



**United Nations
Environment
Programme**

Distr.
LIMITED

UNEP/OzL.Pro/ExCom/41/7
21 November 2003



ORIGINAL: ENGLISH

EXECUTIVE COMMITTEE OF
THE MULTILATERAL FUND FOR THE
IMPLEMENTATION OF THE MONTREAL PROTOCOL

Forty first Meeting
Montreal, 17 -19 December 2003

FINAL REPORT ON THE EVALUATION OF THE IMPLEMENTATION OF RMPs

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I Background

1. The Thirty-first Meeting of the Executive Committee decided:
 - (a) “to request national ozone{ XE "ozone" } officers, with the assistance of the implementing agency concerned, to review and assess the content, implementation to date and expected outcomes of their RMPs against their objective to phase out all consumption in the refrigeration{ XE "refrigeration" } servicing sector{ XE "sector" } according to the Montreal Protocol{ XE "Montreal Protocol" } timetable{ XE "timetable" }.
 - (d) “that it will review in 2005 whether further assistance is needed for the post-2007 period, and what assistance the Fund might consider at that time to enable full compliance{ XE "compliance" } with the Protocol’s phase-out{ XE "phase-out" } requirements.” (Decision 31/48).
2. In the Monitoring and Evaluation Work Programme 2003, an evaluation of RMPs has been foreseen in order to support the planned review by collecting empirical evidence and feedback by the countries concerned with regard to the implementation of their RMPs.
3. An extended desk study with country studies on Guatemala, Jamaica and St. Lucia (document UNEP/OzL.Pro/ExCom/39/14), was submitted to the 39th meeting of the Executive Committee. The Executive Committee took note of the information provided in document UNEP/OzL.Pro/ExCom/39/14, including the proposed evaluation issues and approach for further evaluations of RMPs, with the understanding that the Senior Monitoring and Evaluation Officer would also take into account the comments and suggestions made by members of the Sub-Committee on Monitoring, Evaluation and Finance during its Meeting (document UNEP/OzL.Pro/ExCom/39/43, para 43).
4. Seven new country studies and the synthesis report are being submitted to the 41st meeting of the Executive Committee. In view of time and budget constraints, the large number of RMPs approved and the only recent start of RMPs in non-LVC countries, **the focus of the present report is on LVC countries** while it is proposed to evaluate RMPs and phase-out plans for the refrigeration sector of non-LVC countries next year. The report presents findings, lessons learnt, and recommendations to improve the effectiveness of RMPs and enhance the capacity of LVC countries to achieve CFCs phase-out in the refrigeration servicing sector and thus to comply with the provisions of the Montreal Protocol. It was prepared by the lead consultant, Prof. Stefan Musto, jointly with the Senior Monitoring and Evaluation Officer, and includes inputs from the other consultants.

II Evaluation Issues for the Overall Study

5. The evaluation issues for further field visits identified in the Extended Desk Study on RMP evaluation (document UNEP/OzL.Pro/ExCom/39/14, p.11-12), are the following:
 - (a) Is appropriate legislation including as center piece an import licensing system in force and operational without legal ambiguities and inconsistencies?

- (b) Has the application of legal regulations and import licensing quotas led to the expected reduction of the availability of controlled substances? If not, have specific measures of enforcement (consumption taxes, reduction of quotas, inspections, etc.) been introduced? If so, which ones and which are the results?
- (c) Have legislation and import licensing contributed to bringing about a significant change in market price relations between controlled and allowed substances? If not, have measures been taken to influence those price relations by restricting demand for CFCs and, in affirmative case, what sort of measures?
- (d) Have customs training programmes improved the enforcement of import restrictions and has the training of technicians in good practices contributed to the reduction of consumption of CFCs? If so, to what extent? If not, where are the problems?
- (e) Has the R&R equipment supplied actually been used and contributed to the reduction of CFC consumption? If so, what sort of equipment? If not, specify reasons;
- (f) Assessment of the performance of the NOU and the political support it receives, including the cooperation with other government departments and the private sector;
- (g) How reliable are data on consumption of refrigerants? Which are the sources of information? How reliable are these sources (customs, importers, distributors, etc.)? Are data provided by different sources consistent? If not, whom to trust and why? How detailed are the data by type of refrigerant, equipment in use and user category? How to establish a reliable monitoring system with regard to CFC consumption and project results?

6. The evaluation issues added by members of the MEF-Subcommittee are:

- (a) What is the role of Implementing and Bilateral Agencies in preparing, implementing and monitoring RMPs, in particular if several agencies are involved?
- (b) Is the support provided by implementing agencies and Bilateral Agencies to NOUs sufficient?
- (c) What importance has the price of CFCs in relation to the price for substitutes for the viability of conversion and R&R operations?
- (d) How are regulations, like obligatory certification for technicians, viewed by the stakeholders and how are the latter involved in the development of such regulations?
- (e) How to use an environmental tax on CFCs for the purpose of further ODS phase-out?
- (f) What is the need for and role of CFC reclamation centers for the conversion of the refrigeration service sector?

7. On the basis of information collected on the issues listed above the following more general questions were to be addressed:

- (a) Has the introduction of the RMP as concept helped to synchronize the individual activities? Has a learning process taken place, in the countries and overall? Has the quality of RMP up-dates and new RMPs improved compared to older RMPs? Can the co-ordination and synchronization of measures still be improved?
- (b) What is needed in addition to the measures in place? Is the funding which is final for all those countries which got an RMP up-date or a new RMP after the 31st meeting (with 50% additional funding compared to the older ones according to decision 31/48) enough and the activity mix correct to reach the 85% reduction of CFC-consumption in 2007? Would additional funding make a difference? or is rather the country, its government and private sector, supposed to increase their activities? or both in combination?
- (c) What does this imply for RMP up-dates or Terminal Phase-out Management Plans (TPMPs) or National CFC phase-out plans? Are the latter still better coordinated? Do they include additional measures or just more funding against the commitment for an accelerated CFC-phase-out by 2005 or 2006?

III Discussions in Regional Network Meetings and Questionnaires Received

8. Various regional network meetings held in the first half of this year discussed the implementation and evaluation of RMPs and provided country-specific information which varies in terms of completeness, however.

- (a) **South and South-East Asia Networks**
Bangladesh, Cambodia, Lao PDR, Mongolia, Nepal and Sri Lanka participated in a thematic meeting in Dhaka focussing on RMPs. The papers presented provide interesting material on the various topics of CFC-phase-out in the refrigeration servicing sector but are not responding to all items in the list of questions attached to the extended desk study (document UNEP/OzL.Pro/ExCom/39/14).
- (b) **West Asia Network**
A discussion took place in the meeting in Bahrain, and a questionnaire largely similar to the one attached to UNEP/OzL.Pro/ExCom/39/14 was used. The network coordinator collected country papers based on this questionnaire and prepared an introduction for the region.
- (c) **Latin American Network**
Discussions were held in the network meeting in Bogotá. Brazil, Cuba, Chile, Colombia, Costa Rica, Dominican Republic, El Salvador, Honduras, México, Panamá, Paraguay and Perú answered the questionnaire. The detail and completeness of information provided varies, however.

(d) English Speaking Caribbean Network

A synopsis of country information was received as follow-up to the last meeting in St. Kitts and Nevis, which complemented the discussions held at the meeting in Grenada last year.

(e) English and French Speaking African Networks

Group discussions were held at the meeting of English-speaking countries in Addis Ababa and again at the joint meeting in Mauritius. Only four questionnaires were received from this group.

9. The information received was analyzed and taken into account when preparing specific questions for countries selected for field visits. In case of missing information, the NOUs of countries visited were asked to provide such data. The information was also used for preparing the synthesis report.

IV Field Visits

10. The following criteria for composing the sample of countries visited had been listed in the extended desk study:

- (a) Countries in compliance and countries in non-compliance;
- (b) LVC countries and higher-volume-consuming countries;
- (c) Landlocked countries and countries of open access or transit trade (important regarding illegal imports); as well as large and small countries;
- (d) Countries in Asia, Africa, Latin America, Europe and Middle East;
- (e) Countries with differing approval date and funding volume of the respective RMP, and other countries with a terminal phase-out plan (TPMP) or National CFC phase-out plan;
- (f) RMPs implemented by different agencies.

11. All criteria were applied in the selection of countries listed below, except that the focus was on LVC countries. The only non-LVC country in the sample was Macedonia, because the network meeting was held in this country. However, Macedonia is also small in terms of geographical size and consumption of CFC in the refrigeration servicing sector. By focussing on LVC countries, the sample was more homogenous requiring less countries to be visited in order to arrive at representative conclusions.

12. The following seven countries were visited, in addition to the three visited earlier for the extended desk study:

Bahrain: LVC, RMP approved in November 1998 with UNEP as implementing agency; a R&R project was approved in May 1997 with UNDP as implementing agency. The NOU provided valuable information in a questionnaire filled in after the network meeting, and the country is the most advanced in the region with regard to RMP implementation.

- Ghana: LVC, RMP approved at the 32nd meeting in line with decision 31/48, including an incentive programme and monitoring activities to be implemented by UNDP; customs training by UNEP; early training and R&R projects, which were evaluated in 2000; country case study up-dated.
- Macedonia: Non-LVC, RMP approved in July 1999, implementing agency is UNIDO, advancing well with good monitoring system. Visited at the occasion of the Regional Network Meeting from 6 to 9 October 2003.
- Mauritius: LVC, RMP approved at the 26th meeting as part of the RMP project for 14 English speaking African countries implemented by GTZ, visited at the occasion of the Joint Regional Network meeting from 29 September to 2 October 2003. Well advanced in terms of CFC phase-out.
- Perú: LVC, RMP approved at 27th meeting, implemented by UNEP, R&R project approved by 19th meeting implemented by UNDP, completed in December 2001, PCR.
- Senegal: LVC, RMP approved at the 33rd Executive Committee Meeting, in line with decision 31/48, including a R&R scheme implemented by UNIDO, monitoring by UNEP and a hydrocarbon demo project by Switzerland, following up on earlier training programmes by UNEP and a R&R project by UNIDO; country case study of the 2000 evaluation of training and R&R projects, up-dated.
- Uruguay: LVC, RMP approved in March 1999, with Canada as implementing agency, up-date approved in July 2001 in accordance with Decision 31/48, implementing agencies are UNDP and UNEP, well advanced and monitored, 6 workshops conducted about the use of hydrocarbons, incentive programme; country case study of the 2000 evaluation of training and R&R projects, up-dated.

13. During the country visits, interviews were carried out with the NOU and relevant stakeholders involved in the design and implementation of the RMP, including other government departments, representatives of the industrial and commercial sector, and also small servicing shops. These discussions complemented information from existing surveys and reports based on project monitoring. Support by the NOUs and cooperation by both public and private sources of information has been, in most countries visited, highly satisfactory.

14. The country studies give an overview of measures taken, results achieved, problems faced and initiatives planned, and then describe in more detail specific features particular to each country visited. These case studies form the basis for the present synthesis report which summarizes the findings. They are available at request as hard copy and at the UNMFS website, in section 2, 41st Meeting of the Executive Committee, Evaluation Reports. Comments on the draft reports were received from UNDP, UNIDO, Germany, Macedonia and Sweden; they were taken into account in the final versions.

V Holistic Approach Used for the Analysis

15. Performance of RMPs in terms of impact achieved depends on a complex set of interrelated factors, many of them beyond the scope of the individual projects implemented under the Plan. Therefore, evaluation requires that all relevant determining factors responsible for success or failure be analyzed. Based on the available desk research, case studies, and experiences in RMP implementation in a number of Art. 5 countries, the following main categories of influencing factors can be distinguished:

- (a) Political support to the NOU and the NOU's own efficiency;
- (b) Effective legislation and enforcement of the legal regulations, including as centerpiece a properly functioning import licensing system;
- (c) Price relations between CFCs and alternative substances;
- (d) Close cooperation with the stakeholders (particularly importers and servicing sector);
- (e) External factors (e.g. level of income, economic development).

16. Ranking these factors in accordance with their relative importance in influencing success is not possible, because the conditions and their respective interlinkages turn out to be very different in the individual countries. In countries with a relatively high and rapidly increasing level of per capita income, generally new, CFC-free cars and other appliances are being imported (e.g. Mauritius), whereas in countries with a lower level of economic development and growth rate it is still usual that second or third hand CFC based equipment comes in (e.g. West Africa).

17. The reduction of CFC consumption can not be attributed to single components of a complex programme. Efforts, for instance, to quantify CFC phased-out as a result of customs training or R&R activities, are not very conclusive because progress or failure are depending on the overall constellation of factors influencing, positively or negatively, the phase-out process. Such factors are market price relations, political commitment, effectiveness of law enforcement, performance of the Ozone Unit, closeness of cooperation with industrial and commercial companies, and some other conditions. Evidently, it makes not much sense to carry out retrofitting or replacement activities where imports are not restricted and where CFCs are still much cheaper than substitutes. A holistic approach is used, comprising an analysis of all relevant factors influencing the phase-out process when specific programmes or projects are to be designed, prepared, implemented and evaluated.

18. According to decision 22/24 of the Executive Committee from June 1997, recovery and recycling projects should be implemented only after incentives or regulatory measures are put in place, in order to ensure their sustainability. Also customs training shall not be organized before import regulations are in force. Therefore, appropriate legislation is the first and basic precondition to be fulfilled if RMPs are to be implemented. Later RMPs and RMP-updates were approved with conditions requesting minimum price levels for CFC or similar prices for CFC and substitutes before sub-projects could be implemented. The 38th meeting of the Executive Committee confirmed this although some Art. 5 countries had voiced difficulties to ensure a certain level of CFC prices. Therefore the compromise wording was:

- (ii) Consistent with previous decisions, not commence the recovery and recycling component of the RMPs until the legislation controlling CFC imports was in place and measures had been taken to ensure that the local market prices of CFCs and non-ODS refrigerants were similar (decision 38/38 (a) (ii)).

19. The fulfilment of conditions imposed at the time of approval and the meaningful sequencing of the different measures is an important part of the analysis.

VI Overview of RMPs and Compliance in LVCs

20. Since 1997, a total number of 279 projects have been approved under 47 RMP, 32 RMP up-dates and 21 national or terminal phase-out plans for the CFC phase-out in the refrigeration servicing sector of 92 countries. 212 of these projects were for 73 LVCs. 66 projects are completed, 52 of those in LVCs. The total funding approved was US \$ 25.7 million (plus 1 global project for US \$ 0.8 million) of which US \$15.7 million was for LVCs. Until the end of 2002 US \$ 10.8 million were disbursed, of which US \$ 6.6 million was for LVCs (see Table 1).

