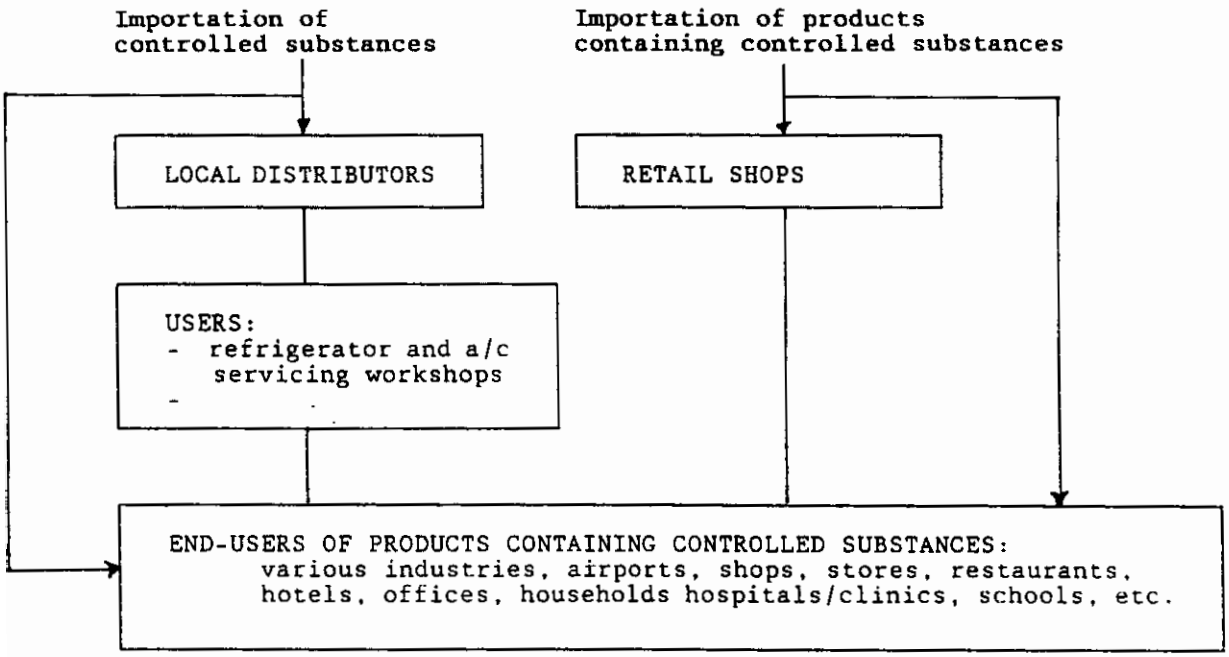
## 2.3 Industry Structure

There are two main importers of controlled substances which are distributed to the users. The users are mainly the servicing workshops for refrigeration and air-conditioning systems.

The products containing controlled substances are imported by retail shops and also by hotels and resorts industries.

The structure of the industries that deal with controlled substances are shown in Figure 2.4 below:

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 that import and use controlled substances are as follows:

Importers of controlled substances (as bulk chemicals):

2 main importers of CFCs
(for distribution to the users)

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

(a) 1 organization that operates refrigerated ships (refrigerants used are ammonia and HCFC-22)
(b) 2 main refrigerator and stationary air-conditioner servicing and maintenance workshops and 8-12 very small workshops.
(c) 3 main motor garages that service vehicles and approximately 10 small garages. Some of these garages undertake repairs and recharging of mobile air-conditioners.
(d) 2 dry cleaners (using methyl chloroform)
(e) 4-8 hotels/resorts companies maintain and service refrigeration and air-conditioning systems in their resorts and hotels (most of the time).
(f) Approximately 10 electronics maintenance shops using a minimal quantity of solvents imported in form of sprays.

Importers of products containing controlled substances

(a) 11 main retail shops sell refrigerators and stationary air-conditioners. Very few units are in stock and orders for import are made upon customers' request
(b) 5 dealers import and sell various types of vehicles. All the cars

and mini buses that are imported now come with mobile air-conditioners, but not the other vehicles

(c) Many larger-scale hotels and industries import their own refrigeration systems and air-conditioners (approximately

(d) National Security Service, Airports, Dhiraagu (telecommunications company) and Maldives Air (aircrafts) import and use halon fire extinguishers

End-users of the products that contain controlled substances

(a) The largest end-user sector for refrigerators and air-conditioners is the hotels and resorts. There are 67 resorts and 3 hotels in Maldives

(b) State Trade Organization operate refrigerated ships and .. other small private shipping companies use ships, a very few of which carry refrigeration systems on board

(c) Households, offices, shops, workshops, hospitals/clinics and schools.

## 2.4 The Status of Response to the Montreal Protocol

### 2.4.1 The Government Response

Maldives acceded to the Vienna Convention for the Protection of the Ozone Layer on 26 April 1988 and its Montreal Protocol on 16 May 1989 and both the Convention and the Protocol entered into force for Maldives on 22 September 1988 and 14 August 1988, respectively.

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

Maldives has participated with interest in the various meetings convened under the Vienna Convention and the Montreal Protocol. Ministry of Planning and Environment made a request to UNEP for assistance with regard to data collection for the purpose of reporting statistical data required by Article 7 of the Montreal Protocol was made in 1989. As a consequence, a UNEP expert (Chief of Environmental Law and Institutions Unit) visited the Maldives to discuss the issues under the Montreal Protocol including the problem of data reporting.

The Ministry of Planning and Environment has encouraged and assisted industries as well as other Governmental Offices to participate in meetings on CFCs and halons, for example, participation of Maldives Association of Tourism Industry in the Regional Workshop on the Implementation of the Montreal Protocol (Thailand, November 1991); and participation of Ministry of Defence and National Security and Maldives Airports Authority in the Halons Recycling Programme (Japan, ..... 1992).

Under an environmental awareness raising programme initiated by the Ministry of Planning and Environment, radio and television programmes as well as newspaper articles have featured issues on the environment, sometimes focusing on the problem of ozone layer depletion and the international efforts made to protect the ozone layer. A number of public lectures on environment have been organized inviting visiting experts as speakers and inviting secondary schools to attend. School curriculum also includes teaching of environmental sciences under which problems of ozone layer depletion is addressed. Furthermore, a National Workshop on the Protection of the Ozone Layer is being scheduled, as a part of this country programme preparation, in order to increase public awareness about the ozone layer issue and to inform the industries as well as the public regarding this country programme.

The Government of Maldives is committed to phasing out the consumption of controlled substances in Maldives as soon as possible but not later than the year 2000. The Government has already taken actions to pursue this goal.

Although Maldives, 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 embarking on action to phase out its consumption of the controlled substances. 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, Maldives could meet its goal to phase out the consumption of the controlled substances earlier than the Protocol requires for Article 5 countries.

### 2.4.2 The Industry Response

The industries' awareness on the problem of ozone layer depletion is generally high. However, no specific actions have yet been taken for phase-out of ODSs.

Several resorts which constitute the largest end-user sector, have been indicating their interest in substitute and alternatives for refrigerator systems. Efforts are being made by these resorts to use products that are ozone friendly.

## 2.5 Institutional Framework

**Ministry of Planning and Environment:**

Under the existing institutional framework, the issues of environment which includes global environmental issues such as the protection of the ozone layer, falls under the responsibility of the Ministry of Planning and Environment. This Ministry, prior to 1988, was Ministry of Planning and Development. In 1988 the Government decided to make mandatory environmental impact assessment for all development projects.

The Environment Section within the Ministry is responsible for all environmental matters and is the focal point for both national and international matters on the environment. Nationally, it plays a coordinating role on environmental issues with other Governmental offices whose activities have a bearing on the environment. Ministry of Planning and Environment advises on environmental aspects of projects and activities planned and implemented in those offices. It is also the focal point for UNEP matters.