Table 1
RMP Project Approvals and Implementation for (LVC and non-LVC countries)

Status	No. of Countries Approved	No. of Approved Projects ⁽¹⁾	No. of Completed Projects	Total Funds Approved including Adjustments (US\$)	Funds Disbursed (US\$)
LVC	74	217	52	16,021,724	6,599,785
Non-LVC	18	61	14	9,727,072	4,235,257
Total	92	278	66	25,748,796	10,835,042

⁽¹⁾ Excluding one global project.

21. Before 1997 already numerous R&R projects and training programmes had been approved and implemented. 30 R&R projects with a targeted phase-out of 439 ODP tonnes and a funding volume of US \$4.4 million were approved for LVC countries outside RMPs, that means in most cases before 1997. There were also 12 training projects with a targeted phase-out of 118.5 ODP tonnes and a funding volume of US \$0.7 million. This phase-out was reportedly almost fully achieved while for the R&R projects only 343.1 ODP tonnes were reported as phased out (see Annex I, Tables 8 and 9) as well as country specific data in Annex V.

22. LVC countries in Africa received 82 projects for US \$5.4 million, followed by the LAC region with 66 projects for US \$4.7 million, Asia and the Pacific (57 projects for US \$4.8 million) and Europe (12 projects for US \$1.1 million). 86 projects were approved for implementation by UNEP, followed by bilateral agencies (72), UNDP (43) and UNIDO (16).

23. 24 of 52 completed projects showed delays of 13-24 months and nine more than 25 months, using the originally planned and approved completion dates. When using the revised planning after the 22nd meeting of the Executive Committee the respective figures are 16 and 8 projects. The delays of on-going projects are even more frequent, with 24 of 165 showing a delay of 13-24 months and 44 of 25 months and more. The respective figures using the revised planned completion dates are 21 and 37 projects.

24. Annex II (a) gives an overview of approval dates, sub-projects, funds approved and disbursed, phase-out targets for each LVC country. The planned ODS phase-out is related to the R&R project. An actual phase-out of 132.0 ODP tonnes in total was reported for 11 completed R&R projects under RMPs in LVC countries, compared to 132.9 ODP tonnes planned. In view of the weakness of data collection and reporting on R&R activities, which are described in more detail in paragraph 33 below and in the overview of the case studies (see annex VI), this figure is doubtful. Moreover, it does not include phase-out related to other measures, like training of technicians and customs officers, as well as legislation which might result in larger phase-out although this is difficult to quantify.

25. The unreliability of phase-out data related to RMPs makes it also difficult to identify the contribution of RMPs to enable compliance. Although in LVC countries RMPs are the major and often only instruments to advance the phase-out, the cause and effect relation is not straight forward, as many other factors influence the results. Annex II (b) provides an overview of the phase-out approved through RMP and other projects for LVC countries and identifies the countries where further action is required to meet the freeze, the 50% and the following reduction steps (shaded in the table). It also shows the latest CFC consumption reported by country for the refrigeration servicing sector which is often not specified, however, in the data received by the Fund Secretariat.

26. In order to complete the picture, the same overview data are also provided for non-LVC countries in Annexes III and IV.

VII Comparative Assessment of Results Achieved and Factors Influencing the Performance of RMPs in the Countries Visited

27. In the table in Annex VI, a comparative assessment of the results of RMPs and of the relevant factors which influence the performance of the RMPs in the countries visited is presented. Some of these factors are implicit elements of the RMP (legislation, training of technicians and customs, import licensing, supply of R&R equipment, monitoring), some others are external variables (political support, law enforcement) which generally play an important role regarding results and effectiveness of such programmes. It is the interlinkage of these factors which ultimately determines the extent of present and future compliance.

28. Experiences of a few countries visited cannot be considered as being representative for all Article 5 countries. Nevertheless, the facts, figures and problems mentioned by the National Ozone Units visited and by representatives of private industrial and commercial companies, as well as by the Ozone officers interviewed at the network meetings of English-Speaking Caribbean Countries, of English- and French-speaking African countries and of the East European and Central Asian countries suggest that despite all country-specific differences as mentioned above, there are some problems and weaknesses in implementing RMPs which are fairly similar in LVC countries across regions and continents. Regarding the factors influencing, positively or negatively, RMP performance, the following observations were made which supplement the findings of the extended desk study presented to the 39th meeting of the Executive Committee (document UNEP/OzL.Pro/ExCom/39/14).

29. It could be verified that RMPs have played a decisive role in coordinating activities for the reduction of CFC consumption in the servicing sector and in accelerating the phase-out process. Most countries visited have complied with the freeze target by 1999 despite increases of CFC consumption in 1997/1998 in some countries. Even in one case of non-compliance, increased efforts to meet the target have been undertaken under the RMP. In six cases the 50% reduction target has already been achieved (Jamaica, Macedonia, Mauritius, Saint Lucia, Senegal and Uruguay, see overview table in Annex VI). The most important factors contributing to this progress were enforced legislation, strict import controls reducing the availability of CFCs, and adequate training of customs officers and refrigeration technicians. In all countries where such progress can be reported, close cooperation between the NOU and private stakeholders (importers, distributors, workshops) has been established.

30. **Political commitment.** Although in most developing countries the ozone issue do not belong to the highest political priorities, commitment to comply with the obligations deriving from the Montreal Protocol is generally strong. This commitment, however, is also depending on election periods, government changes and other political developments. At least, in case of all countries visited, commitment to meet these obligations is present. However, the process of legislation is lengthy in some countries (see below).

31. **Capacity of the NOU.** National Ozone Units are in general sufficiently well equipped due partly to the facilities provided by their respective governments, and partly due to the support received under the Institutional Strengthening Projects. Nevertheless, in almost all cases complaints have been articulated regarding personnel resources. The staff is generally very limited (1 to 2 professional staff members) and overloaded with work, in particular if they deal also with other international environment conventions, as it is often the case in small countries, despite being funded by the Multilateral Fund. In some cases, national consultants (e.g. Ghana) have been employed on a half-time contract basis who effectively contribute to the NOU's overall performance, particularly in managing regular communication with the private stakeholders. The performance of the NOU plays a key role in planning, implementing and controlling activities under the RMPs. It is not so much their level within the formal hierarchy of the administrative structure but rather their actual professionalism, technical know-how and management performance as well as their continuity in office and contact to their superiors which exert the decisive influence on the extent of success achieved (or failure).

32. **Co-operation with stakeholders.** In some cases regular contacts and co-operation with all relevant stakeholders such as government departments, companies, workshops, even in the so called informal sector are taking place (e.g. Macedonia, Jamaica, Senegal, Ghana), in other cases such contacts prove to be more difficult either because no professional associations or National Ozone Committees are established (e.g. Bahrein, Perú), or because such associations represent but a small fraction of the refrigeration sector. Evidently, the task to regularly communicate with private stakeholders is much easier in small countries than in countries with a significant geographical size and a high level of structural complexity. Nevertheless, the well orchestrated and active involvement of the private sector in the process of CFC phase-out has shown to be one of the key elements of compliance and successful RMP implementation. This starts with the preparation of the RMP or its up-date, continues in the preparation of legislation and the implementation of training and other activities, and includes reporting by associations or companies on consumption trends and conversion activities, which constitute one of the main sources of information for the respective NOU. Problems of coordination have been reported mostly in countries where a large and uncontrolled informal servicing sector is operating.

33. **Legislation.** In almost all countries visited, ODS related legislation is in place, (except in Uruguay), sometimes after years of delay, as in Saint Lucia. The center piece is an import licensing system with quota allocations to CFC importers. In some countries, regulations are in the process of being further elaborated and adjusted to the phase-out requirements (e.g. Ghana, Jamaica, Macedonia). Regarding countries with a TPMP approved, an accelerated timetable for import quota reductions has been introduced (e.g. Mauritius, Jamaica, but also Perú which has no TPMP). The fact that in several countries final regulations conforming to the Montreal Protocol requirements are still in the phase of preparation or waiting for amendments is due to the circumstance that legislation, particularly in countries under political and economic transformation (e.g. Eastern Europe, Central Asia), is a sensitive political issue. The introduction of binding legal regulations and their implementation is depending not only on the political will of governments but also on the composition of parliaments which may be more or less susceptible to the influence of industrial or commercial interests. Some countries also face difficulties to introduce trade restrictions for ODS because they are implementing a general trade liberalization programme with the IMF and/or the World Bank or are part of a regional free trade zone (e.g. Mercosur).

34. **Monitoring and Reporting.** The validity and reliability of data concerning imports and use of ODSs is a basic requirement for the calculation of actual consumption and phase-out achieved. The main sources of information at the disposal of the NOU are the regular reports of customs, importers with quota allocated, and industrial or commercial companies benefitting from specific measures (incentives, equipment supplied, etc.) under the RMP. According to the NOUs in the countries visited, the import monitoring system is in all cases in place and the data collected are mostly reliable. If inconsistencies are observed between customs data and information from importers, efforts are made to clarify the discrepancies. While in Ghana, Macedonia and Uruguay, data on recovered and recycled CFC are regularly collected from the workshops, this is rather exceptional and the data are not always reliable. The companies are often reluctant to record their operations, if only for some fear that data might end up in the fiscal administration, or that they may be asked to return the equipment if they do not use it regularly. The annual reports on RMP performance requested by Decision 31/48 are not prepared. However, 51 PCRs were received for 66 completed RMP subprojects, and usually the requests for RMP up-dates provide an assessment of the previous activities under the RMP. These reports are of variable quality and completeness but are improving, in particular PCRs from UNEP on training activities and some reports presented with requests for RMP up-dates progress.

35. **Customs training.** Training courses for customs officers have been carried out in all countries under consideration, and in country training capacity has been built up in all cases. One of the questions which has also been discussed at the network meetings is whether customs training should be preceded by the supply of CFC-identifying detectors. In some cases (e.g. Bahrein, Ghana) customs training was carried out before RMPs had been approved and detectors had been supplied. Here, opinions were widely diverging. Training in terms of general awareness raising and acquiring of a fundamental knowledge of ODS issues is justified before equipment has been supplied, while further customs training should be combined with the supply of detectors provided under the RMP. As far as customs identification kits are concerned, several countries reported the need for small portable units and complained that the kits supplied are not in all cases appropriate to identify mixtures. Another problem mentioned in some cases is that customs are not always adequately computerised to fulfill the necessary monitoring requirements.

36. **Training of technicians.** In all cases under consideration, training courses in good practices have been carried out covering 30 to 70% of technicians working in registered workshops, in some cases including also technicians working in the informal servicing sector (e.g. Macedonia, Ghana). In general, training of technicians is now a self-sustaining process, as local trainers were trained and the training modules incorporated into the curricula of the refrigeration courses in Technical Colleges. In companies whose owners or technicians were trained under the RMP project, the knowledge was generally passed on to other technicians. Nevertheless, most countries visited consider that more training activities are needed. Although certificates are handed out once a technician has successfully completed a training course, such certification is in most countries not mandatory to perform recovery and related activities. Governments hesitate to make such certification obligatory for fear of creating a social problem in the often large and uncontrollable informal servicing sector which is interested in training and equipment but prefers to avoid registration, oversight and reporting. Regarding the question, how much CFC emissions are avoided due to training of technicians in good practices, none of the countries concerned was able to provide quantified figures or even rough estimates. However, the practice of venting remaining CFC before repair (if some is left in the system) and of flushing with nitrogen or compressed air which is also cheaper, and this might be the single most important effect in emission reduction in the domestic sector. Secondly, leak fixing and preventive control is receiving much more attention now which is particularly significant for commercial and industrial installations where leakage rates of 30 and up to 50% per year were reported as fairly common. This plays also a big role for mobile air conditioning in cars, busses, trucks, containers and ships (the latter are mostly on R-22 already). The introduction of good practices in refrigeration servicing might therefore be the most decisive factor in reducing CFC consumption and emissions, with recovery and recycling being the less important part of it. Further training should in particular include leak testing and reduction, tube joining methods and specification of appropriate components.

37. **Recovery and recycling.** Recovery of CFC is regularly practiced by the workshops which received equipment. However, there are few reliable quantitative data available, as mentioned above. Moreover, the figures in project documents and progress as well as completion reports generally do not show separate amounts for CFC to be recovered and recycled. The following practices were commonly observed and reported:

- (a) Little recovery and re-use of refrigerants takes place in the workshops for small appliances but much more at the client's site if commercial or industrial installations units are serviced and large quantities of CFC or more often R-22 can be recovered. They are usually filled right back into the same equipment, if the technician trusts that no serious contamination, e.g. through a compressor burn-out, has taken place.
- (b) Recovery and re-use is also applied in some MAC workshops where combined R&R machines are employed which are equipped with filters and dryers to eliminate particles and moisture. However, quantities recovered are limited because MAC are usually brought in for servicing only when the cooling is completely down, that means there is often no more refrigerant left in the system. When a car is re-charged from a recycling machine it is getting refrigerant from several previous clients at the same time. This is not an issue with MAC systems because the refrigerant is unlikely to be contaminated with acids, and anyway

contamination is not so critical. There is always a risk of mixing different refrigerant types in a recovery or recycling machine in a workshop which services systems with different refrigerants. However, good operator practice / training should prevent this. Project equipment can be used for CFC and HFC-134a which requires different hoses. Privately bought R&R equipment which is common in large workshops operating as licensed contractors of principal car manufacturers is usually fitted for HFC-134a only and CFC is vented. Cases of HFC-134a MAC systems being recharged with cheaper CFC-12 were reported for some countries but seem to be limited.

- (c) Servicing of domestic refrigerators generates very little recovered CFC even when they are brought into the workshops, because the main reason for repairs are either leakages or compressor burn-outs. In the first case, the small charge is further diminished and in the second the CFC is contaminated with acid which only reclamation and technically sophisticated recycling machines would be able to take out.
- (d) Recovered CFC is very rarely brought to recycling centers. The main reason is that the need and utility is seen only for the few cases, where recycling would make a difference, that means when simple or repeated recovery would not sufficiently eliminate contaminants and moisture and when the CFC recovered is not contaminated to an extent that it would warrant reclamation or destruction. Another limiting factor is that the transport of recovered CFC in cylinders is time consuming and costly. Moreover there is often some mistrust with regard to the reliability of recycling centres in terms of quality, fees charged, timeliness of service and, in situation of CFC-scarcity, return of the recycled CFC. Efforts to increase the use of recycling centers would need to address all these issues, which does not seem likely in the countries visited.

38. **Equipment supplied.** All the countries visited have been provided under the RMP with recovery units, recycling machines and leak detectors, and in some cases, tool sets. They have been distributed on a contractual basis and in accordance with pre-formulated criteria to workshops which presented applications. In a few countries, e.g. in Senegal and St. Lucia, workshops participated to some extent in the cost by paying into a fund from which supplementary activities were supported. In Senegal, every year, some additional recovery equipment was distributed as award to workshops and technicians which showed the best results in terms of applying training and equipment received previously. In most countries, also a few recycling centers have been established, either in private workshops or in technical colleges for training purposes. Simultaneously, some private companies have purchased their own recovery and recycling equipment. The machines preferred by the industry were those delivered by recent projects which are less bulky and with oil-less compressors, compared to the bigger and heavier ones supplied by the early UNDP projects with compressors requiring regular oil change. These units albeit small are capable of recovering refrigerant from any commercial or industrial application regardless of the amount of refrigerant contained within, although installations with hundreds of kg of refrigerant will take several hours to empty and refill. The recent generation of machines is also preferred because the alternate use for CFC and R-22 is easier to handle. Their prices are now comparable. The precision of leak detectors reportedly varied with the brand, and generally soapy water was considered to be more reliable, cheaper and easy to use because leak detectors require regular cleaning or replacement of their sensor tips in order to be accurate. However, to detect a leak in a car with soapy water would require significant demounting whereas an electronic leak detector can be held in front of the air inlet.

39. **Impact of prices for refrigerants.** While in many countries, CFC is still significantly cheaper than HFC-134a, the difference has narrowed in others, and in a few places, CFC is now more expensive than HFC-134a, at least during the hot season when demand peaks and CFC has become scarce due to import restrictions, as in Jamaica, or as a result of import duties, in Mauritius, or Swaziland and other countries bordering South Africa which has introduced a levy on CFC. In view of the small refrigerant charge, the domestic sector is not very sensitive to price differences of refrigerants while MAC and commercial/industrial sectors tend to pay more attention to it. Generally, it seems availability, convenience of handling and operational reliability of refrigerants are more important than prices. For the commercial and industrial sector, it is mainly the price of HCFC-22 in relation to CFC-12 which has some influence, but also here technical reasons and (future) availability seem to be more important determinants for the conversion than price differences.

40. **Government Measures influencing price relations.** In countries where CFCs are still much cheaper than alternatives, some price equalization can be achieved either through the introduction of import taxes or environment fees on CFCs (advantage is obvious, disadvantage is an additional burden on end-users), or through subsidies for alternative substances (advantage for users, burden for state budget), or through specific incentive programmes. Mauritius has introduced a 40% import tax on CFCs inverting thereby price relations and making alternatives more competitive in the market. The example of Mauritius can, evidently, not be followed by countries at a lower stage of economic development where similar price increases would hurt the servicing sector and/or possibly result in illegal imports if borders cannot be effectively controlled. Some Eastern European countries have also taken measures to influence prices: Macedonia imposed a levy on CFCs to feed an Environment Fund. Other countries are considering pros and cons of taking similar measures.

41. **Retrofitting domestic and small commercial appliances.** Several countries visited (Ghana, Senegal, Uruguay) conducted recently training seminars and pilot tests with regard to the retrofitting of domestic and small commercial appliances to hydrocarbons. These programmes built on experiences gained mostly in Cuba and India. The interest of technicians and consumers reportedly was high, because it offers an option to continue operating CFC-based refrigerators with limited cost for retrofits, when CFC will cease to be available in some years. There are also claims that the energy efficiency would improve which is not proven, however. Cost for replacing or sealing electrical devices in order to avoid sparks are limited (10-20 US \$ per refrigerator) but intensive safety training for technicians and adaptations of workshops are needed in case they are not well ventilated. The alternative conversion to HFC-134a would require a new compressor; workshops complained about the relative high cost for this retrofit, due also to costly ester oils required which moreover are difficult to handle due to their hygroscopic nature. In Jamaica, some retrofits of CFC-refrigerators to HFC-134 were made but the costs were found too high, so consumers prefer to buy new refrigerators. Another option which is not often used yet in Art. 5 countries because of availability of cheap CFC and so far limited commercial availability and higher prices for alternatives is the conversion to various drop-in substitutes consisting of HCFC or HFC blends. An overview of the advantages and disadvantages of retrofits to HC, HFC-134 or HCFC drop-in blends is given in Annex VII.

42. **Incentive programmes for retrofitting.** Awareness raising alone will not necessarily be sufficient to motivate the private sector to embark upon conversion of technologies implying additional investments. The examples of Mauritius and Ghana demonstrate that economic development and/or financial incentives may encourage the conversion of CFCs (and R 502) to alternative substances and to reduce substantially refrigerant leakages. In Mauritius three government owned buildings which have been identified as the main remaining users of ODS are to be retrofitted to alternative refrigerants, with most funding to be provided by the Government and partial funding under a proposed TPMP. Under the incentive programme started in Ghana, 20 large scale cold rooms shall be converted to ozone friendly substances (R-134a, R-404), 8 of which have been already completed and 12 are under preparation. New drop-in refrigerants may also offer useful transitional solutions (in the case of Ghana, the use of drop-in refrigerant is not considered for an incentive payment). In Georgia and Uruguay, the response of private industries to incentive programmes has been hesitant, mainly due to the weak economic situation, while in Burkina Faso the selection process to determine beneficiaries could so far not be agreed upon between UNDP and the country. The limited evidence suggest that incentive programmes can, in principle, be effective if the following elements are in place: an operational and effective import licensing system with quota allocations, a reliable control of the level of CFC consumption, a narrowing or even inverted price differential between CFCs and alternative refrigerants, the introduction of economic incentives to industrial and commercial companies, and last not least, economic growth which helps to mobilize public and private funds for modernization investments.

43. Proposals for **Terminal Phase-Out Management Plans or national CFC phase-out plans** must be carefully reviewed with regard to the country's capacity to comply with the respective commitments. Some countries submitting such plans are more prepared or better coordinated as others for advanced terminal phase-out strategies. TPMPs and other terminal phase-out plans, sometimes submitted in expectation of more funding, can only be successful in case of overall administrative efficiency, good coordination with the industry, and in situations of general economic growth, when public and private investments for modernizing or replacing equipment are more easy to mobilize.

VIII Conclusions

44. In the Extended Desk Study on RMP Evaluation (UNEP/OzL.Pro/ExCom/39/14) some issues for further evaluations had been formulated. The visits to the countries selected and participation in network meetings provided additional insights to complement the information in earlier studies with regard to the role of RMPs in the process of ODS phase-out. However, not all questions listed in the desk study can be answered with certainty and for all countries. Although many findings are of a general nature, and information collected by questionnaires and in network meetings point to more similarities than differences between LVC and non-LVC countries, some case studies in non-LVC countries are needed in order to take into account their specific conditions, in particular with regard to the use of and further needs for R&R equipment.

45. From the 10 country studies conducted, it appears that the RMPs play a significant role for realizing the planned CFC phase-out and contribute to an improved sequencing of activities and better co-ordination among stakeholders. The prospects to achieve further CFC phase-out as planned and scheduled according to the timetable set by the Montreal Protocol differ by country, depending to a large extent on how well the linkages between the various components of the RMP have been established and on external factors (political conditions, economic development, climatic conditions, etc.). Further CFC phase-out depends mainly on the political will of the country concerned to enforce existing regulations, the performance of the National Ozone Office, the coordination with industries and the use of training capacities created. In addition, market developments, that means prices and availability of CFC and substitutes as well as equipment using them, either favour or hinder the continued phase-out of CFC's. The main findings of the evaluation are:

- (a) Appropriate legislation including as center piece an import licensing and quota system is in place and operational in most countries visited. For some countries, also bans on the import of ODS-based equipment have been introduced or are under preparation. This is helped by the fact that non-Article 5 countries have stopped producing CFC-based refrigeration equipment including MAC about 8 to 10 years ago, and second hand non-CFC refrigeration equipment is now starting to become widely available.
- (b) Enforcement of legal regulations and application of import licensing quotas has actually led to the reduction of the availability of controlled substances although not always to the extent to which the reduction was originally targeted.
- (c) Legislation and import licensing have contributed, though to a very varying degree, to bring about a change in market price relations between CFC and substitutes.
- (d) Customs training was very useful for establishing awareness and generally reliable control mechanisms for imports. Local trainers have been trained and curricula adopted, which are now the base for continued training programmes.
- (e) Training programmes for technicians in good refrigeration practices have been successfully delivered starting with training of trainers and extending them to the larger part of the formal sector.
- (f) The introduction of good practices in refrigeration servicing seems to be the most decisive factor in reducing CFC consumption and emissions. This concerns particularly leak identification and elimination, no more flushing with CFC, avoiding over-charging with refrigerants, less frequent equipment breakdown after well executed repairs and maintenance, and, lastly, recovery and recycling.
- (g) Recovery and re-use of CFC is practiced by workshops which received equipment, if commercial or industrial installations are serviced and large quantities of CFC or by now more often R-22 can be recovered and re-used at site. Also in the MAC sector, some CFC is recovered and usually filled right back into the same equipment. Recovered CFC is very rarely brought to recycling centers which remain largely idle. Servicing of domestic refrigerators generates very little recovered CFC. Recovered and recycled volumes of refrigerants are generally much less than expected and envisaged in project documents as the basis for determining equipment quantities and costs. Records are in most cases not systematic, however, and do not show separate amounts for recovered and recycled CFC.

- (h) In some countries, growing volumes of recovered contaminated CFCs are stored, waiting for either reclamation or destruction, while such facilities are not available in the country concerned. In other countries, contaminated CFCs are vented by technicians who see no other way of dealing with them.

IX Recommendations

46. Future and, to the extent possible, on-going programmes and projects for the CFC phase-out in the refrigeration sector in LVC countries should be refocused by:

- (a) concentrating the support on the development of legislation and coordination mechanisms with industry, where this is not yet in place, and on further training programmes for refrigeration technicians and customs officers, using the created national capacities and providing expert support and tool sets, as required;
- (b) focussing for recovery and re-use of CFC on large size commercial and industrial installations and MAC sectors, if significant numbers of CFC-12 based systems still exist and the availability of CFC is strongly reduced by the adoption of effective import control measures;
- (c) further exploring possibilities for facilitating cost-effective retrofitting and/or use of drop-in substitutes, possibly through incentive programmes;
- (d) becoming more selective in providing new recovery and in particular recycling equipment by:
 - (i) establishing during project preparation the confirmed and justified demand for R&R equipment focussing on refrigeration servicing workshops with a proven large consumption of CFC;
 - (ii) delivering equipment to the country only against firm orders and with significant cost participation by the workshops for equipment provided, using to the extent possible locally assembled machines;
 - (iii) procuring, delivering and distributing equipment in several stages, after reviewing the utilization of equipment delivered and verifying further demand.
- (e) on-going monitoring of the use of equipment and knowledge acquired by the beneficiaries by way of national consultants holding regular consultations and collecting periodic reports from the workshops, in cooperation with the associations of technicians. Progress reports based on such monitoring should be prepared annually by the consultant and/or NOU, in cooperation with the implementing agency, as foreseen in decision 31/48.

Annex I: Overview of Approved Refrigerant Management Plan (RMPs) and their Implementation in LVC Countries

Table 1
Project Approvals and Implementation by Region

Region	No. of Approved Projects	No. of Completed Projects	ODP To Be Phased Out (ODP Tonnes)	ODP Phased Out (ODP Tonnes)	Total Funds Approved including Adjustments (US\$)	Funds Disbursed (US\$)	Approved Cost Effectiveness (US\$/kg)*	Actual CE of Completed Projects (US\$)*	PCR Received
Africa	82	20	242.1	41.0	5,369,119	2,196,703	11.54	16.86	16
Asia and the Pacific	57	4	272.3	6.0	4,836,220	852,601	9.81		6
Europe	12	4	42.1	41.0	1,113,656	877,598	17.85	15.49	3
Latin America and the Caribbean	66	24	166.8	82.0	4,702,729	2,672,883	15.68	12.03	15
Total	217	52	723.3	170.0	16,021,724	6,599,785	12.21	13.88	40

*Projects without ODP phase-out approved were excluded from the calculation of the Cost-Effectiveness

Table 2
Project Approvals and Implementation by Agency

Agency	No. of Approved Projects	No. of Completed Projects	ODP To Be Phased Out (ODP Tonnes)	ODP Phased Out (ODP Tonnes)	Total Funds Approved including Adjustments (US\$)	Funds Disbursed (US\$)	Approved Cost Effectiveness (US\$/kg)*	Actual CE of Completed Projects (US\$)*	PCR Received
Bilateral	72	14	81.6	0.0	3,698,759	1,583,407	16.75		6
UNDP	43	9	468.9	155.0	6,017,123	2,585,895	12.36	13.00	2
UNEP	86	27	0.0	0.0	4,005,550	1,600,009			29
UNIDO	16	2	172.8	15.0	2,300,292	830,474	9.66	18.46	3
Total	217	52	723.3	170.0	16,021,724	6,599,785	12.21	13.88	40

*Projects without ODP phase-out approved were excluded from the calculation of the Cost-Effectiveness

Table 3
Project Approvals and Implementation by Type of Projects

Type	No. of Approved Projects	No. of Completed Projects	ODP To Be Phased Out (ODP Tonnes)	ODP Phased Out (ODP Tonnes)	Total Funds Approved including Adjustments (US\$)	Funds Approved (US\$)	Approved Cost Effectiveness (US\$) ⁽¹⁾	Actual CE of Completed Projects (US\$/kg) ⁽¹⁾	PCR Received
Investment ⁽²⁾	2		11.7	0.0	291,397	970	24.91		
Technical Assistance ⁽³⁾	125	26	711.6	170.0	10,682,485	4,341,587	12.00	13.88	16
Training	90	26	0.0	0.0	5,047,842	2,257,228			24
Total	217	52	723.3	170.0	16,021,724	6,599,785	12.21	13.88	40

⁽¹⁾ Projects without ODP phase-out approved were excluded from the calculation of the Cost-Effectiveness.

⁽²⁾ Including one Recovery/Recycling activity that is part of the RMPs.

⁽³⁾ Including 41 Recovery/Recycling activities that are part of the RMPs.

Table 4
Completed Projects with Implementation Delays
 (Using original planned completion dates, according to the 2002 progress reports)

Agency	Delays in Months						Total
	Early Completion	On Time	1-6	7-12	13-24	25 and More	
Bilateral	1		1	6	6		14
UNDP	1	3		2	3		9
UNEP	1			2	15	9	27
UNIDO ¹			1	1			2
Total	3	3	2	11	24	9	52

¹UNIDO in addition reported one project as completed in 2003.

Table 5
Completed Projects with Implementation Delays
 (Using planned completion dates as corrected after the 22nd meeting of the Executive Committee, according to the 2002 progress reports)

Agency	Delays in Months						Total
	Early Completion	On Time	1-6	7-12	13-24	25 and More	
Bilateral	3		1	6	4		14
UNDP	1	3		2	3		9
UNEP	5	1		4	9	8	27
UNIDO ¹			1	1			2
Total	9	4	2	13	16	8	52

¹UNIDO in addition reported one project as completed in 2003.