The Ministry of Planning and Environment is also responsible for the National Environment Action Plan and Work Programme, developed with assistance of UNDP and UNEP from 1989 and approved by the Government in 1990. The National Environment Plan seeks to establish a strategic framework for activities designed to address environmental problems, strengthen environmental management and planning capabilities and ensure that environmental concerns are taken fully into account in development planning. In 1990 an Environmental Research Unit was established in the Ministry of Planning and Environment. This Unit is responsible for the various projects and activities under the National Environment Action Plan.

The Minister for Planning and Environment is advised by the National Commission for the Protection of the Environment (NCPE) in order to carry out the responsibilities of the Ministry. The NCPE was appointed by the Office of the President on 19 June 1989. This Commission replaced a smaller body, the Environment Committee which was established in 1983. The mandate of the NCPE include: involvement in assessment, planning and implementation of projects in Maldives that affect the environment, planning and implementation of activities to protect the environment, planning and advising on ways and means to tackle environmental problems, examination of activities and projects of other Government offices to provide advice on environmental matters and to ensure that environmental protection component is included and implemented, planning of policies and steps necessary to protect the country from natural disasters, monitoring of natural disasters and planning of relief work. The Commission consists of 20 members from all Government Offices whose work affects the environment. Those offices include: Department of Meteorology,

Ministry of Tourism, Ministry of Fisheries and Agriculture, Ministry of Defence and National Security, Ministry of Planning and Environment, Ministry of Health and Welfare, Ministry of Transport and Shipping, Ministry of Trade and Industries, Ministry of Public Works and Labour, Ministry of Education, Ministry of Atolls Administration, Ministry of Home Affairs and Sports and Male Municipality, Maldives Airports Authority, Voice of Maldives, TV Maldives, Office of Physical Planning and Design) with the Minister of Planning and Environment as its President.

**Ministry of Trade and Industries:**

The Ministry of Trade and Industries is responsible for issuing licenses trade licenses to industries and companies. Hence, the only industries and companies that will be registered by the Ministry are those that must import goods and materials for their business. The Ministry is also responsible for screening importation of goods and products that are banned or restricted.

**Industry associations and training institutes:**

There are two main industry associations in Maldives, whose members are importers/users of ozone depleting substances and related equipment:

(a) **Maldives Association of Tourism Industry:**

Most resorts and hotels belong to this association. The Association promotes Maldivian hotels and resorts abroad, organize workshops for the members to discuss various aspects of tourism such as improvement of services.

(b) **Maldives Traders Association:**

Traders ranging from large businesses small-scale businesses are members of this Association. The Association analyses the domestic market demand for various products and decides on the import quotas for various commodities. Negotiations on trade issues with Government is also conducted through the Association. The Association protects the interests of business community and also negotiates the import duty within the range of duty given for various commodities under the Legislation on Import Duty. The Association publishes newsletters to disseminate trade information.

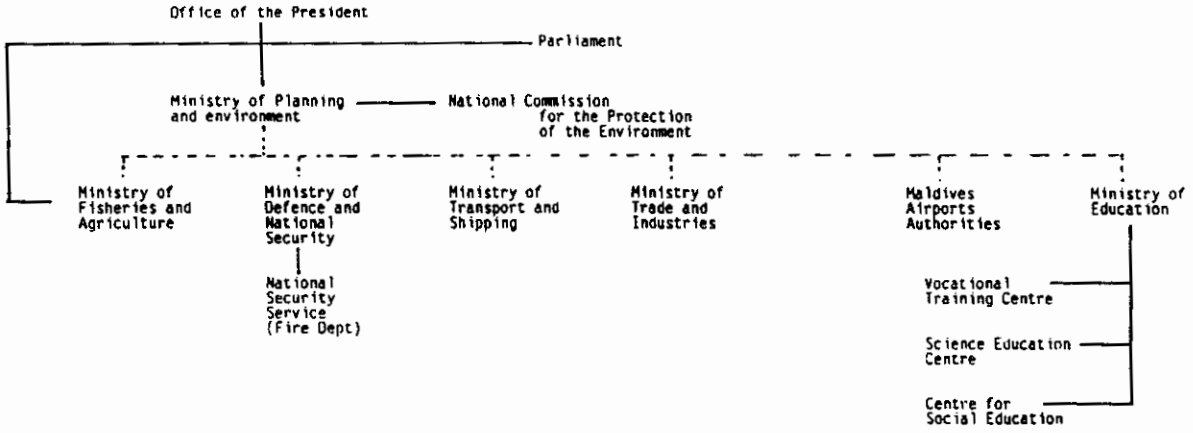
Institutions in Maldives that offer various opportunities for technical training is the Vocational Training Centre (VTC). VTC plays an imprtant role in training and educating the technicians that deal with ODSs.

(a) **Vocational Training Centre:**

Mainly trains young technicians in various fields. Courses on refrigeration and air-conditioning and servicing of electronic are among the courses organized. Refresher courses are also conducted.

Figure 2.5 below shows the existing institutional framework of Governmental bodies that are directly relevant to the consumption and use of controlled substances, showing the existing links of cooperation and authority.

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




## 2.6 Existing Policy and Operational Framework

There are no specific laws and regulations that have yet been enacted in Maldives for the reduction and phase-out of the consumption of controlled substances. However, the Government has formulated a new national environmental legislation which has been approved by the Parliament and in the process of being ratified by the President. This new legislation empowers the Ministry of Planning and Environment to adopt regulations on all environmental matters as well as to ratify international legal agreements. The Ministry is also entrusted to adopt national laws in order to comply with any international agreement to which Maldives is a Party. The laws and regulations adopted by the Ministry will be submitted directly to the President's Office for final approval.

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

### 2.6.1 Trade

Maldives is a fast developing island economy with limited natural and human resources and an acute shortage of raw materials. Most of the goods required in the country must be imported. Agriculture is limited because of lack of cultivable land and poor quality of the soil, hence most food stuff is also imported. The main export commodities are fish and fish products (accounted for 72% of all exports in 1990), marine products and garments.

State Trading Organization (STO) is one of the two public sector organizations responsible for carrying out trade activities. STO imports basic foods, medicines, consumer goods and fuel. It also acts as an agent for the import of all requirements of Government departments. STO also sells the imported goods to the public. The second parastatal is Maldives Transport and Contracting Company Ltd. (MTCC) dealing in trading of cement, steel, timber and other building materials as well as marine diesel engines for boats. Neither of these organizations holds a monopoly on import of any product. However, since all Government purchases are made through STO, STO holds a

monopoly in the public sector market. There are no price controls as such , but STO sells products at fixed prices.

There has been a strong expansion of imports due to the abolition of import quotas in 1989, and the promotion of private sector participation in trade. Between 1988 and 1989, the value of imports increased by 21%, whereas the value of exports increased by 11%.

Trade licenses are issued by the Ministry of Trade and Industries. All commodities imported must be under trade licenses. The imported commodities are checked by the Customs against the import license. Duties on imports are decided by the Parliament.

The Parliament is in the process of approving a reduction in duty for aerosols that are ozone friendly in order to create an incentive for importation of ozone friendly aerosols.

### 2.6.2 Industries

The Maldives' economy performed exceptionally well during the 1980s with an average annual growth rate in GDP of 10%. The two key sectors in the economy are tourism (18.3% in 1990) and fishery (15.2% in 1990). For both these sectors, refrigeration and air-conditioning are essential.