Table 6
Projected Implementation Delays for Ongoing Projects
 (Using original planned completion dates, according to the 2002 progress reports)

Agency	Delays in Months						Total
	Early Completion	On Time	1-6	7-12	13-24	25 and More	
Bilateral	1	28	1	9	2	17	58
UNDP		22	1	2	4	5	34
UNEP	6	20	2		13	18	59
UNIDO		1	4		5	4	14
Total	7	71	8	11	24	44	165

Table 7
Projected Implementation Delays for Ongoing Projects
 (Using planned completion dates as corrected after the 22nd meeting of the Executive Committee, according to the 2002 progress reports)

Agency	Delays in Months						Total
	Early Completion	On Time	1-6	7-12	13-24	25 and More	
Bilateral	1	28	1	9	2	17	58
UNDP		22	1	2	4	5	34
UNEP	7	23	4	3	10	12	59
UNIDO		1	5		5	3	14
Total	8	74	11	14	21	37	165

Table 8
Overview of Recovery and Recycling Approved Outside RMPs

Status	No. of Approved Projects	No. of Completed Projects	ODP To Be Phased Out (ODP Tonnes)	ODP Phased Out (ODP Tonnes)	Total Funds Approved including Adjustments (US\$)	Funds Disbursed (US\$)	Approved Cost Effectiveness (US\$/kg)*	Actual CE of Completed Projects (US\$/kg)*	PCR Received
LVC	30	26	439.3	343.1	4,355,275	4,077,089	9.84	10.96	24
Non-LVC	50	45	1,897.7	1,349.2	13,337,026	11,943,637	5.90	6.84	36
Total**	80	71	2,337.0	1,692.3	17,692,301	16,020,726	6.64	7.73	60

*Projects without ODP phase-out approved were excluded from the calculation of the Cost-Effectiveness

** Excluding one global and one regional projects.

Table 9
Overview of Training Projects Approved Outside RMPs

Status	No. of Approved Projects	No. of Completed Projects	ODP To Be Phased Out (ODP Tonnes)	ODP Phased Out (ODP Tonnes)	Total Funds Approved including Adjustments (US\$)	Funds Disbursed (US\$)	Approved Cost Effectiveness (US\$/kg)*	Actual CE of Completed Projects (US\$/kg)*	PCR Received
LVC	12	9	118.5	113.1	728,300	576,617	2.05	2.02	9
Non-LVC	13	4	44.8	44.8	3,113,822	725,142	4.80	4.80	4
Total	25	13	163.3	157.9	3,842,122	1,301,759	2.81	2.81	13

*Projects without ODP phase-out approved were excluded from the calculation of the Cost-Effectiveness

Annex II (a)
Implementation of RMPs in LVC Countries

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Annex II (a)

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Country	Status	RMP approved	Programme Approved to Meet 85% CFC Reduction	Date of Approval	Implementing Agency	Recovery and Recycling	Customs Training	Training in Good Refrigeration Practices/Technicians/Trainers	Monitoring	Incentive Programme	Awareness	Assistance in the design of policies and regulations	Other RMP Activities	No. of Approved Projects	No. of Completed Projects	ODP To Be Phased Out	ODP Phased Out	Total Funds Approved including Adjustments (US\$)	Funds Disbursed (US\$)	PCR Received
Albania	LVC	No	Yes*																	
Angola	LVC	Yes	Yes	Apr-03	Germany	X	X	X		X	X		Enforcement of regulation	1	0	103.0		700,000		
Antigua and Barbuda	LVC	Yes	No	Nov-98	Canada	X	X	X						3	3	1.0		124,400	124,400	
Bahamas	LVC	Yes	Yes*	Nov-97	UNDP, UNEP	X UNDP		X UNEP	(Training) UNEP					3	2	12.6	13.0	215,275	194,775	2
Bahrain	LVC	Yes	No	Nov-98	UNEP		X	X						2	2	0.0	0.0	75,000	67,884	2
Barbados	LVC	No	No																	
Belize	LVC	Yes	No	Nov-99	Canada, UNDP	X UNDP	X Canada	X Canada	X Canada				Policy Dialogue programme and regulatory framework for phasing out ODS (Canada)	4	2	1.7	2.0	149,625	144,384	
Benin	LVC	Yes	Yes	Dec-00	Canada		X	X					Development of code of good practice and Training of environmental inspectors and investigators	4	0	0.0		270,900	110,000	
Bolivia	LVC	Yes	Yes	Mar-02, Apr-03	Canada	X	X	X	X		X		Assistance in preparation of regulations and technical norms	6	0	14.0		517,000	71,000	
Bosnia and Herzegovina	LVC	No	No																	
Botswana	LVC	Yes	No	Nov-98	Germany							X		1	0	1.5		70,375	65,000	
Brunei Darussalem	LVC	No	No																	
Burkina Faso	LVC	Yes	Yes	Nov-99, Dec-00, Jul-01	Canada, UNDP		X Canada	X Canada	X UNDP	X UNDP				4	2	3.0	0.0	231,100	134,835	
Burundi	LVC	Yes	No	Nov-98	UNDP, UNEP	X UNDP	X UNEP	X UNEP	X UNDP					4	2	5.4	5.0	210,027	171,205	2
Cameroon	LVC	Yes	Yes	Nov-02	UNIDO	X	X	X	X					1	0	112.6	0.0	522,982	0	
Central African Republic	LVC	Yes	Yes	Jul-01	France		X	X	X				Development and implementation of a tax/incentive programme and registration of refrigeration service technicians, distributors and importers of CFCs.	4	0	0.0		170,090	0	
Chad	LVC	Yes	Yes	Nov-99, Nov-02	UNDP, UNEP	X UNDP	X UNEP	X UNEP	X UNDP	X UNDP				5	3	14.8	9.0	553,248	226,761	2
Comoros	LVC	Yes	Yes	Dec-01	UNEP		X	X	X				Assessment of the end-user subsector	4	0	0.0	0.0	138,000	36,907	
Congo	LVC	Yes	Yes	Dec-00	UNEP		X						Assistance for information-sharing	2	0	0.0	0.0	85,400	75,022	
Costa Rica	LVC	No	No																	
Cote D'Ivoire	LVC	Yes	Yes	Mar-98, Jul-02	France	X	X	X	X				Set up of an import/export licensing system and Training in Data Management Systems for Customs and Statistics Department	2	0	24.8		277,150	39,115	
Croatia	LVC	Yes	Yes*	Jul-99	UNIDO	X	X	X						3	2	15.0	15.0	398,160	376,281	3
Dominica	LVC	Yes	No	Nov-98	UNEP		X	X						2	0	0.0	0.0	35,000	17,000	
Ecuador	LVC	No	No																	
El Salvador	LVC	Yes	No	Jul-98	UNDP, UNEP	X UNDP	X UNEP	X UNEP	X UNDP					4	2	36.3	36.0	465,377	442,095	1
Ethiopia	LVC	Yes	No	Nov-98	Germany							X		1	0	0.0		20,000	15,500	
Federated States of Micronesia	LVC	Yes	Yes*	Mar-02	Australia	MAC R&R	X	X					Assistance for enforcing ODS regulations	2	0	0.0	0.0	36,000	0	
Fiji	LVC	Yes	No	Nov-99	UNDP, UNEP	X UNDP	X UNEP	X UNEP						3	0	5.2	0.0	209,755	160,999	

Annex II (a)
Implementation of RMPs in LVC Countries

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Annex II (a)

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Country	Status	RMP approved	Programme Approved to Meet 85% CFC Reduction	Date of Approval	Implementing Agency	Recovery and Recycling	Customs Training	Training in Good Refrigeration Practices/Technicians/Trainers	Monitoring	Incentive Programme	Awareness	Assistance in the design of policies and regulations	Other RMP Activities	No. of Approved Projects	No. of Completed Projects	ODP To Be Phased Out	ODP Phased Out	Total Funds Approved including Adjustments (US\$)	Funds Disbursed (US\$)	PCR Received
Gabon	LVC	Yes	No	Nov-98	UNDP, UNEP	X UNDP	X UNEP	X UNEP	X UNDP					4	2	12.2	12.0	284,264	244,122	1
Gambia	LVC	Yes	Yes	Nov-99, Jul-02	UNEP, Germany			X UNEP					Policy development/related information dissemination (UNEP) and Phasing out ODS use in the refrigeration and air conditioning sector (Germany)	3	2	0.0	0.0	138,700	30,000	2
Georgia	LVC	Yes	Yes	Nov-97, Dec-01	UNDP, UNEP	X UNDP		X UNEP	X UNDP	X UNDP			Training in monitoring and controlling ODS (UNEP)	6	1	5.2	4.0	329,100	171,986	
Ghana	LVC	Yes	Yes	Dec-00	UNDP, UNEP	X UNDP	X UNEP		X UNDP	X UNDP				4	0	15.7	9.0	393,357	195,732	
Grenada	LVC	Yes	No	Mar-00	UNDP, UNEP	X UNDP	X UNEP	X UNEP						3	1	1.2	1.0	122,100	62,477	
Guatemala	LVC	Yes	Yes	Mar-99, Dec-01	UNEP		X		X				1) Code of good practices in refrigeration; 2) Licensing system; 3) Alternative to the use of CFC-12 in the refrigeration sector; 4) Establishment and enforcement of legislation.	8	3	0.0	0.0	285,000	30,000	3
Guinea	LVC	Yes	No	Mar-00	UNEP		X	X						2	1	0.0	0.0	109,000	47,000	1
Guyana	LVC	Yes	Yes	Nov-97, Dec-01	Canada, UNEP	X Canada		X UNEP	(Training) UNEP				Assistance for implementation of additional activities in RMP (UNEP)	4	1	6.5	0.0	204,950	138,450	1
Haiti	LVC	Yes	Yes	Apr-03	UNDP, UNEP	X UNDP	X UNEP	X UNEP	X UNDP					4	0	14.0		356,956		
Honduras	LVC	Yes	No	Jul-99	UNIDO	X	X	X						3	0	14.2	0.0	354,150	245,136	
Jamaica	LVC	Yes	Yes*	Mar-99	Canada		X	X						2	2	0.0		105,090	105,090	2
Kenya	LVC	Yes	No	Nov-98	Germany							X		1	0	0.0		20,000	14,000	
Kiribati	LVC	Yes	Yes*	Mar-02	Australia	MAC R&R	X	X					Assistance for enforcing ODS regulations	2	0	0.0	0.0	28,000	0	
Kyrgyzstan	LVC	Yes	Yes	Jul-02	UNDP, UNEP	X UNDP	X UNEP	X UNEP	X UNDP	X UNDP	X UNDP			5	0	11.6	0.0	561,727	9,170	
Lao People's Democratic Republic	LVC	Yes	Yes	Jul-01	France, UNEP, Sweden	X France	X France	X France	X UNEP				Development of import/export licensing system (Sweden)	5	0	0.0	0.0	273,592	16,906	
Lesotho	LVC	Yes	No	Nov-98	Germany							X		1	1	0.0		25,000	25,000	1
Madagascar	LVC	Yes	No	Nov-99	France	X		X					Training of personnel in charge of control and monitoring of imports of ODS	3	0	12.0		154,900	25,627	
Malawi	LVC	Yes	No	Nov-98	Germany							X		1	0	0.0		35,000	32,858	
Maldives	LVC	Yes	Yes	Nov-02	UNDP, UNEP		X UNEP	X UNEP	X UNEP	X UNDP	X UNDP			4	0	3.5	0.0	200,000	0	
Mali	LVC	Yes	Yes	Nov-99, Dec-00	UNDP, UNEP	X UNDP	X UNEP	X UNEP	X UNDP				Assistance in drafting ODS-related legislation (UNEP)	5	2	6.3	0.0	249,093	176,587	2
Marshall Islands	LVC	Yes	Yes*	Mar-02	Australia	MAC R&R	X	X					Assistance for enforcing ODS regulations	2	0	0.0	0.0	34,000	0	
Mauritania	LVC	No	No																	
Mauritius	LVC	Yes	No	Nov-98	Germany							X		1	1	0.0		35,000	35,000	1
Moldova	LVC	Yes	No	Jul-98	UNDP, UNEP	X UNDP		X UNEP	(Training) UNEP					3	1	21.9	22.0	386,396	329,331	
Mongolia	LVC	Yes	Yes	Dec-00	UNEP		X	X						2	0	0.0	0.0	143,170	130,341	1
Mozambique	LVC	Yes	No	Nov-98	Germany							X		1	0	0.0		35,000	33,010	
Myanmar	LVC	No	No																	
Namibia	LVC	Yes	No	Nov-98	Germany							X		1	0	0.0		20,000	16,220	