The industry sector consists of a government owned tuna fish canning factory with an annual production capacity of 13,000 tonnes, 6 garment factories producing entirely for export, a soft drink bottling plant and enterprises in Male producing PVC pipes, rubber products, toilet soap, cement blocks, furniture and a small range of food products. There are also well-equipped printing industries and a boat building industry producing around 50 fishing boats annually. A new fish refrigeration complex consisting of 1,500 Ton capacity cold storage, a blast freezer and an ice plan, is under construction. A variety of fish processing enterprises exist in the atolls. These enterprises are small scale and the processing involves salting and drying of fish.

The fish canning factory has a refrigerated storage capacity of 700 tonnes. The refrigeration system uses ammonia. The freezer vessels (10) and container ships (2) operate with ammonia or HCFC-22 refrigerants. The refrigeration system in the new fish refrigeration complex is also expected to operate with ammonia and HCFC-22.

The potential for further increasing fish and marine products for export is high. The National Development Plan includes programmes and projects for development of tuna fishery; coral reef management and reef fishery development; export product diversification and marketing; fishery infrastructure development; and research and manpower development.

Tourism sector is another area with high development potential. Maldives, has about 70 resorts and 3 hotels, mainly on 2 of the 19 Atolls. Plans are being made for opening other islands for development of tourist resorts.

The National Development Plan also includes programmes and projects for expanding and upgrading Male International Airport; developing and improving inter and intra Atoll transport systems and services as well as telecommunications; and developing new and upgrading existing generation and distribution of electrical power supply. Electrification of 16 islands in 5 atolls is also under plan.

Currently the records and data kept by the Government on industries and their works are not comprehensive in terms of their functions. Industries are required to apply for licenses to operate only if their business involves direct import of materials and products.

The factories are inspected by the Ministry of Trade and Industries.

## 3. IMPLEMENTING PHASE OUT

### 3.1 Strategy Statement by Government

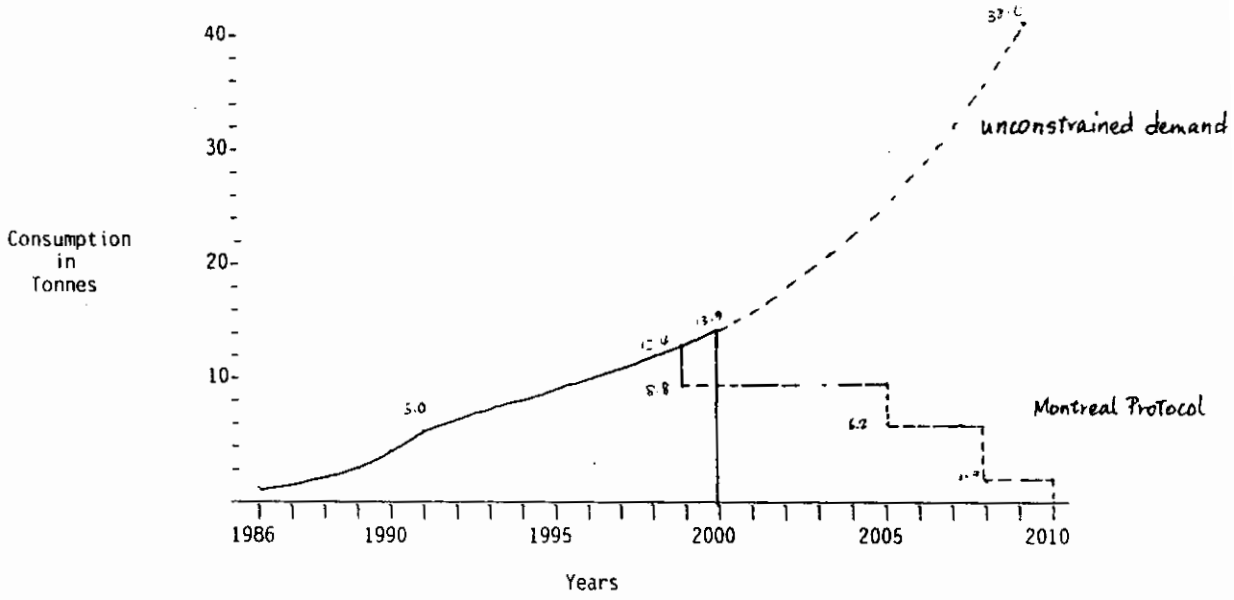
Maldives is a Party operating under paragraph 1 of Article 5, hence, is required to phase out the consumption of CFCs, halons and carbon tetrachloride controlled under the Montreal Protocol by the year 2010 and methyl chloroform by the year 2015, 10 years later than the phase-out years for non-Article 5 countries. The Parties at their Fourth Meeting in Copenhagen (November 1992) agreed on adjustments requiring phase out of CFCs, carbon tetrachloride and methyl chloroform by 1996 and halons by 1994; and Amendment that includes requirement to phase out HCFCs by 2030. The adjustments and Amendments are yet to enter into force and how the provisions will be applied to the Article 5 countries will depend on a review in 1995.

Government of Maldives is committed to comply with the Montreal Protocol and is prepared to go faster than the Protocol requires for phasing out the consumption of controlled substances for Article 5 countries. The Action Plan outlined in section 3.2 should enable Maldives to phase out the consumption of controlled substances as follows:

| | | |
|---|---|---|
| Annex A: | Group I - CFCs | 2000 |
| | Group II - Halons | 1996 |
| Annex B: | Group II - Carbon tet. | 2000 |
| | Group III - Methyl chl. | 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 under the Montreal Protocol.

Although the consumption of the controlled substances in Maldives is small the use of the substances is crucial to the society and the economy of the country. Although the consumption is small at present, substantial growth in demand for the substances and products containing controlled substances can be anticipated, particularly in light of the potential for further development in fisheries and tourism which are the major sectors of national economy.

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 for the controlled substances and avoid greater investments to be made at a later stage to tackle the problem. The unavailability of controlled substances is expected to be a major problem in the near future. It is, therefore, essential that change to ozone friendly substances and technology occurs in Maldives as fast as possible to prevent disruptions to the economy and the lives of the people.

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 Maldives has become a Party (Climate and Biological Diversity Conventions). Institutional strengthening, public awareness and training aspects of the Action Plan are vital in smoothly phasing out the ODSs. The experience gained through these activities would also be useful in the field of other global environmental problems.

Under the Action Plan some 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 would be essential.

## 3.2 Action Plan

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

(i) Government Actions comprising five programmes;
(ii) Industry Actions comprising six 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 provided by the Multilateral Fund; ensure the convening of appropriate training programmes; and 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, providing information to the various community sectors within the country as well as to exchange information between Maldives and International Communities.

The Action Plan covers the period from 1993 to 1995. The Country Programme should be updated during 1995 so that the updated Action Plan could be implemented from 1996. The strategy of the Government for this phase of the Country Programme will emphasize the following elements:

- a strong public awareness raising campaign to promote ozone friendly equipment and technology, inducing action in ODS using industries and change in the attitudes of the consumers;
- provision of information on ozone friendly equipment and technology with assistance of the Implementing Agencies to acquire the necessary information from appropriate sources;

- training in the refrigeration and air-conditioning sector and the customs.

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. Five of them are in the refrigeration sector, the main use sector in Maldives. Some domestic refrigerators containing HFC-134a is soon expected to be marketed in Europe. It is expected that refrigeration systems containing HFC-134a and the refrigerant HFC-134a itself will be widely available in international markets by around the year 1995. Projects that would deal with domestic refrigerators for the general public have not been included in this country programme which covers the period 1993-1995. However, pilot projects for conversion of refrigeration systems in resorts are included for 1995 under the assumption that it would be possible to acquire HCF-134a technology by that time.

Whether or not the incremental cost for purchasing of more expensive ozone friendly equipment would be covered by the Multilateral Fund is uncertain at this stage. It is a policy decision to be taken by the Executive Committee, and the Committee is expected to discuss this issue in detail.

The incremental cost for purchasing and using HFC-134a (for servicing) 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. It is possible that the cost of HFC-134a would gradually decrease. It is assumed that equipment using HFC-134a would only start being imported and purchased in Maldives from 1995 and retrofit of commercial refrigeration systems is also expected to start in Maldives in 1995. Under this assumption, servicing and refilling of refrigeration systems with HFC-134a would be negligible during the implementation of this Country Programme. However, in the future update of the Country Programme, projects that would cover the appropriate incremental cost of HFC-134a may be included.

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 below 3.3.4, Future Developments in the Action Plan.)

### 3.2.2 Government Actions

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

PROGRAMME 1: Policies and Regulations 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 the compliance with the Montreal Protocol and the implementation of the country programme.

The preparation of the Policy Strategy should begin in early 1994 for adoption and release by around August 1994.

The Policy Strategy will include:

- The target year for phasing-out the consumption of controlled substances in Maldives;
- Description of incentives to be given to the industries that import/use controlled substances and their products;
- The intention of the Government to introduce regulations to control the importation of the controlled substances and their products as well as descriptions of those regulations;
- 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: **Regulations**

The Ministry of Planning and Environment will adopt a number of regulations under appropriate existing legislation. The regulations will include the following:

- A ban on importation of halon fire extinguishers from 1 January 1995, except for essential uses which will include uses in aircrafts, airports, and defense facilities. STO which is responsible for importing all goods for Government departments will import only for essential uses that will be specified under the regulation.

- 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 and their mixtures (bulk chemicals) from 1 January 2000.

- Duty exemption from 1994 for the recycling and recovery units for refrigerants as well as Government subsidy of 30% for every equipment. The equipment must be able to recycle CFC, HCFC as well as HFC refrigerants. (See below: Element 2, Programme for Financial Assistance and Incentives.)

- Requirements for every industry or company that deal with controlled substances to annually report (starting in 1994) data on the imports/consumption of the controlled substances.

The preparation of the regulations should begin in late 1993. All the regulations will be enforced by around June 1994.

As mentioned in section 2.6 above, the Ministry of Planning and Environment will, in accordance with the mandate under the Environmental Legislation, ensure that environmental aspects are incorporated into new projects. The Ministry will encourage ozone friendly technology to be employed in various new projects (such as the establishment of a new fish refrigeration complex).

PROGRAMME 2: Programme for Financial Assistance and Incentives

Element 1: **Establishment of Ozone Layer Fund**

An Ozone Layer Fund (OLF) will be established under the [Ministry of Planning and Environment][Maldives Monetary Authority] for the purpose of implementation of the country programme. OFF will receive funds from the Multilateral Fund for the various programmes and projects under the country programme. The OLF will be administered by the [Ministry of Planning and Environment][Maldives Monetary Authority] for the implementation of the country programme. Disbursement of the funds for the various activities under the country programme will be authorized by the Ministry of Planning and Environment.

ODS Desk to be established under the Environment Section of the Ministry of Planning and Environment will draw up the annual budgets and account for the expenditures.

The OLF should be established soon after this Country Programme is approved by the Executive Committee in 1993.

Element 2: **Ozone Friendly Logos**

Two logos will be designed by the Ministry of Planning and Environment:

1. Logo for ozone friendly products: to indicate that a product is ozone friendly. The importers of foam products, aerosols and refrigeration/air-conditioning equipment can imprint the logo on the products if the products are not containing or are made using controlled substances or HCFCs.

   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.

2. Logo for CFC-free environment: to indicate places such as hotels, stores and retail shops are using/dealing with equipment that do not contain CFCs (and halons). The logo may be used in advertisements and promotion of the relevant places if no CFCs (and halons) are used in the refrigeration and aerosol products they are dealing with.

   HCFCs contained in room air-conditioners will be allowed until there is alternatives available. Hence for the time being the logo will be used to indicate CFC-free environment.

The Ministry of Trade and Industry will check on the relevant manufacturers and retail shops to ensure correct utilization of the logos.

The logos will be designed during the latter half of 1993 and should be launched in January 1994. The Minister for Planning and Environment will hold a press conference on the launch of the logos (see Programme 3, Institutional Strengthening Programme; Element 2, Information Exchange and Public Awareness Raising).

Element 3: **Duty exemption/reductions**

- No import duty will be placed on equipment for recovery and recycling of refrigerants. This duty exemption will start in 1994 for a trial period of two years. The subsidy is requested to be covered by the Multilateral Fund (see section 3.2.3, Industry Actions; Project R3).

- The Government contemplates to reduce import duty on refrigeration equipment (domestic and commercial) that do not contain controlled substances or HCFCs. Such a duty reduction is planned to be implemented from January 1995, for a trial period of one or two years. 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. However, there are the following uncertainties:

  * The Executive Committee is yet to take a policy decision on whether or not the Multilateral Fund could cover the incremental cost for purchasing new ozone friendly equipment that are more expensive than the CFC equipment;
  * The prices of ozone friendly equipment at that time.

  The import duty reduction scheme would depend upon whether or not the incremental cost for the equipment would be covered by the Multilateral Fund. The Ministry of Planning and Environment will await the decision of the Executive Committee, and decide upon appropriate scheme for the duty reduction, and submit it as a proposal to the Executive Committee. It is hoped that a scheme could be decided in 1994 so that new import duty could be placed from 1995.

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 also include public awareness raising, information exchange and some training activities.

Element 1: **Ministry of Planning and Environment**

- Establishment of an ODS Desk under the Environment Section. The ODS Desk will ensure and monitor the implementation of the country programme through coordination with other bodies, Governmental and others, that will be involved in the implementation of the various programmes, projects and elements under the country programme. Where necessary, the Environment Section and the Environment Research Unit will assist.

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

  (a) working in close cooperation with the Environment Section in drawing up the Government Policy on the Protection of the Ozone Layer, and in formulating the regulations (Programme 1, Policy and Regulations Programme);
  (b) designing the ozone friendly logo (Programme 2, Financial Assistance and Incentives);
  (c) monitoring and recording (as database) the consumption and use of the controlled substances, evaluate the implementation of the country programme, and report data and information as necessary to the Ozone Secretariat (Programme 4, ODS Monitoring Programme);
  (d) organizing and coordinating the various information exchange, public awareness and training activities;
  (e) function as information desk to help industries, companies and the public on ODS issues.

- One ODS officer will be recruited for the ODS Desk. He/She will work under the supervision of the Director of Environmental Affairs. The officer should have a university degree. Until a person with appropriate expertise is found/trained, someone will be recruited for the post on a temporary basis. The ODS Desk should be filled by October 1993.

- Until the ODS officer is recruited, the preparatory work that are required for the implementation of the Action Plan will be undertaken

by the Ministry of Planning and Environment. Purchase and installation of necessary equipment should start as soon as the funding for the activities under the Country Programme is approved by the Executive Committee.

- The administrative support for the ODS Desk will be provided by the Ministry of Planning and Environment.

- The necessary equipment for the ODS Desk in order for it to efficiently and effectively carry out its task are as follows:

  (a) A personal computer (with computer zone 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), 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; and
  (c) A heavy duty photocopier.
  (d) two telephone lines

  A budget of US $ 9,000 has been allocated for equipment. Necessary equipment will be acquired within the budget.

Element 2: **Public awareness raising, information exchange and training activities**

Public awareness raising

- TV, radio and newspaper announcements/advertisements on:
  * problems of ozone layer depletion
  * international efforts to protect the ozone layer and the Maldives Country Programme;
  * policies and regulations for the protection of the ozone layer;
  * ozone friendly equipment, substitutes and technology;
  * Ozone Friendly Logos;
  * establishment of ODS Desk which will be ready to answer questions from industries and the public on ozone friendly substitutes, alternatives and equipment.