Annex II (a)
Implementation of RMPs in LVC Countries

Country	Status	RMP approved	Programme Approved to Meet 85% CFC Reduction	Date of Approval	Implementing Agency	Recovery and Recycling	Customs Training	Training in Good Refrigeration Practices/Technicians/Trainers	Monitoring	Incentive Programme	Awareness	Assistance in the design of policies and regulations	Other RMP Activities	No. of Approved Projects	No. of Completed Projects	ODP To Be Phased Out	ODP Phased Out	Total Funds Approved including Adjustments (US\$)	Funds Disbursed (US\$)	PCR Received
Nepal	LVC	Yes	No	Jul-99	UNDP, UNEP	X UNDP		X UNEP	X UNDP				1) Policy development and related information dissemination; 2) Training in monitoring and control of CFC and establishment of import/export licensing system. (UNEP)	5	1	6.0	6.0	217,871	155,768	1
Nicaragua	LVC	Yes	No	Jul-98	Finland							X		1	0	12.8		225,430	15,000	
Niger	LVC	Yes	No	Mar-99	UNDP, UNEP	X UNDP	X UNEP	X UNEP	X UNDP					4	1	5.8	6.0	207,558	137,238	1
Oman	LVC	Yes	Yes	Jul-01	UNIDO	X	X	X	X					4	0	13.0	0.0	470,000	49,525	
Palau	LVC	Yes	Yes*	Mar-02	Australia	MAC R&R	X	X					Assistance for enforcing ODS regulations	2	0	0.0	0.0	38,000	0	
Papua New Guinea	LVC	No	Yes*																	
Paraguay	LVC	Yes	Yes	Dec-00	UNDP, UNEP	X UNDP	X UNEP	X UNEP	X UNEP				Policy dialogue programme on complementary policy and enforcement (UNEP)	4	0	23.0	12.0	508,098	290,295	
Peru	LVC	Yes	No	Mar-99	UNEP		X UNEP						Support for licensing system and Code of good practices in refrigeration (UNEP)	3	2	0.0	0.0	54,000	22,000	2
Qatar	LVC	Yes	Yes	Jul-01	UNIDO	X	X	X	X					4	0	13.0	0.0	470,000	89,225	
Saint Kitts and Nevis	LVC	Yes	No	Mar-98	Canada							X		1	0	2.0		124,300	112,367	
Saint Lucia	LVC	Yes	No	Nov-97	Canada							X		1	0	3.0		146,900	146,900	
Saint Vincent	LVC	Yes	No	Jul-98	UNEP			X	X					2	1	0.0	0.0	65,000	40,000	1
Samoa	LVC	Yes	Yes	Dec-00	UNEP		X	X						2	1	0.0	0.0	102,300	85,866	2
Senegal	LVC	Yes	Yes	Mar-01	UNIDO, UNEP, Switzerland	X UNIDO			X UNEP				Demonstration project to retrofit domestic refrigerators for the use of hydrocarbon refrigerant (Switzerland)	3	1	5.0	0.0	200,730	114,770	1
Seychelles	LVC	Yes	Yes	Nov-98, Jul-03	Germany	X		X		X		X	ODS identification kits for Customs Department	2	1	0.0		66,607	25,000	1
Solomon Islands	LVC	Yes	Yes*	Mar-02	Australia	MAC R&R	X	X					Assistance for enforcing ODS regulations	2	0	0.0	0.0	42,000	0	
Swaziland	LVC	Yes	No	Nov-98	Germany							X		1	0	4.0		90,375	88,550	
Tanzania	LVC	Yes	No	Nov-98	Germany							X		1	0	0.0		45,000	36,757	
Togo	LVC	Yes	Yes	Nov-02	UNDP, UNEP	X UNDP	X UNEP	X UNEP	X UNDP	X UNDP				5	0	13.3	0.0	382,500	0	
Tonga	LVC	Yes	Yes*	Mar-02	Australia	MAC R&R	X	X					Assistance for enforcing ODS regulations	2	0	0.0	0.0	38,000	0	
Trinidad and Tobago	LVC	Yes	Yes*	Nov-97	UNDP, UNEP	X UNDP		X UNEP	(Training) UNEP					3	3	18.5	18.0	278,374	276,374	3
Tuvalu	LVC	Yes	Yes*	Mar-02	Australia	MAC R&R	X	X					Assistance for enforcing ODS regulations	2	0	0.0	0.0	26,000	0	
Uganda	LVC	Yes	No	Nov-98	Germany							X		1	0	0.0		25,000	19,887	
Uruguay	LVC	Yes	Yes	Mar-99, Jul-01	Canada, UNDP, UNEP		X Canada	X Canada		X UNDP			1) Implementation of a license/quota system for ODS (Canada); 2) Demonstration and training project for the use of hydrocarbons as refrigeration (UNEP).	5	2	6.0	0.0	365,704	195,140	
Vanuatu	LVC	Yes	Yes*	Mar-02	Australia	MAC R&R	X	X					Assistance for enforcing ODS regulations	2	0	0.0	0.0	34,000	0	
Yemen	LVC	Yes	Yes	Jul-02	UNDP, UNEP	X UNDP	X UNEP	X UNEP	X UNEP				Establishment of regulations and legislation (UNEP)	5	0	220.0	0.0	1,836,805	86,917	
Zambia	LVC	Yes	No	Nov-98	Germany							X		1	1	0.0		25,000	25,000	1

Annex II (a)
Implementation of RMPs in LVC Countries

Country	Status	RMP approved	Programme Approved to Meet 85% CFC Reduction	Date of Approval	Implementing Agency	Recovery and Recycling	Customs Training	Training in Good Refrigeration Practices/Technicians/Trainers	Monitoring	Incentive Programme	Awareness	Assistance in the design of policies and regulations	Other RMP Activities	No. of Approved Projects	No. of Completed Projects	ODP To Be Phased Out	ODP Phased Out	Total Funds Approved including Adjustments (US\$)	Funds Disbursed (US\$)	PCR Received
Countries Without or Insufficient Data to determine their Status (LVC or Non-LVC)																				
Cambodia	IDR	No	No																	
Cape Verde	NDR	No	No																	
Djibouti	NDR	Yes	Yes	Jul-02	UNDP, UNEP	X UNDP	X UNEP	X UNEP	X UNDP				Assistance to establish legislation (UNEP)	5	0	5.7	0.0	277,763	0	
Guinea Bissau	NDR	No	No																	
Liberia	NDR	No	No																	
Rwanda	NDR	No	No																	
Sao Tome and Principe	NDR	No	No																	
Sierra Leone	IDR	No	No																	
Somalia	NDR	No	No																	
Suriname	NDR	No	No																	
* National CFC Phase-Out Program or Total Phase-Out Plan																				

Annex II (b)
Compliance Data for LVC Countries

Country	Status	Year of Latest Consumption	Latest consumption	CFC baseline (1995-1997)	Total Phase-out approved but not yet implemented (as of September 2003)	RMP Phase-out approved but not yet implemented (as of June 2003)	Date for completion of approved projects	Additional Phase-out Needed to Meet the Freeze	Additional Phase-out Needed to Meet 50% CFC Reduction	Additional Phase-out to Meet 85% CFC Reduction	Additional Phase-out to Meet 100% CFC Reduction	Latest Consumption in Refrigeration Servicing	Year of Latest Consumption in Refrigeration Servicing	Non-Compliance with the Montreal Protocol according to the Implementation Committee	Remaining Eligible Consumption
Albania	LVC	2002	0.0	40.8	21.0		100% by 2006	0.0	0.0	0.0	0.0	N/A		X	N/A
Angola	LVC	2002	105.0	85.8	103.0	103.0	100% by 2008	0.0	0.0	0.0	2.0	N/A	2002		
Antigua and Barbuda	LVC	2002	3.7	10.7	0.0		N/A	0.0	0.0	2.1	3.7	N/A	2002		9.7
Bahamas	LVC	2002	55.0	64.9	18.0		100% by 2003	0.0	4.6	27.3	37.0	N/A	2002	X	N/A
Bahrain	LVC	2002	94.6	135.4	5.0		100% by 2003	0.0	21.9	69.3	89.6	N/A	2002		97.9**
Barbados	LVC	2002	9.5	21.5	0.0		N/A	0.0	0.0	6.3	9.5	N/A	2002		21.5
Belize	LVC	2002	21.7	24.4	0.0		N/A	0.0	9.5	18.0	21.7	N/A	2002	X	14.3**
Benin	LVC	2002	35.5	59.9	27.3		100% by 2003	0.0	0.0	0.0	8.2	N/A	2002		27.3
Bolivia	LVC	2002	65.5	75.7	23.9	14.0	100% by 2005	0.0	3.7	30.2	41.6	N/A	2002	X	38.0
Bosnia and Herzegovina	LVC	2002	237.0	24.2	112.6		100% by 2004	100.2	112.3	120.8	124.4	N/A	2002	X	
Botswana	LVC	2000	2.5	6.9	1.5	1.5	100% by 2003	0.0	0.0	0.0	1.0	N/A	2000		5.3
Brunei Darussalam	LVC	2002	43.4	78.2	0.0		N/A	0.0	4.3	31.7	43.4	N/A	2002		78.2
Burkina Faso	LVC	2002	16.3	36.3	3.0	3.0	100% by 2006	0.0	0.0	7.9	13.3	N/A	2002		22.4
Burundi	LVC	2001	46.5	59.0	35.5	0.4	100% by 2005	0.0	0.0	0.0	2.1	N/A	2001		18.5**
Cameroon	LVC	2002	226.0	256.9	112.6	112.6	100% by 2007	0.0	0.0	74.9	113.4	N/A	2002	X	-1.1
Central African Republic	LVC	2002	3.8	11.3	0.0		N/A	0.0	0.0	2.1	3.8	N/A	2002		4.3
Chad	LVC	2001	31.6	34.6	6.0	6.0	100% by 2006	0.0	8.3	20.4	25.6	N/A	2000		21.7
Comoros	LVC	2002	1.8	2.5	0.0		N/A	0.0	0.6	1.4	1.8	N/A	1999		2.5
Congo	LVC	2002	5.5	11.9	0.0		N/A	0.0	0.0	3.7	5.5	N/A	2002		-7.8
Costa Rica	LVC	2002	137.4	250.2	0.0		N/A	0.0	12.3	99.8	137.4	N/A	2002		152.9
Cote D'Ivoire	LVC	2002	106.5	294.2	42.8	24.8	100% by 2006	0.0	0.0	19.6	63.7	N/A	1998		164.6
Croatia	LVC	2002	140.1	219.3	50.0	0.0	100% by 2004	0.0	0.0	57.2	90.1	N/A	2002		N/A
Dominica	LVC	2002	3.0	1.5	0.0		N/A	1.5	2.2	2.7	3.0	N/A	2002		1.5**
Ecuador	LVC	2002	229.6	301.4	0.0		N/A	0.0	78.9	184.3	229.6	N/A	2002		225.3
El Salvador	LVC	2002	101.6	306.6	0.0	0.0	N/A	0.0	0.0	55.6	101.6	N/A	2002		247.9
Ethiopia	LVC	2002	30.0	33.8	0.0		N/A	0.0	13.1	24.9	30.0	N/A	2002	X	39.2
Federated States of Micronesia	LVC	2000	1.0	1.2	0.0		N/A	0.0	0.4	0.9	1.0	N/A			N/A
Fiji	LVC	2002	0.0	33.4	5.2	5.2	100% by 2003	0.0	0.0	0.0	0.0	N/A	2001		28.2
Gabon	LVC	2002	5.0	10.3	0.0	0.0	N/A	0.0	0.0	3.5	5.0	N/A	2002		1.5
Gambia	LVC	2002	4.7	23.8	0.0		N/A	0.0	0.0	1.1	4.7	N/A	2002		6.1
Georgia	LVC	2002	15.5	22.5	1.5	1.5	100% by 2005	0.0	2.8	10.6	14.0	N/A	2002		16.3
Ghana	LVC	2002	21.2	35.8	6.7	6.7	100% by 2006	0.0	0.0	9.1	14.5	N/A	2001		31.3
Grenada	LVC	1998	3.8	6.0	1.2	1.2	100% by 2002	0.0	0.0	1.7	2.6	N/A	1998		
Guatemala	LVC	2002	239.6	224.7	0.0		N/A	14.9	127.2	205.9	239.6	N/A	2002	X***	191.1
Guinea	LVC	2001	35.4	42.4	0.0		N/A	0.0	14.2	29.0	35.4	N/A	2001		29.5**
Guyana	LVC	2002	14.3	53.2	6.5	6.5	100% by 2003	0.0	0.0	0.0	7.8	N/A	2002		39.5**
Haiti	LVC	2001	169.0	169.0	14.0	14.0	100% by 2006	0.0	70.5	129.6	155.0	N/A			
Honduras	LVC	2002	131.2	331.6	14.2	14.2	100% by 2003	0.0	0.0	67.3	117.0	N/A	2002		317.4
Jamaica	LVC	2002	31.7	93.2	59.5		100% by 2006	0.0	0.0	0.0	0.0	N/A	2002		N/A
Kenya	LVC	2002	152.3	239.5	8.5		100% by 2003	0.0	24.1	107.9	143.8	N/A	2002		190.2**
Kiribati	LVC	2002	0.0	0.7	0.0		N/A	0.0	0.0	0.0	0.0	N/A			N/A
Kyrgyzstan	LVC	2001	53.0	72.8	11.6	11.6	100% by 2007	0.0	5.0	30.5	41.4	N/A			
Lao People's Democratic Republic	LVC	2002	42.3	43.3	16.3		100% by 2004	0.0	4.4	19.5	26.0	N/A	2002		28.3**
Lesotho	LVC	2000	2.4	5.1	0.0		N/A	0.0	0.0	1.6	2.4	N/A	1998		2.4
Madagascar	LVC	2001	9.9	47.9	12.0	12.0	100% by 2003	0.0	0.0	0.0	0.0	N/A	2001		35.9
Malawi	LVC	2002	19.0	57.7	33.0		100% by 2003	0.0	0.0	0.0	0.0	N/A	2002		24.7
Maldives	LVC	2002	2.8	4.6	3.5	3.5	100% by 2005	0.0	0.0	0.0	0.0	N/A	1998	X	1.1
Mali	LVC	2002	26.0	108.1	6.3	6.3	100% by 2004	0.0	0.0	3.5	19.7	N/A	2002		82.3
Marshall Islands	LVC	2000	0.5	1.2	0.0		N/A	0.0	0.0	0.4	0.5	N/A			N/A
Mauritania	LVC	1999	13.4	15.7	2.0		100% by 2000	0.0	3.6	9.1	11.4	N/A	1999		13.7**
Mauritius	LVC	2002	7.3	29.1	8.0		100% by 2003	0.0	0.0	0.0	0.0	N/A	2002		5.1
Moldova	LVC	2001	23.5	73.3	0.0		N/A	0.0	0.0	12.5	23.5	N/A	2001		51.4
Mongolia	LVC	2002	6.9	10.6	5.6		100% by 2005	0.0	0.0	0.0	1.3	N/A	2002		5.0
Mozambique	LVC	2001	8.4	18.2	0.0		N/A	0.0	0.0	5.7	8.4	N/A	1997		11.3**
Myanmar	LVC	2002	43.5	54.3	0.0		N/A	0.0	16.4	35.4	43.5	N/A	1997		54.3
Namibia	LVC	2002	20.0	21.9	0.0		N/A	0.0	9.1	16.7	20.0	N/A	2002	X	16.7