- Two press conferences by the Minister of Planning and Environment to announce:
  * the adoption of the Maldives Country Programme; and
  * the launch of the Ozone Friendly Logo.

- TV and radio programmes on ozone layer depletion, ozone depleting substances and their substitutes and alternatives, international efforts being made to protect the ozone layer and the Maldives Country Programme to be implemented. Copies of various video films on the ozone layer issue will be requested from UNEP for broad casting in Maldives and local production of programmes will be arranged. The existing weekly TV and radio on the environment will also be utilized to focus on the issues on ozone layer and ODS.

- Special addresses on the ozone layer depletion for schools in conjunction with special school events.

- Annual public lectures.

- 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 Maldives Country Programme. Assistance of experts may be sought for preparing the articles.

Information exchange

- ODS Desk will establish a link to the UNEP IE/PAC's OzonAction Database which contains up-to-date information on substitutes, new technologies, new products, contacts to producer industries, and other activities in the field of protection of the ozone layer. The ODS Desk will gather information through the Database as well as other sources such as through direct contacts with manufacturing industries abroad.

- The ODS Desk will function as information service desk for the industries and the public. The TV, radio and newspaper announcements will include an introduction of the ODS Desk and its information service role. Special effort will be made to strengthen informmation flow to the chemical distributors, solvent users, retail shops that import refrigeration equipment and users of industrial and commercial refrigeration systems.

- Disseminate information to the industries and public through issuing of a pamphlet on the substitutes and new products. The newsletters and pamphlets:

  **Newsletter:** The ODS Desk 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. The newsletter will be produced biennially.

  **Pamphlets:** A number of pamphlets will be produced and distributed for different target groups:

  * For the consumers (general public and other end-users of refrigeration equipment) to encourage purchase of ozone friendly aerosols and equipment. Information on the availability of ozone friendly refrigeration equipment will be included. Such pamphlets may be distributed through retail shops that sell refrigeration equipment, service workshops, Maldives Association for Tourism Industry, Maldives Trade Association, and the Atoll Administration and their Atoll Offices.

  * For distributors of controlled substances and refrigeration technicians to inform them of substitutes, HFC-134a equipment, recovery and recycling machines, etc.

Training

- Existing courses for technical training on refrigeration and air-conditioning will be upgraded. The Vocational Training Centre and the Ministry of Planning and Environment will examine the existing courses and incorporate necessary changes to ensure: (i) better practices for servicing refrigerators in order to minimize the emission of the refrigerant gases into the atmosphere; (ii) training on the use of recovery recycling units; (iii) training on the substitutes and new equipment; (iv) safety with ammonia systems; (v) retrofit with HFC-134a for commercial refrigeration systems. Establishment of new courses will also be considered.

  It may be necessary to request for assistance of external refrigeration experts. Should the need arise, the Implementing Agencies will be contacted. (A budget for this has not been included.)

  The courses will be examined during 1994 and new upgraded courses will be started from 1995.

  Assistance is also requested from the Implementing Agencies (UNDP and UNEP) in training the local trainers through organization of national/regional technical seminars and training courses for the trainers.

- Training of customs officers will be organized.

  The Customs operate effectively in terms of checking and recording imports. Illegal import is not a problem in Maldives. The coding system will be amended to include a separate classification code for each controlled substance listed in Annex A of the Montreal Protocol and for other ODSs that are used in Maldives (see Programme 4, ODS Monitoring Programme; Element 3 Customs data).

  An officer from the Ministry of Planning and Environment will conduct a seminar at the Customs Office. Appropriate Customs Officers will be trained to identify the controlled substances and their mixtures, their trade names and how to categorize them under the coding system for each controlled substance.

  Appropriate documents will be prepared which will form the basis for the training. The documents should also serve as a manual to be used by the Customs Officers. The trained officers will train other officers as necessary using the manual.

  The training will be conducted once in late 1993. The new coding system will be implemented from 1994.

- Recently, environmental science has become a part of school curriculum. Currently, the school syllabus is being revised and the new syllabus will start in 1994. Ministry of Planning and Environment will ensure that ozone layer issue in incorporated into the environment course.

Budget (in US $):

| | 1993 | 1994 | 1995 | Total |
|---|---|---|---|---|
| **Personnel cost** 1 officer | 2,000 | 2,000 | 2,000 | 6,000 |
| **Equipment** | 9,000 | - | - | 9,000 |
| **Local travels** (2 officers:@20 days) | 4,000 | 4,000 | 4,000 | 12,000 |
| **Public awareness, information exchange, etc.** | 5,000 | 5,000 | 5,000 | 15,000 |
| **Miscellaneous** (stationary, commun., equipmt. maintenance, etc.) | 3,000 | 3,000 | 3,000 | 9,000 |
| Sub-total | 23,000 | 14,000 | 14,000 | 51,000 |
| contingency (10%) | 2,300 | 1,400 | 1,400 | 5,100 |
| **GRAND TOTAL** | **25,300** | **15,400** | **15,400** | **56,100** |

PROGRAMME 4: ODS Phase-out Monitoring Programme

The monitoring programme will also comprise the following elements:

Element 1: **ODS Desk**

Monitoring of the consumption of the controlled substances and the implementation of the Country Programme will be undertaken by the ODS Desk. The ODS Desk will also be responsible for: (i) designing the reporting format to be used by the industries/companies; (ii) ensuring

that relevant industries/companies comply with the reporting regulation to be enforced from around June 1994.

The ODS Desk will monitor the consumption of the controlled substances in order to evaluate the effectiveness of the Action Plan and to report statistical data to the Ozone Secretariat for fulfilling the reporting requirement under Article 7 of the Montreal Protocol.

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

Element 2: **Monitoring of industries and companies dealing with controlled substances and products containing controlled substances**

The Statistics Section under the Ministry of Planning and Environment, in cooperation with the Ministry of Trade and Industries will conduct a survey of the industries/companies and record their works. This survey will be conducted in 1993 or 1994 along with the annual data collection for the Statistics year book. Industries that import/use controlled substances and their products will be identified and monitored by the ODS Desk.

When industries/companies apply for import license for any chemicals, refrigeration and air-conditioning equipment, and aerosols, the Ministry of Trade and Industries will provide the information with copy of the license to the ODS Desk. The ODS Desk will determine which of the chemicals imported are ODSs.

Male Municipality and Atolls Administrations are responsible for giving permissions for use of land or premises for business. When such permissions are granted, the Male Municipality and the Atolls Administration will provide the information on the new industries or businesses to the Ministry of Planning and Environment (ODS Desk). The ODS Desk will determine whether or not the industries or businesses would be dealing with controlled substances and take appropriate action for monitoring.

Element 3: **Customs data**

The Customs will operating with the Harmonized Systems of the Customs Cooperation Council from July 1993. The Ministry of Planning and Environment will check the coding system to see whether a separate classification (sub-headings) for each controlled substance in Annex A is incorporated. If not, the coding system will be adjusted to include the those classification codes (sub-headings) for each controlled substance as recommended by the Customs Cooperation Council. This will enable monitoring of importation of individual controlled substance listed in Annex A of the Montreal Protocol.

The Ministry of Planning and Environment will also examine the possibilities of incorporating further classification codes for other ODSs such as methyl chloroform, carbon tetrachloride and HCFC-22.

The Customs Department will report the relevant importation data together with information on the importers to the ODS Sub-Unit on quarterly basis.

The coding system will be adjusted for implementation from 1 January 1994. Appropriate training of the Customs Officers will take place during late 1993.

3.2.3 Industry Actions

The Industry Actions will consist of five industrial projects, four of them under refrigeration and air-conditioning sector which is the largest use sector in the Maldives.

SECTOR: Refrigeration and Air-conditioning

Project R1: **Pilot investment project: equipping a resort with new refrigeration and air-conditioning systems that do not contain controlled substances**

To select a resort that is being established or being redeveloped (with changes in the refrigeration equipment) and to equip them with new refrigeration systems that do not contain CFCs or HCFCs.

If the pilot project is successful, other similar investment projects will be drawn up for other resorts and hotels. Other resorts and hotels may be able to undertake similar projects on their own, on the basis of experience gained through this pilot project.

Phase I: **Preparations**

ODS Desk, Ministry of Tourism and Maldives Association for Tourism Industry (MATI) will select an appropriate resort. The necessary research on the refrigeration systems required by the resort will also be carried out.

Phase II: **Pre-investment study**

A pre-investment study is requested to be carried out by an Implementing Agency under the Multilateral Fund in 1995. (A budget for the study is not included in this Country Programme. The cost of the study is also requested to be covered by the Implementing Agency.) The purposes of the pre-investment study will include the following:

* Identification of appropriate refrigeration equipment and suppliers of the equipment;
* Identification of necessary training for the new equipment;
* Determination of the cost of the project and the incremental costs that would be eligible for funding from the Multilateral Fund;
* Drawing up a project proposal for consideration by the Executive Committee;

Phase III: **Project implementation**

The project will be included in the Country Programme update for implementation in 1996.

Project R2: **Pilot investment project: retrofitting the refrigeration systems of an existing resort to use substitute refrigerant (ammonia/HFCs)**

An existing resort will be selected for retrofitting the refrigeration systems with large compressors to use HFCs-134a/ammonia. Domestic refrigerators will be replaced with new ones operating on HFC-134a.

If the pilot project is successful, other similar investment projects will be drawn up for other resorts and hotels. Other resorts and hotels may be able to undertake similar projects with local expertise and on the basis of experience gained through this pilot project.

Phase I: Preparations

ODS Desk, Ministry of Tourism and Maldives Association for Tourism Industry (MATI) will select an appropriate resort that requires replacement of domestic refrigerators and has large refrigeration systems that could be retrofitted.

Phase II: Pre-investment study

A pre-investment study is requested to be carried out by an Implementing Agency under the Multilateral Fund in 1995. (A budget for the study is not included in this Country Programme. The cost of the study is also requested to be covered by the Implementing Agency.) The purposes of the pre-investment study will include the following:

* Identification of appropriate suppliers of domestic refrigerators;
* Identification of a refrigeration company abroad that will be requested to carry out the retrofitting. The retrofitting should be carried out as a demonstration for local servicing workshops.
* Identification of necessary training for the new equipment;
* Determination of the cost of the project and the incremental costs that would be eligible for funding from the Multilateral Fund;
* Drawing up a project proposal for consideration by the Executive Committee;

Phase III: Project implementation

The project will be included in the Country Programme update for implementation in 1996.

Project R3: **Recovery and 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 the local companies for purchasing such equipment. 30% 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 1994.

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 to the Ministry of Planning and Environment, 30% of the price paid will be refunded to the workshop.

Any eligible company which purchases the equipment before 1994 can claim the refund in 1994.

Budget: US $ 9,600

Assumptions for the estimation:

- Total estimated cost: US$ 24,000
  For the trial period of two years, 40% of the total estimated cost is requested from the Multilateral Fund.
- The number of workshops (including motor garages servicing automobile air-conditioners) that will purchase a recycling and recovery unit is assumed to be 20
- The price of one unit equipment is assumed to be US$ 4,000.

TRAINING ELEMENT

A short training course will be organized in 1994 for the technicians that deal with various refrigeration and air conditioning systems (including automobile air-conditioners). The courses will include:

(i) teaching of better practices for servicing refrigeration and air-conditioning systems in order to conserve refrigerants and 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).

Appropriate experts (3 experts: one on better practices and substitutes and new equipment; one on retrofitting; and one on recovery and recycling) in the field of refrigeration will be invited from abroad to teach the courses. The invited experts will spend about ten days in Maldives.

For the demonstration on recovery and recycling equipment, an effort will be made to identify a company manufacturing recovery and recycling machines that would be willing to cover the cost for its expert to undertake the demonstration. This company would benefit from promoting its equipment.

The Vocational Training Center will also be invited. The advise of the experts would be helpful in amending the existing refrigeration courses.

Budget:

| | 1994 |
|---|---|
| Fee for three experts: | 6,000 |
| Travel for three experts: | 15,000 |
| Daily Subsistence Allowance: | 4,500 |
| TOTAL | 25,500 |

Project R4: **Retrofitting industrial refrigeration systems to use ammonia**

The cost for retrofitting industrial refrigeration systems to use ammonia depends on the type, size and state of the equipment being retrofitted. The operational cost for operating industrial refrigeration systems using ammonia is generally cheaper compared with CFC equipment. Incremental cost is therefore dependent upon the balance between the cost of the retrofit and the operational costs (for which there is not a clear indication on the time period that the operational costs should be accounted for).

The industries will be required to retrofit their systems to use ammonia before the year 2000 when importation of controlled substances will be banned by regulation. The industries may choose to retrofit their refrigeration equipment with substitutes other then ammonia or HCFCs. The industries will be invited to submit proposals for the retrofit to ODS Desk and request for financial assistance in covering the incremental cost. The ODS Desk will consider the proposals and if appropriate, pass on the requests to the Implementing Agency/Fund Secretariat for consideration by the Executive Committee for funding.

The necessary information on this plan with invitation for submission of proposals will be given to the industries in 1994.

TRAINING ELEMENT

A one-week course will be conducted in 1995 for training industrial refrigeration technicians on retrofitting industrial refrigeration systems to use ammonia together with training on 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 |
|---|---|
| Fee for the expert: | 2,000 |
| Travel for the expert: | 5,000 |
| Daily Subsistence Allowance: | 1,100 |
| TOTAL | 4,600 |

Project R5: **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.

Phase I: Identification of the commercial refrigeration systems that could be retrofitted

Under the Monitoring Programme (Government Actions, Programme 4), it will be possible to identify the commercial refrigeration systems that are operating in Maldives.

Through public awareness and information exchange activities, the users of commercial refrigeration systems will be encouraged to consult a service workshop to see whether their systems could be retrofitted. (This should occur after the training course under Project R3 has taken place.) If determined feasible, the users will submit a request (together with information on the equipment) for retrofit to the ODS Desk. On the basis of requests received, a plan for project ijmplementation and budget will be drawn up withh any necessary assistance of an Implementing Agency.

Phase II: Project implementation

This project will be implemented (1996 or 1997) under the Country Programme update. The technology for retrofit are still immature. Both the retrofit technology and the costs involved are expected to be more certain in a few years time. The project implementation phase will be further developed during 1995 for inclusion in the Country Programme update.

The present idea of the project implementation is described below:

- 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 owner of a commercial refrigeration system, after having retrofitted their equipment, will submit appropriate receipts to the ODS Sub-Unit. The receipts may be either: (i) importation licenses and invoices 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 having it serviced under normal circumstances) will be worked out and this incremental cost will be refunded to the owner of the equipment.

SECTOR: Solvents

Project S1 **Substitution of solvents that are controlled substances**

The public awareness and information exchange activities (Government Action, Programme 3) is expected to induce action by solvent using industry. The ODS Desk will provide information on substitutes to the solvent users upon request.

Any subsitution that might involve incremental costs will be handled on case by case basis.

### 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 1996.

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 Sub-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 1996.