Annex II (b)
Compliance Data for LVC Countries

Country	Status	Year of Latest Consumption	Latest consumption	CFC baseline (1995-1997)	Total Phase-out approved but not yet implemented (as of September 2003)	RMP Phase-out approved but not yet implemented (as of June 2003)	Date for completion of approved projects	Additional Phase-out Needed to Meet the Freeze	Additional Phase-out Needed to Meet 50% CFC Reduction	Additional Phase-out to Meet 85% CFC Reduction	Additional Phase-out to Meet 100% CFC Reduction	Latest Consumption in Refrigeration Servicing	Year of Latest Consumption in Refrigeration Servicing	Non-Compliance with the Montreal Protocol according to the Implementation Committee	Remaining Eligible Consumption
Nepal	LVC	2002	0.0	27.0	0.0		N/A	0.0	0.0	0.0	0.0	0.0	2002	X	21.0**
Nicaragua	LVC	2001	35.2	82.8	12.8	12.8	100% by 2003	0.0	0.0	9.9	22.4	N/A	2000		60.4**
Niger	LVC	2002	26.6	32.0	0.0	0.0	N/A	0.0	10.6	21.8	26.6	29.1	2001		26.2
Oman	LVC	2002	179.5	248.4	13.0	13.0	100% by 2005	0.0	42.3	129.2	166.5	179.5	2002		269.1
Palau	LVC	2002	0.1	1.6	0.0		N/A	0.0	0.0	0.0	0.1	0.1	2002		N/A
Papua New Guinea	LVC	2002	0.0	36.3	30.8		100% by 2005	0.0	0.0	0.0	0.0	N/A	1998	X***	N/A
Paraguay	LVC	2002	96.9	210.6	16.1	11.0	100% by 2005	0.0	0.0	49.2	80.8	96.9	2002		59.3
Peru	LVC	2002	196.5	289.5	33.8		100% by 2005	0.0	17.9	119.3	162.7	140.2	2002		227.2
Qatar	LVC	2002	106.0	101.4	13.0	13.0	100% by 2004	0.0	42.3	77.8	93.0	N/A	2001		88.4**
Saint Kitts and Nevis	LVC	2002	5.3	3.7	2.0	2.0	100% by 2003	0.0	1.5	2.8	3.3	5.3	2002		1.7**
Saint Lucia	LVC	2001	3.0	8.3	3.0	3.0	100% by 2003	0.0	0.0	0.0	0.0	N/A	2001		5.3
Saint Vincent	LVC	2002	6.0	1.8	0.0		N/A	4.2	5.1	5.7	6.0	3.8	1998	X	
Samoa	LVC	2002	2.2	4.5	0.0		N/A	0.0	0.0	1.5	2.2	0.3	2002		4.8
Senegal	LVC	2002	71.9	155.8	5.0	5.0	100% by 2003	0.0	0.0	43.5	66.9	71.9	2002		114.7
Seychelles	LVC	2002	1.5	2.9	0.0		N/A	0.0	0.1	1.1	1.5	N/A	2002		2.8
Solomon Islands	LVC	2001	0.6	2.0	0.0		N/A	0.0	0.0	0.3	0.6	N/A			N/A
Swaziland	LVC	2001	1.3	24.6	4.0	4.0	100% by 2003	0.0	0.0	0.0	0.0	N/A	2001		20.6
Tanzania	LVC	2001	131.2	253.9	86.2		100% by 2004	0.0	0.0	6.9	45.0	N/A	2001		82.0
Togo	LVC	2002	35.3	39.8	13.3	13.3	100% by 2006	0.0	2.1	16.0	22.0	35.3	2002		26.5
Tonga	LVC	2002	0.8	1.3	0.0		N/A	0.0	0.1	0.6	0.8	0.8	2002		N/A
Trinidad and Tobago	LVC	2002	63.6	120.0	48.9		100% by 2006	0.0	0.0	0.0	14.7	63.6	2002		N/A
Tuvalu	LVC	2002	0.0	0.3	0.0		N/A	0.0	0.0	0.0	0.0	N/A			N/A
Uganda	LVC	2001	13.4	12.8	0.0		N/A	0.6	7.0	11.5	13.4	N/A	1999		12.8
Uruguay	LVC	2002	75.2	199.1	10.3	6.0	100% by 2007	0.0	0.0	35.0	64.9	71.3	2002		137.5
Vanuatu	LVC	2002	0.0	0.0	0.0		N/A	0.0	0.0	0.0	0.0	N/A			N/A
Yemen	LVC	2002	959.9	349.1	412.7	220.0	100% by 2005	198.1	372.7	494.8	547.2	698.4	2002		
Zambia	LVC	2001	11.8	27.4	0.0		N/A	0.0	0.0	7.7	11.8	11.7	2001		27.4
Countries Without or Insufficient Data to determine their Status (LVC or Non-LVC)															
Cambodia	IDR	2002	94.2	NDR	0.0		N/A				94.2	94.2	2002		
Cape Verde	NDR		NDR	NDR	0.0		N/A					N/A			
Djibouti	NDR		NDR	NDR	5.7	5.7	100% by 2004					N/A			
Guinea Bissau	NDR		NDR	NDR	0.0		N/A					N/A			
Liberia	NDR		NDR	NDR	0.0		N/A					N/A			
Rwanda	NDR		NDR	NDR	0.0		N/A					N/A			
Sao Tome and Principe	NDR		NDR	NDR	0.0		N/A					N/A			
Sierra Leone	IDR	2002	80.8	NDR	0.0		N/A				80.8	N/A			
Somalia	NDR		NDR	NDR	0.0		N/A					N/A			
Suriname	NDR		NDR	NDR	0.0		N/A					N/A			
** Countries which have not made or confirmed their final selection of an option. As per Decision 37/66, Option 1 will be applied if such a country submits a project without making a selection.															
*** Countries in potential non-compliance with the CFC freeze according to the Implementation Committee.															

Annex III
Implementation of RMPs in Non-LVC Countries

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Annex III

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Country	Status	RMP approved	Programme Approved to Meet 85% CFC Reduction	Date of Approval	Implementing Agency	Recovery and Recycling	Customs Training	Training in Good Refrigeration Practices/Technicians/Trainers	Monitoring	Incentive Programme	Awareness	Assistance in the design of policies and regulations	Other RMP Activities	No. of Approved Projects	No. of Completed Projects	ODP To Be Phased Out	ODP Phased Out	Total Funds Approved including Adjustments (US\$)	Funds Disbursed (US\$)	PCR Received
Algeria	Non-LVC	Yes	No	Jul-02, Apr-03	UNIDO	X	X	X						2	0	45.0	0.0	900000	13596	
Argentina	Non-LVC	No	No																	
Bangladesh	Non-LVC	Yes	No	Nov-99	UNDP, UNEP	X UNDP	X UNEP	X UNEP	X UNDP					4	0	12.6	0.0	424,225	271,148	
Brazil	Non-LVC	No	Yes*																	
Chile	Non-LVC	Yes	No	Dec-01	Canada, UNEP	X Canada		X Canada	X UNEP		X UNEP		Enabling a control and regulatory network (UNEP)	6	1	40.0	0.0	1,160,920	76,400	
China	Non-LVC	No	No																	
Colombia	Non-LVC	No	No																	
Congo, DR	Non-LVC	No	No																	
Cuba	Non-LVC	Yes	No	Nov-99, Mar-00	Canada	X	X	X					Implementation and enforcement of regulations on ODS	4	0	8.0		210,000	198,400	
Dominican Republic	Non-LVC	Yes	No	Jul-98	UNDP, UNEP	X UNDP	X UNEP	X UNEP	X UNDP					4	2	37.4	37.0	505,468	467,132	1
Egypt	Non-LVC	Yes	No	Nov-99	Germany	X							Modification of legal provisions and information system and Implementation of measures to address the informal sector.	3	0	100.0		912,000	784,682	
India	Non-LVC	No	No																	
Indonesia	Non-LVC	No	No																	
Iran	Non-LVC	No	No																	
Jordan	Non-LVC	Yes	Yes*	Jul-99	UNIDO	X	X	X					Technical assistance and support to develop regulations for ODS to implement the Environment Law of 1995	4	3	19.1	0.0	437,194	353065	3
Korea DPR	Non-LVC	Yes	No	Jul-03	UNEP		X						Assistance for the development of a licensing system	1	0	0.0		50,000		
Kuwait	Non-LVC	Yes	No	Jul-02	UNIDO, UNEP	X UNIDO	X UNEP	X UNEP	X UNEP					4	0	64.0	0.0	624,586	0	
Lebanon	Non-LVC	No	No																	
Libya	Non-LVC	No	No																	
Macedonia	Non-LVC	Yes	No	Jul-99	UNIDO	X	X	X						3	3	13.5	13.5	313,956	270,015	3
Malaysia	Non-LVC	No	Yes*																	
Mexico	Non-LVC	No	No																	
Morocco	Non-LVC	No	No																	
Nigeria	Non-LVC	No	Yes*																	
Pakistan	Non-LVC	No	No																	
Panama	Non-LVC	Yes	No	Nov-99	Finland, UNEP		X Finland	X UNEP	X Finland				Monitoring on assistance to develop legislation (UNEP)	4	0	0.0	0.0	239,200	39,366	
Philippines	Non-LVC	No	Yes*																	
Romania	Non-LVC	Yes	No	Jul-99	UNIDO	X	X	X					Development criteria for ODS and ODS consuming equipment imports	3	3	50.0	50.0	466,409	465,026	3
Serbia and Montenegro	Non-LVC	No	No																	
South Africa	Non-LVC	No	No																	
Sri Lanka	Non-LVC	Yes	No	Dec-00	UNDP, UNEP		X UNEP	X UNEP	X UNDP	X UNDP				4	0	5.0	0.0	571,455	172,670	
Sudan	Non-LVC	Yes	No	Jul-99	UNIDO	X	X	X					Development criteria for ODS and ODS consuming equipment imports	3	1	50.0	0.0	458,250	339,614	
Syria	Non-LVC	Yes	No	Nov-99, Mar-00	Germany, UNEP	X Germany	X UNEP	X UNEP					Assistance for the establishment of regulations and legislation (UNEP)	4	0	120.0	0.0	1,041,546	700,718	

Annex III
Implementation of RMPs in Non-LVC Countries

Country	Status	RMP approved	Programme Approved to Meet 85% CFC Reduction	Date of Approval	Implementing Agency	Recovery and Recycling	Customs Training	Training in Good Refrigeration Practices/Technicians/Trainers	Monitoring	Incentive Programme	Awareness	Assistance in the design of policies and regulations	Other RMP Activities	No. of Approved Projects	No. of Completed Projects	ODP To Be Phased Out	ODP Phased Out	Total Funds Approved including Adjustments (US\$)	Funds Disbursed (US\$)	PCR Received
Thailand	Non-LVC	No	Yes*																	
Tunisia	Non-LVC	No	No																	
Turkey	Non-LVC	No	Yes*																	
Venezuela	Non-LVC	No	No																	
Vietnam	Non-LVC	Yes	No	Jul-01, Dec-01	UNDP, UNEP, Poland	X (R&R, MAC R&R) UNDP	X Poland	X UNEP	X UNDP				Workshop for finalisation of regulations (UNEP)	6	1	22.8	0.0	666,863	42,440	1
Zimbabwe	Non-LVC	Yes	No	Nov-98	Germany							X		1	0	0.0		45,000	40,985	
* National CFC Phase-Out Program or Total Phase-Out Plan																				

Annex IV
Compliance Data for Non-LVC Countries

Country	Status	Year of Latest Consumption	Latest consumption	CFC baseline (1995-1997)	Total Phase-out approved but not yet implemented (as of September 2003)	RMP Phase-out approved but not yet implemented (as of June 2003)	Date for completion of approved projects	Additional Phase-out Needed to Meet the Freeze	Additional Phase-out Needed to Meet 50% CFC Reduction	Additional Phase-out to Meet 85% CFC Reduction	Additional Phase-out to Meet 100% CFC Reduction	Latest Consumption in Refrigeration Servicing	Year of Latest Consumption in Refrigeration Servicing	Non-Compliance with the Montreal Protocol according to the Implementation Committee	Remaining Eligible Consumption
Algeria	Non-LVC	2002	1,002.8	2,119.5	439.1	45.0	100% by 2004	0.0	0.0	245.8	563.7	N/A	2002		452.8**
Argentina	Non-LVC	2002	2,139.2	4,697.3	632.3		100% by 2005	0.0	0.0	802.3	1,506.9	1,764.4	2002		2,294.7
Bangladesh	Non-LVC	2002	328.0	581.6	12.6	12.6	100% by 2003	0.0	24.6	228.2	315.4	205.6	2002		664.4
Brazil	Non-LVC	2002	2,660.4	10,525.8	2,628.5		100% by 2005	0.0	0.0	0.0	31.9	4,035.0	2002		N/A
Chile	Non-LVC	2001	470.2	828.7	475.2	40.0	100% by 2005	0.0	0.0	0.0	0.0	168.5	2001		607.0
China	Non-LVC	2001	33,922.6	57,818.7	23,018.7		100% by 2007	0.0	0.0	2,231.1	10,903.9	0.0	2001		2,377.5
Colombia	Non-LVC	2002	1,037.0	2,208.2	284.0		100% by 2005	0.0	0.0	421.8	753.0	853.4	2002		1,285.1
Congo, DR	Non-LVC	2002	569.4	665.7	137.0		100% by 2005	0.0	99.6	332.6	432.4	241.0	2002		249.6
Cuba	Non-LVC	2002	488.8	625.1	48.5	8.0	100% by 2005	0.0	127.8	346.6	440.3	366.3	2002		573.4
Dominican Republic	Non-LVC	2002	329.8	539.8	17.9	0.0	100% by 2005	0.0	41.9	230.9	311.9	325.8	2002		332.9**
Egypt	Non-LVC	2002	1,294.0	1,668.0	137.9	100.0	100% by 2005	0.0	322.1	905.9	1,156.1	800.0	2002		765.7
India	Non-LVC	2002	3,913.66	6,681.1	1,955.7		100% by 2005	0.0	0.0	955.8	1,958.0	1,352.0	2002		876.3
Indonesia	Non-LVC	2002	5,506.3	8,332.7	2,881.3		100% by 2005	0.0	0.0	1,375.1	2,625.0	2,222.2	2002		396.9
Iran	Non-LVC	2001	4,204.8	4,571.7	2,273.4		100% by 2004	0.0	0.0	1,245.6	1,931.4	851.0	2001		1,693.8
Jordan	Non-LVC	2002	191.8	673.3	427.8	19.1	100% by 2009	0.0	0.0	0.0	0.0	39.8	2002		N/A
Korea DPR	Non-LVC	2002	299.0	441.7	0.0		N/A	0.0	78.2	232.7	299.0	243.0	2002		291.7**
Kuwait	Non-LVC	2002	349.0	480.4	64.0	64.0	100% by 2005	0.0	44.8	212.9	285.0	N/A			
Lebanon	Non-LVC	2002	491.7	725.5	251.8		100% by 2004	0.0	0.0	131.1	239.9	350.4	2002		47.1**
Libya	Non-LVC	2001	985.4	716.7	367.4		100% by 2005	0.0	259.6	510.5	618.0	N/A	2000	X	618.0
Macedonia	Non-LVC	2002	34.1	519.7	25.0		100% by 2003	0.0	0.0	0.0	9.1	34.1	2002		97.2
Malaysia	Non-LVC	2002	1,605.5	3,271.1	466.8		100% by 2004	0.0	0.0	648.1	1,138.7	1,312.9	2002		N/A
Mexico	Non-LVC	2002	1,943.7	4,624.9	179.9		100% by 2005	0.0	0.0	1,070.1	1,763.8	849.4	2002		2879.6
Morocco	Non-LVC	2002	668.6	802.3	333.7		100% by 2004	0.0	0.0	214.5	334.9	N/A	2002		18.4**
Nigeria	Non-LVC	2002	3,286.7	3,650.0	647.5		100% by 2005	0.0	814.2	2,091.7	2,639.2	N/A	2002	X	N/A
Pakistan	Non-LVC	2001	1,666.3	1,679.4	1,066.3		100% by 2005	0.0	0.0	348.1	600.0	N/A	2001		472.9**
Panama	Non-LVC	2002	195.3	384.2	42.0		100% by 2003	0.0	0.0	95.7	153.3	175.3	2002		299.2
Philippines	Non-LVC	2002	1,632.3	3,055.9	15.0		100% by 2004	0.0	89.4	1,158.9	1,617.3	N/A	2002		N/A
Romania	Non-LVC	2001	185.7	675.8	0.0		N/A	0.0	0.0	84.4	185.7	153.1	2001		145.8
Serbia and Montenegro	Non-LVC	2002	371.7	849.2	276.8		100% by 2005	0.0	0.0	0.0	94.9	207.2	2002		517.8**
South Africa	Non-LVC	2001	16.0	592.6	0.0		N/A	0.0	0.0	0.0	16.0	N/A			
Sri Lanka	Non-LVC	2002	185.0	445.6	16.1	5.0	100% by 2006	0.0	0.0	102.1	168.9	182.9	2002		337.0
Sudan	Non-LVC	2002	253.0	456.8	50.0	50.0	100% by 2003	0.0	0.0	134.5	203.0	207.0	2002		359.2
Syria	Non-LVC	2002	1,201.6	2,224.7	738.5	120.0	100% by 2006	0.0	0.0	129.4	463.1	386.5	2002		137.1
Thailand	Non-LVC	2002	3,063.1	6,082.1	491.8		100% by 2005	0.0	0.0	1,659.0	2,571.3	1,996.5	2002		N/A
Tunisia	Non-LVC	2002	465.8	870.1	295.4		100% by 2005	0.0	0.0	39.9	170.4	178.0	2002		157.6
Turkey	Non-LVC	2002	697.4	3,805.7	610.8		100% by 2004	0.0	0.0	0.0	86.6	697.4	2002		N/A
Venezuela	Non-LVC	2002	1,550.6	3,322.4	418.2		100% by 2004	0.0	0.0	634.1	1,132.4	1,383.6	2002		2,044.8
Vietnam	Non-LVC	2002	235.5	500.0	72.4	22.8	100% by 2005	0.0	0.0	88.1	163.1	197.0	2002		186.8
Zimbabwe	Non-LVC	2001	259.4	451.4	0.0		N/A	0.0	33.7	191.7	259.4	259.4	2001		430.2

** Countries which have not made or confirmed their final selection of an option. As per Decision 37/66, Option 1 will be applied if such a country submits a project without making a selection.