In 1995, before deciding on the projects, feasibility studies will be requested to be carried out by an Implementing Agency (UNDP, UNIDO, 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 Maldives by 1997, the domestic refrigerators and freezers that need compressor replacement from 1997 onwards will have to be scrapped.

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 specified servicing workshops which will certify that the compressors need to be replaced. Upon deposit of the old equipment, the depositor will be given a 'deposit fee'. This fee should equal the replacement cost explained in paragraph above.

Disposal of the scrapped equipment would be a problem in Maldives. Some means of disposal of the scrapped refrigerators would have to be devised and such disposal mechanism may 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 Maldives by 1997, the domestic refrigerators and the freezers will be retrofitted. The Country Programme update to be implemented from 1996 will 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

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 inducing and enabling effective and successful phase-out. The activities will help to prevent the future growth in the consumption of controlled substances.

The expected total cumulative consumption of CFC-12 under three scenarios are compared below to show the amount of consumption of controlled substances that will be avoided by implementing the Country Programme (until complete phase-out):

| | Cumulative consumption (Tonnes) | |
|---|---|---|
| Country Programme: | 69 | (1992-1999, inclusive) |
| Montreal Protocol: | 128 | (1992-2009, inclusive) |
| Unconstrained demand: | 313 | (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.

Each project outlined under the Action Plan will be further developed at a later stage into project proposals for submission to the Fund Secretariat/Executive Committee. The Ministry of Planning and Environment (ODS Desk) will prepare the project proposals with necessary assistance of the Implementing Agencies. The budget estimates contained in the Country Programme will be further refined when project proposals are prepared.

The detailed plan for the implementation of each project and the modalities for preparing accounts of the expenditures will be worked out with appropriate Implementing Agency.

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

| Programmes/projects | 1993<br>J F M A M J J A S O N D | 1994<br>J F M A M J J A S O N D | 1995<br>J F M A M J J A S O N D |
|---|---|---|---|
| **GOVERNMENT ACTIONS** | | | |
| Programme 1 | | | |
| 1. policy | | <------P----> R | |
| 2. legislation | <--P------ | ----------> R <------Imple | mentation---------- |
| Programme 2 | | | |
| 1. Ozone Layer Fund | E | | |
| 2. Ozone Friendly Logos | <-----P---> | L | |
| 3. Duty exemption (recyl) | | <--------Imple | mentation----------> |
| Programme 3 | | | |
| 1. ODS Desk | E | | |
| 2. Awareness, info. exchange, etc. | <------Imple | mentation---------- | ---------- |
| Programme 4 | | | |
| 1. ODS Desk | <--P----> | <------Implementation------ | ---------- |
| 2. Industry reports | <--P----> | <------Implementation------ | ---------- |
| 3. Customs data | <--P----> T | <------Implementation------ | ---------- |
| **INDUSTRY ACTIONS** | | | |
| 1. Project R1 | | | |
| Phase I | | <----------P----------> | |
| Phase II | | | <-Study-> |
| 2. Project R2 | | | |
| Phase I | | <----------P----------> | |
| Phase II | | | <-Study-> |
| 3. Project R3 | | <------Implementation------ | ---------- |
| Training element | | X | |
| 4. Project R4 | | <------Implementation------ | ---------- |
| Training element | | | X |
| 5. Project R5 | | | |
| Phase I | | <------Implementation------ | --------> |
| 6. Project S1 | | <------Implementation------ | ---------- |

KEY: P = preparation
L = launch (Press Conferences by the Minister when the Logos are launched)
X = event
R = release

Table 3.2 Summary of the programmes, projects and elements under the Action Plan

| Programmes/projects/ elements | Brief Description | Commencement/ Duration | Use sector | Budget |
|---|---|---|---|---|
| **GOVERNMENT ACTIONS** | | | | |
| Programme 1 | | | | |
| 1. policy | Adoption of an overall policy for the protection of the ozone layer. | January 1994 (begin preparation) August 1994 (adoption) | All | |
| 2. regulation | Adoption of various regulations to control and monitor the consumption of controlled substances. | October 1993 (begin preparation) June 1994 (enforcement) | All | |
| Programme 2 | | | | |
| 1. Ozone Layer Fund | Establishment of Ozone Layer Fund under the Min.of Plan. and Env. for the implementation of the Country Prog. | August 1993 | All | |
| 2. Ozone Friendly Logos | Designing of a logos for ozone friendly products and CFC-free environment. | January 1994 (launch) | Aerosols, refrig., foams | |
| Programme 3 (Inst. strengthening) | Establishment of an ODS Desk under the Min. of Planning and Environment to coordinate ODS activities. | October 1993 | All | 56,100 |
| | Organization of public awareness, info. exchange and training (e.g. customs officers training). | To be organized as appropriate | All | |
| Programme 4 | | | | |
| 1. ODS Desk | Monitoring responsibilities of the ODS Desk. | 1994 (preparations) 1995 (implementation) | All | |
| 2. Industry reports | Reporting by each industry on the import and use of controlled substances. | 1994 (preparations) 1995 (implementation) | All | |
| 3. Customs data | Adoption of separate subheadings for each controlled substances and reporting to the ODS Sub-Unit | 1993 (preparations) 1994 (incorporation) | All | |

Table 3.2 continued_/

| Programmes/projects/ elements | Brief Description | Commencement/ Duration | Use sector | Budget |
|---|---|---|---|---|
| **INDUSTRY ACTIONS** | | | | |
| 1. Project R1 | Pilot project to equip a resort with ozone friendly refr. equipment. | . | Refrig. | |
| Phase I | Identification of suitable resort. | 1994 | | |
| Phase II | Pre-investment study by an Implementing Ag. | early 1995 | | |
| Phase III | Project implementation in the Country Programme update. | (1996/7/8) | | |
| 2. Project R2 | Pilot project to retrofit refr. systems at a resort. | . | Refrig. | |
| Phase I | Identification of suitable resort. | 1994 | | |
| Phase II | Pre-inveswtment study by an Impelmenting Ag. | early 1995 | | |
| Phase III | Project implementation in the Country Programme update. | (1996/7/8) | | |
| 3. Project R3 | Recycling of refrigerants. | January 1994 | Refrig. | 9,600 |
| Training element | Short course on better service practices, use of recycl.units, retrofit technology (HFC-134a), etc. | early 1994 | | 25,500 |
| 4. Project R4 | Retrofitting existing industrial refrigeration systems to ammonia. | 1993 onwards | Refrig. | |
| Training element | Short course on retrofit and safety. | early 1995 | | 4,600 |
| 5. Project R5 | Retrofitting existing commercial refrig. equipment to use HFC-134a. | . | Refrig. | |
| Phase I | Identification of suitable equipment for retrofit. | 1993 onwards | | |
| Phase II | Project Implementation in the Country Programme update. | (1996/7/8) | | |
| 6. Project S1 | Assistance to solvent users on substitutes | 1993 onwards | Solvents | |

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

| Programmes and projects | 1993 | 1994 | 1995 | TOTAL |
|---|---|---|---|---|
| **GOVERNMENT ACTIONS** | | | | |
| Programme 3<br>Institutional strengthening | 25,300 | 15,400 | 15,400 | 56,100 |
| SUB-TOTAL | 25,300 | 15,400 | 15,400 | 56,100 |
| **INDUSTRY ACTIONS** | | | | |
| 1. Project R1 | - | - | - | - |
| Phase II | - | - | (Impl.Ag.) | - |
| 2. Project R2 | - | - | - | - |
| Phase II | - | - | (Impl.Ag.) | - |
| 3. Project R3 | - | 9,600 | - | 9,600 |
| Training element | - | 25,500 | - | 25,500 |
| 5. Project R4 | - | ? | ? | ? |
| Training element | - | - | 4,600 | 4,600 |
| SUB-TOTAL | - | 35,100 | 4,600 | 39,700 |
| GRAND TOTAL | 25,300 | 50,500 | 20,000 | 95,800 |

## ANNEX I

**PRIVATE SECTOR**

Villa Trade and Shipping Company Pvt. Ltd.
Mr. Abdull Gafoor Moosa,
Shipping Manager.