OVERVIEW OF RECOVERY AND RECYCLING PROJECTS APPROVED OUTSIDE RMPs

Country	Status	RMP approved	Programme Approved to Meet 85% CFC Reduction	Date of R&R Approval	Implementing Agency	Recovery/Recycling outside RMP	MAC Recovery/Recycling outside RMP	R&R Phase-out approved but not yet implemented (as of June 2003)	Number of Approved Projects	Number of Completed Projects	ODP To Be Phased Out	ODP Phased Out	Total Funds Approved including Adjustments (US\$)	Funds Disbursed (US\$)	PCR Received
Argentina	Non-LVC	No	No	Mar-95, Jul-95	USA, Australia	X Australia	X USA		2	2	20.4	20.0	210,000	210,000	1
Bahrain	LVC	Yes	No	May-97	UNDP	X			1	1	20.5	20.0	239,151	239,151	1
Barbados	LVC	No	No	Nov-95	UNIDO	X			1	1	14.0	14.0	164,688	164,688	1
Benin	LVC	Yes	Yes	May-97	UNIDO	X			1	1	12.9	12.9	113,903	113,903	1
Bolivia	LVC	Yes	Yes	Oct-96	UNDP	X			1	1	13.8	14.0	145,309	145,309	1
Burkina Faso	LVC	Yes	Yes	May-97	UNIDO	X			1	1	15.5	15.5	96,000	96,000	1
Chile	Non-LVC	Yes	No	Jun-92, May-96	IBRD, USA	X IBRD	X USA		2	2	14.0	14.0	260,000	260,000	2
China	Non-LVC	No	No	Feb-92, Nov-93, Mar-95, Jul-95, May-96	UNDP, USA, Denmark	X UNDP/USA/ Denmark	X UNDP/USA		7	7	48.4	21.4	1,173,311	1,129,364	7
Colombia	Non-LVC	No	No	Dec-94, Jul-95	USA, UNDP	X UNDP	X USA		2	2	122.5	123.0	898,685	907,025	1
Congo	LVC	Yes	Yes	Oct-96	UNDP	X			1	1	19.2	19.0	187,320	187,320	1
Costa Rica	LVC	No	No	Oct-92, May-96	USA, UNDP	X UNDP	X USA		2	2	47.1	18.0	451,693	451,693	1
Cuba	Non-LVC	Yes	No	Dec-94	UNDP	X			1	1	49.0	49.0	163,833	163,833	1
Dominican Republic	Non-LVC	Yes	No	Jul-95, Nov-95	UNDP, USA	X UNDP/USA	X USA	0.0	3	3	0.0	17.0	372,000	372,000	3
Gambia	LVC	Yes	Yes	May-97	UNIDO	X			1	1	7.8	7.7	67,650	67,650	1
Ghana	LVC	Yes	Yes	Oct-92	UNDP	X			1	1	50.0	50.0	328,000	328,000	1
Guatemala	LVC	Yes	Yes	Nov-95, May-96	UNDP, USA	X UNDP	X USA		2	2	36.0	26.0	357,131	357,131	2
Guinea	LVC	Yes	No	May-97	UNIDO	X			1	1	12.9	12.9	80,780	80,780	1
India	Non-LVC	No	No	Jun-93	UNIDO	X			1	1	0.0	0.0	12,061	12,061	1
Indonesia	Non-LVC	No	No	Dec-94	IBRD		X		1	1	41.0	41.0	275,407	275,407	
Iran	Non-LVC	No	No	Nov-97	France	X			1		0.0		345,923	183,106	
Jamaica	LVC	Yes	Yes*	Nov-95, Nov-97	USA, UNDP	X UNDP	X USA		2	2	26.6	17.0	289,099	289,098	2
Kenya	LVC	Yes	No	Jul-99	Germany	X		8.5	1		8.5		98,725	87,361	
Lebanon	Non-LVC	No	No	Nov-97	France	X		62.0	1		62.0		425,289	0	
Lesotho	LVC	Yes	No	May-97	UNDP	X			1	1	3.6	4.0	56,095	56,095	1
Malawi	LVC	Yes	No	May-96	UNDP	X			1	1	7.2	7.0	106,009	106,009	1
Malaysia	Non-LVC	No	Yes*	Feb-92, Nov-95	IBRD	X	X		2	2	475.0	374.5	1,614,172	1,614,172	1
Mauritius	LVC	Yes	No	Jul-99	Germany	X		8.0	1		8.0		183,377	170,501	
Mexico	Non-LVC	No	No	Nov-91, Jul-94, Nov-95	IBRD, USA, UNDP	X IBRD/UNDP	X USA		5	5	260.0	351.3	1,176,817	1,176,817	5
Mongolia	LVC	Yes	Yes	Dec-01	UNDP	X		5.6	1		5.6	0.0	108,600	19,309	
Morocco	Non-LVC	No	No	Nov-97	France	X		22.0	1		22.0		355,867	0	
Mozambique	LVC	Yes	No	May-97	UNDP	X			1	1	6.9	7.0	115,671	115,671	1
Namibia	LVC	Yes	No	Mar-98	Germany	X			1	1	0.0	0.0	34,400	34,400	
Panama	Non-LVC	Yes	No	Nov-95	UNDP	X			1	1	17.0	17.0	161,857	161,857	
Peru	LVC	Yes	No	May-96	UNDP	X			1	1	28.6	29.0	289,587	289,587	1
Philippines	Non-LVC	No	Yes*	Nov-95, May-97	USA, UNIDO	X UNIDO	X USA		2	2	71.0	60.0	842,067	842,067	1
Senegal	LVC	Yes	Yes	May-97	UNIDO	X			1	1	36.1	36.1	136,250	136,250	1
Sri Lanka	Non-LVC	Yes	No	Oct-96	UNDP	X			1	1	31.2	31.0	350,928	350,928	1
Tanzania	LVC	Yes	No	Mar-02	Germany	X		11.7	1		11.7		164,223	6,568	
Thailand	Non-LVC	No	Yes*	Jun-92	IBRD		X	250.0	1		250.0	0.0	900,000	637,572	
Trinidad and Tobago	LVC	Yes	Yes*	Nov-97	USA		X		1	1	10.0		117,000	117,000	1
Tunisia	Non-LVC	No	No	Jun-92	IBRD	X			1	1	42.0	42.0	332,836	332,836	1
Turkey	Non-LVC	No	Yes*	Jun-92, Nov-97	IBRD, USA	X IBRD	X USA		3	3	17.0	4.0	587,080	587,080	3
Uganda	LVC	Yes	No	May-96	UNDP	X			1	1	3.6	4.0	55,983	55,983	1
Uruguay	LVC	Yes	Yes	Mar-94, Nov-95	UNDP, IBRD	X UNDP/IBRD			2	2	26.0	22.0	262,551	255,552	2
Venezuela	Non-LVC	No	No	Oct-92, Mar-93, Mar-94, Jul-94, Dec-94, May-97	USA, UNDP, Canada	X UNDP/Canada	X USA/UNDP	87.0	8	7	280.0	109.0	1,975,418	1,913,864	7
Vietnam	Non-LVC	Yes	No	Oct-96	UNDP, Australia, USA	X UNDP/Australia	X USA		3	3	28.2	28.0	591,812	501,985	
Zambia	LVC	Yes	No	May-96	UNDP	X			1	1	7.2	7.0	106,080	106,080	1
Zimbabwe	Non-LVC	Yes	No	Jul-95	UNIDO	X			1	1	47.0	47.0	311,663	311,663	1

Annex V (b):

OVERVIEW OF TRAINING PROJECTS APPROVED OUTSIDE RMPs

Country	Status	RMP approved	Programme Approved to Meet 85% CFC Reduction	Date of R&R Approval	Implementing Agency	Customs Training	Training in Good Refrigeration Practices/Technicians/Trainers	Phase-out approved but not yet implemented (as of September 2003)	Number of Approved Projects	Number of Completed Projects	ODP To Be Phased Out	ODP Phased Out	Total Funds Approved including Adjustments (US\$)	Funds Disbursed (US\$)	PCR Received
Albania	LVC	No	Yes*	Apr-03	UNEP	X	X	0.0	2	0	0.0	0.0	118,125	0	0
Argentina	Non-LVC	No	No	Feb-97, Dec-00	UNEP	X	X	0.0	3	1	44.8	44.8	690,000	244,000	1
Brazil	Non-LVC	No	Yes*	Jul-02	Germany	X	X	0.0	2	0	0.0	0.0	1,640,000	170,820	0
Colombia	Non-LVC	No	No	Jul-95, Dec-01	UNEP, Canada	X Canada	X UNEP	0.0	2	0	0.0	0.0	255,250	110,000	0
Cote D'Ivoire	LVC	Yes	Yes	Jul-94	UNEP		X	0.0	1	1	0.0	0.0	76,000	76,000	1
Ethiopia	LVC	Yes	No	Mar-00	UNEP		X R&R	0.0	1	0	0.0	0.0	82,735	65,255	0
Gambia	LVC	Yes	Yes	May-96	UNEP	X		0.0	1	1	0.0	0.0	9,500	8,500	1
Ghana	LVC	Yes	Yes	Jun-93	UNEP		X	0.0	1	1	0.0	0.0	99,000	99,000	1
Guatemala	LVC	Yes	Yes	Feb-97	UNEP		X	0.0	1	1	68.3	68.3	70,000	70,000	1
Korea, DPR	Non-LVC	Yes	No	Jul-03	UNEP		X	0.0	1	0	0.0	0.0	70,000	0	0
Lebanon	Non-LVC	No	No	Nov-97	France		X R&R	0.0	1	1	0.0	0.0	52,668	52,668	1
Mauritania	LVC	No	No	Sep-94	France		X	0.0	1	1	0.0	0.0	25,000	25,000	1
Morocco	Non-LVC	No	No	Nov-97	France		X R&R	0.0	1	1	0.0	0.0	53,361	53,361	1
Namibia	LVC	Yes	No	Oct-96	Finland		X R&R	0.0	1	1	5.4	0.0	103,440	103,440	1
Peru	LVC	Yes	No	Feb-97	UNEP		X	0.0	1	1	44.8	44.8	70,000	54,922	1
Philippines	Non-LVC	No	Yes*	Jun-91, Dec-01	UNDP, UNEP	X UNEP	X UNDP	0.0	2	1	0.0	0.0	232,543	82,293	1
Senegal	LVC	Yes	Yes	Nov-93, Feb-97	UNEP, France		X	0.0	2	2	0.0	0.0	74,500	74,500	2
Venezuela	Non-LVC	No	No	Jul-01	UNEP	X		0.0	1	0	0.0	0.0	120,000	12,000	0
* National CFC Phase-Out Program or Total Phase-Out Plan															

Annex VI
Evaluation of RMPs in the countries visited – Observations from the Case Studies

Issues	Bahrain	Ghana	Guatemala	Jamaica	Macedonia	Mauritius	Peru	Saint Lucia	Senegal	Uruguay
Overall progress	Baseline: 135,4 t (CFC) Consumption in 2002: 94,6 t Phase-out achieved by 2002: -30%	Baseline: 35,8 t (CFC) Consumption 2002: 21,1 t. Phase-out achieved:-41%	Baseline:224,6 t (CFC) (corrected by NOU to 324 t) Consumption 2002: 239,6 t Phase-out achieved: to be clarified.	Baseline: 93,2 t (CFC) Consumption 2002: 31,7 t Phase-out achieved: -66%	Baseline: 519,7 t (CFC) Consumption in 2002: 34,1 t. Phase-out achieved: -94%	Baseline: 29,1 t (CFC) Consumption in 2002: 7,3 t. Phase-out achieved: -75%	Baseline: 289,5 t Consumption 2002: 196,5 t. Phase-out achieved: -32.1%	Baseline: 8,3 t (CFC) Consumption 2001: 3.0 t Phase-out achieved: -60%	Baseline: 155.8 consumption 2002: 71.3 Phase-out achieved: -53.9%	Baseline: 199,1 t Consumption 2002: 75,2 t. Phase-out achieved: -62.8%
Status of compliance	Freeze 99 complied with. 50% target requires further phase-out of 26.9 t by 2005. 85% red. by 2007 and 100% by 2010 expected.	Freeze 99 complied with. 50% target requires further phase-out of 3.2 t by 2005. 85% red. by 2007 and 100% red. by 2010 not ensured but targeted.	Freeze 99 not complied with. Further reduction of consumption depending on additional measures to be implemented.	Freeze 99 complied with. Total phase-out under TPMP by Dec. 2005 is to be expected.	Complied with freeze. 85% reduction already done as only 34,1 t still to be phased out. Full early phase-out is likely.	Freeze 99 complied with. 50% by 2005 already achieved. 85% and 100% expected through TPMP as early phase-out.	Freeze 99 complied with. 50% reduction target requires further phase-out of 51.8 tonnes. 85% red. by 2007 and 100% red. by 2010 ensured through enforcement of legal decree.	Freeze 99 complied with. 50% by 2005 already done. 85% and 100% phase-out need further measures.	Freeze complied with. 2005 target already achieved. Probably advanced 100% phase-out.	Freeze 99 complied with. 50% red. already achieved. 85% red. by 2007 and 100% red. by 2010 not ensured but targeted.
Specific factors determining compliance	About 80% of CFC consumption in MAC sector, average age of cars ca 10 years, 60% of them CFC-based.	Approx. 1 million domestic refrigerators, to 80% CFC-based. MAC sector less relevant, only 40% with Air Conditioning. Commercial installations benefit from Incentive Programme for conversion.	Difficulties: baseline significantly underestimated, and relative importance of the refrigeration business for economic and social reasons. Strategy of NOU tries to introduce additional measures of control + enforcement.	Most important user of CFC is the MAC sector (39 t from 67 ODP t) followed by domestic sector and commercial/industrial refrigeration (13 t each). Very important: good performance of import licensing, and close contacts with companies.	Overall control of the refrigeration sector by NOU.	Effective combination of all determining factors. Government funding of retrofitting of commercial refrigeration equipment. Involvement of industry in quota system. Government incentive schemes.	Strict application of import quotas, with total CFC phase-out in year 2005.	Consumption of CFC markedly downward due to restricted availability and price increase, but still continuous demand in servicing and maintenance particularly in the domestic sector. Efforts concentrated mainly on MAC and industrial sector.	Early training programmes, good cooperation with private sector.	Promoting hydrocarbons as an alternative solution compared to the higher priced HFC.