Super Petrol/ Villa Trade Centre
Mr. Abdull Gafoor.

Wheel Engineering Services,
Mr.Aboobakuru.

Dimms,
Mr.Ibrahim Azeez

Male Aerated Waters Company Pvt. Ltd.
Mr. Priyantha.

Maldives Association of Tourism Industries,
Mr. Noraddeen.

Orchid Agency
H. Jazeera.

Universal Enterprises Ptv. Ltd.
38, Orchid Magu.

Safari Tours,
S.E.K. No.1, Chandhanee Magu.

Bright Brothers,
Ma. Ever Bright.

H. Eroma.

H. Kelaamaage Garage.

H. National Electronics.

H. Rasa Electronics

H. Shareef Garage.

M. Noovilu Garage.

M. Vizco Garage.

G. Moonlight View Garage.

H. H.A.D Garage.

Modren Techniques Pvt. Ltd.

M. Static Electronics.

Ma. Night Rose Garage.

Ma. Shiyam's Motor Garage.

G. I.H.F Electronics.

H. Maizan Electronics.

Ma. Circuit.

Kurunba Village Tourist Resort (dry cleaning)

H. Loveside (dry cleannig)

M. Hakatha No.1
Orchid Magu

H. Hakatha No.2
Sosun Magu

## PUBLIC SECTOR

NSS Fire Section,
Min. of Defence and National Security Services.

State Trading Organisation,
Mr. Mohamed Hakeem.
Asst. Manager.

Airports Authority,
Ibrahim Solih,
Trainning Officer.

Dhiraagu Pvt. Ltd.
Medhuziyarai Magu
Ismail Waheed,
Engineering Manager.

FPID,
4th Flr. Huravee Bld.
Ibrahim Shakeeb,
Director.

Min. of Trade and Industries,
1st Flr. Ghazee Bld,
Sikka Mohamed Ismail Manik,
Director of Small Industries.

Min. of Transport and Shipping,
1st Flr. Huravee Bld.
Mohamed Thoufeeq.

Customs,
Mr. Mohamed Shareef.

Min of Tourism,
2nd Flr. Ghazee Bld.
Mr. Shameem.

Dep. of Post and Telecomunication.

Air Maldives,
Marine Drive.

ANNEX II

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

| Tonnes Substances | Prod. | Imports | Exports | Consump. | ODP | Calcul. Consump. |
|---|---|---|---|---|---|---|
| **ANNEX A** | | | | | | |
| Group I | | | | | | |
| CFC 11 | 0 | - | 0 | - | 1.0 | - |
| CFC 12 | 0 | 0.1 | 0 | 0.1 | 1.0 | 0.1 |
| CFC 113 | 0 | 0 | 0 | 0 | 0.8 | 0 |
| CFC 114 | 0 | 0 | 0 | 0 | 1.0 | 0 |
| CFC 115 | 0 | - | 0 | - | 0.6 | - |
| Sub-total | 0 | 0.1 | 0 | 0.1 | | 0.1 |
| Group II | | | | | | |
| 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** | **0.1** | **0** | **0.1** | | - |
| **ANNEX B** | | | | | | |
| Group I | | | | | | |
| 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 |
| Group II | | | | | | |
| Carbon tet | 0 | - | 0 | - | 1.1 | - |
| Group III | | | | | | |
| Methyl chl | 0 | - | 0 | - | 1.0 | - |
| **TOTAL** | **0** | - | **0** | - | | - |

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

| Tonnes Substances | Prod. | Imports | Exports | Consump. | ODP | Calcul. Consump. |
|---|---|---|---|---|---|---|
| **ANNEX A** | | | | | | |
| Group I | | | | | | |
| CFC 11 | 0 | - | 0 | - | 1.0 | - |
| CFC 12 | 0 | 2.2 | 0 | 2.2 | 1.0 | 2.2 |
| CFC 113 | 0 | 0 | 0 | 0 | 0.8 | 0 |
| CFC 114 | 0 | 0 | 0 | 0 | 1.0 | 0 |
| CFC 115 | 0 | - | 0 | - | 0.6 | - |
| Sub-total | 0 | 2.2 | 0 | 2.2 | | - |
| Group II | | | | | | |
| 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** | **0** | **0** | **0** | | **0** |
| **ANNEX B** | | | | | | |
| Group I | | | | | | |
| 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 |
| Group II | | | | | | |
| Carbon tet | 0 | - | 0 | - | 1.1 | - |
| Group III | | | | | | |
| Methyl chl | 0 | - | 0 | - | 1.0 | - |
| **TOTAL** | **0** | - | **0** | - | | - |

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

| Tonnes Substances | Prod. | Imports | Exports | Consump. | ODP | Calcul. Consump. |
|---|---|---|---|---|---|---|
| **ANNEX A** | | | | | | |
| Group I | | | | | | |
| CFC 11 | 0 | - | 0 | - | 1.0 | - |
| CFC 12 | 0 | 3.5 | 0 | 3.5 | 1.0 | 3.5 |
| CFC 113 | 0 | 0 | 0 | 0 | 0.8 | 0 |
| CFC 114 | 0 | 0 | 0 | 0 | 1.0 | 0 |
| CFC 115 | 0 | - | 0 | - | 0.6 | - |
| Sub-total | 0 | 3.5 | 0 | 3.5 | | 3.5 |
| Group II | | | | | | |
| Halon 1211 | 0 | 0 | 0 | 0 | 3.0 | 0 |
| Halon 1301 | 0 | 0.1 | 0 | 0.1 | 10.0 | 1 |
| Halon 2402 | 0 | 0 | 0 | 0 | 6.0 | 0 |
| Sub-total | 0 | 0.1 | 0 | 3.6 | | 1 |
| **TOTAL** | **0** | **3.6** | **0** | **3.6** | | **4.5** |
| **ANNEX B** | | | | | | |
| Group I | | | | | | |
| 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 |
| Group II | | | | | | |
| Carbon tet | 0 | - | 0 | - | 1.1 | - |
| Group III | | | | | | |
| Methyl chl | 0 | - | 0 | - | 1.0 | - |
| **TOTAL** | **0** | **-** | **0** | **-** | | **-** |

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

| Tonnes Substances | Prod. | Imports | Exports | Consump. | ODP | Calcul. Consump. |
|---|---|---|---|---|---|---|
| **ANNEX A** | | | | | | |
| Group I | | | | | | |
| CFC 11 | 0 | - | 0 | - | 1.0 | - |
| CFC 12 | 0 | 5.0 | 0 | 5.0 | 1.0 | 5.0 |
| CFC 113 | 0 | 0 | 0 | 0 | 0.8 | 0 |
| CFC 114 | 0 | 0 | 0 | 0 | 1.0 | 0 |
| CFC 115 | 0 | - | 0 | - | 0.6 | - |
| Sub-total | 0 | 5.0 | 0 | 5.0 | | 5.0 |
| Group II | | | | | | |
| 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** | **5.0** | **0** | **5.0** | | **5.0** |
| **ANNEX B** | | | | | | |
| Group I | | | | | | |
| 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 |
| Group II | | | | | | |
| Carbon tet | 0 | - | 0 | - | 1.1 | - |
| Group III | | | | | | |
| Methyl chl | 0 | - | 0 | - | 1.0 | - |
| **TOTAL** | **0** | - | **0** | - | | - |