Issues	Bahrain	Ghana	Guatemala	Jamaica	Macedonia	Mauritius	Peru	Saint Lucia	Senegal	Uruguay
RMP and related projects	RMP approved in November 1998 with UNEP, R&R project approved in May 1997, IA is UNDP.	RMP approved at the 32 nd meeting of the Executive Committee including incentive programme and monitoring activities, IA is UNDP; customs training by UNEP; early training and R&R projects.	RMP approved at 27 th Meeting, IA is UNEP; RMP up-date at 35 th Meeting, with UNEP; earlier R&R project approved at 18 th Meeting with UNDP, followed by MAC R&R with USA and technicians training with UNEP at 19 th and 21 st Meeting of the Executive Committee.	RMP approved at 27 th Meeting of the Executive Committee, IA is Canada; TPMP was approved at 37 th Meeting of the Executive Committee, IA is again Canada; earlier R&R and MAC R&R project with UNDP and USA approved at 18 th and 23 rd Meeting of the Executive Committee.	RMP approved in July 1999 at the 28 th Meeting of the Executive Committee. IA is UNIDO.	RMP approved at the 26 th Meeting of the Executive Committee as part of the RMP project for 14 English speaking African countries implemented by GTZ.	RMP approved at 27 th meeting, IA is UNEP; R&R project approved by 19 th Meeting of the Executive Committee, IA is UNDP.	First RMP ever approved at 23 rd Meeting of the Executive Committee in November 1997.	RMP approved at the 33 rd Meeting of the Executive Committee, including a R&R scheme implemented by UNIDO, monitoring by UNEP and a hydrocarbon demo project by Switzerland; earlier training programmes by UNEP and a R&R project by UNIDO.	RMP approved in March 1999, IA is Canada; RMP up-date approved in July 2001, IAs are UNDP and UNEP.
Government's strategy	Considering to submit TPMP. CP update required.	Focus on reduction of consumption in domestic sector and larger installations.	At present, in non-compliance. Country facing some structural difficulties, but strategy elaborated by NOU may accelerate phase-out.	Under the TPMP total phase-out by Dec. 2005	Discussion about updating of RMP or preparation of TPMP.	TPMP submitted	Implementation of legal framework and more training and awareness for domestic sector.	Commitment to meet the targets of MP schedule, but no certainty about timely compliance with 2005 and 2002 phase-out targets. RMP up-date submitted to 41 st meeting.	Progressively reduce import quotas, focus on good practices and recovery, prepare HC as alternative.	Focus on Hydrocarbon as alternative.
Political commitment	strong commitment	Correct commitment further enhanced by NOU's performance.	Weak in the past, now medium	Strong	strong commitment but driving force is primarily the NOU.	strong commitment	Strong commitment	Medium	Strong commitment	Strong commitment
Status of NOU	Ministry of Housing, Municipality and Environment	Ministry of Environment and Science	Meteorological Institute under the Ministry of Environment and Natural Resources	Natural Resources Conservation Authority under the Ministry of Land and Environment	Ministry of Environment and Physical Planning	Ministry of Local Government and Environment	Ministry of Production (Industry)	Ministry of Environment	Ministère de l'environnement et de l'assainissement	Ministry of Environment

Issues	Bahrain	Ghana	Guatemala	Jamaica	Macedonia	Mauritius	Peru	Saint Lucia	Senegal	Uruguay
Legislation	Ministerial Order on Control of CFCs (1999), fully operational	ODS Regulation Act from 1994, Comprehensive ODS Act prepared, to be approved by Parliament in 2004.	Legislation in place. Weakness in implementation and enforcement. More specific rules still required.	Basic legal regulations in place. A comprehensive Ozone Act is being approved and implemented.	Legislation in place and operational, still lacking regulations on total ban of ODSs.	Consumer Protection Act (1999), Control of all CFC imports, Import permit for CFC required, prohibition of import of appliances containing CFCs.	Legislation in place and operational, total CFC phase-out 2005.	Legal regulations introduced with some delay (2002). Implementation fairly satisfactory.	Legislation in place and operational (law followed by decree).	ODS Legislation approved, but not operational.
Import licensing	Fully effective, annual quota allocations progressively reduced.	Quota system in place, quotas for 3 companies, further and stricter regulations through the new Act in 2004.	In place and partly operational	In place and operational	Fully effective. 4 importers, quotas in accordance with phase-out time schedule.	Fully effective. Quota on all ODSs since 1999 with annual linear quota reduction of 20% until 2005.	Fully effective, annual quota allocations progressively reduced.	In force but not fully operational.	Fully effective, annual quota allocations progressively reduced.	No Import Licensing
Enforcement	Financial incentives to end-users for retrofitting.	Financial Incentives Programme for commercial companies ready and able to convert to substitutes.	Present instrumentarium needs specification and improvement. Good plans of NOU still to be implemented.	Effective, through customs and close contacts with stakeholders.	Close cooperation with importers and companies. Tax on import of CFCs under consideration.	40% import duty on ODSs introduced. Close cooperation with importers and companies.	Enforcement of annual import quotas	Customs overburdened. So far no reliable customs inventory. No incentives or other measures on CFC prices. Illegal imports not to be ruled out.	Enforcement of annual import quotas.	N/A
Training technicians	Refrigeration trainers: 45. Trained and certified 41 technicians who continue to train others. So far, approx. 600 technicians trained.	In total 3000 technicians trained in good practices, in-country capacity of sustainable training process in place. Certificates issued but not mandatory.	Good progress achieved, 980 technicians trained, 540 certified. Local training capacity is built up.	Since 2001 under TPMP 130 technicians trained. Sustainable in-country capacity for training in place.	266 technicians trained. Some 150 to be trained yet. More training required, particularly for the informal sector.	2 trainers, approx. 60 technicians trained in good practices, more training courses needed.	Some 500 technicians have received appropriate training. Need for substantial additional training for domestic sector and MAC technicians.	Satisfactory training projects, 42 technicians trained. In view of 100 low-skill technicians in the informal sector, further training envisaged.	140 in four UNEP workshops; 110 in four seminars organized by France for HC retrofit; training of 2 lead trainers in India, one workshop for 16 instructors, and 3 workshops for 68 technicians.	250 technicians trained in R&R and good practices, 250 technicians trained in HC technology. More training needed for some 200 to 300 technicians.

Issues	Bahrain	Ghana	Guatemala	Jamaica	Macedonia	Mauritius	Peru	Saint Lucia	Senegal	Uruguay
Customs training	25 customs officers trained, who trained approx. 200 officers more. Customs need small portable identifier kits.	150 customs officers trained, 35 trainers available. Module incorporated in regular courses for customs officers.	Training satisfactory, 116 customs officers trained. Need for appropriate detecting equipment reported.	Good progress, 127 customs officers trained. Computerization and identifier equipment needed.	299 customs officers trained. Because of fluctuations, more training is needed.		One workshop with 32 customs officers trained. A second phase to be implemented soon. Module on ODS control incorporated in regular courses for customs officers.	36 customs officers trained, further training activities continue. Need for specified customs codes, and for further appropriate identifier equipment.	Two workshops conducted instead of four planned; to be followed by courses held by customs school.	Train-the-trainers and follow-up workshops, provided training to 70 customs officers. Module on ODS control incorporated in regular courses for customs officers.
Equipment	76 recovery units supplied, 65 distributed. Recovery (MAC machines) only in 8 MAC workshops operating.	16 R&R machines supplied under the MAC project, 3 recovery machines for end-users located in workshops, 11 identifier in Customs.	The CP envisaged a network of 108 recovery units, 4 recycling centers and 4 training workshops. Reportedly, 20% of the recovery units damaged. 17 manual portable leak detectors found not useful.	70 recovery units supplied, in operation. Recycling machines not used.	109 recovery units, 3 recycling machines supplied.	37 recovery units, 1 reclaiming machine supplied.	120 recovery machines, 8 recycling machines. No effective monitoring system in place.	6 recovery units, 1 recycling equipment and 3 MAC R&R machines supplied. Machines are sold to industry. Some enterprises purchased own equipment.	40 plus 55 recovery machines, R&R machines, leak detectors, tool sets	61 recovery units and 21 recovery and recycling units. R&R equipment actively used in automotive MAC.
CFC recovery	No data, due to lack of reporting by companies. Quarterly reporting not always complied.	No exact data on total volume of CFC recovered. Through Incentive System, 4 mt are expected after completion.	In 2002, estimated 14,4 t representing 3-4% of total CFC consumption recovered.	Estimated 1,1 t of CFC recovered during 2001, no up-date available.	In workshops, 1.3 t of CFC recovered plus 0.7 t of HCFC-22, plus 0.3 t of HFC-134a. 0.4 t contaminated CFC is kept in stock.	Some recovery from commercial units; little for domestic refrigerators	Conflicting reports No reliable information available on CFC recovery. Venting is common practice.	Very small quantities recovered, no figures available.	Commercial and industrial sector is recovering and re-using. Domestic sector minimal, no reliable data. About 3 t of contaminated CFC in stock.	Commercial sector is recovering and re-using. Domestic sector minimal.
Recycling	2 recycling centers, operational costs not covered. Recycling failed due to adverse price relations and technical problems.	Practically no recycling, though companies assess that it could become economically viable.	No recycling machines supplied. Own equipment in some enterprises but no data reported.	2 recycling centers established but no activities reported. Some recycling by machines owned by private companies.	3 recycling centers. Project approved aimed at recycling 13,5 t of CFC, actual amount of CFC recycled by 2 active centers until end of 2002 313 kg, plus 407 kg of HCFC-22.	Practically, no recycling so far. If any, rather seen as service to the client than as profitable activity.	No information available. Most probably no recycling being done at all.	1 recycling center established but practically no recycling activities are taking place.	Recycling machines not used, except one for training; no more recycling equipment requested in 2 nd delivery of equipment.	Practically no recycling being done at centers.

Issues	Bahrain	Ghana	Guatemala	Jamaica	Macedonia	Mauritius	Peru	Saint Lucia	Senegal	Uruguay
Retrofit	Retrofit, as believed, would be more suitable than R&R. Hydrocarbon not familiar in the Gulf region, could cause maintenance problems	Retrofitting activities under the incentive scheme for end-users.	No retrofitting activities, at least no specific information available	Under the TPMP a comprehensive retrofit and replacement programme for end-users to be carried out (Dec.2002-Dec.2004); applying incentives to end-users.	No retrofitting activities, at least no information by NOU available.	Some retrofitting activities being carried out mostly in government owned buildings. Aim is to retrofit to hydrocarbon phasing out HCFC by 2020. Respective training needed.	Some retrofitting in commercial sector, none in Domestic Sector.	No retrofitting activities reported.	Started retrofit to HC for Domestic Sector.	Extensive retrofitting in commercial sector, none in domestic sector.
Prices	R 12 = 3,2 US\$/kg R134a= 4,9 US\$/kg	R 12 = 6,5-7 US\$/kg R134a= 10 US\$/kg R-22 = 7-9 US\$/Kg HC 3.5 = US/kg	R 12 = 3.46 US\$/kg. R 134a = 4.46 US\$/kg R 404a = 20.3 US\$/kg	R 11 = 6,2 US\$/kg R 12 = 6,7 US\$/kg R 134a = 7,9 US\$/kg	R 12 = 4.85 US\$/kg R134a = 7.9 US\$/kg R-22 = 5.7 US\$/kg R-407 = 25.5 US\$/kg	R 12 = 10,1 US\$/kg R134a= 6,3 US\$/kg	R-12 = 7,27 US\$/Kg R-134a = 8,72 US\$/Kg	R 12 = 10.2 US\$/kg R 134a = 19.6 US\$/kg	R-12 = 10-17 US\$/Kg; R-134 = 20 US\$/Kg; R-22 = 12 US\$/kg; HC-12 = 7 US\$/kg	R-12 = 3.8 – 5.1 US\$/kg R134a = 10 US\$/kg R-22 = 4.6 US\$/kg
Monitoring	Data collected from customs and importers. Monitoring in place though quarterly reports not always delivered.	Fairly effective control through the reports of customs and importers, field visits of the NOU and regular contacts with the Refrigeration Association.	Customs data not very reliable. Comprehensive monitoring involving importers, and systematic inspections are planned.	Fairly reliable data collection from importers and customs.	Effective control through regular reports from workshops, customs, companies. Fairly reliable information also about the informal servicing sector.	Regular reports from customs and importers. Data fairly reliable. Some doubt about informal sector.	Data collected from customs and importers.	Data from customs and importers, not always reliable. Monitoring system is now being improved.	Data collected from customs and importers.	Fairly reliable data and information collected from customs, importers, distributors and users.
Illegal trade	Practically no such trade due to strict control mechanisms.	Can not be excluded but not significant. Problem: import of CFC-based 2 nd hand equipment mainly from Europe.	Not excluded (mainly from Mexico) because of significant price differences. Difficult to control.	Illegal imports along coastline not excluded, but beyond the competence of customs. Additional control measures under consideration.	According to NOU, no need for illegal trade. Some illegal transit activities from Turkey to Bulgaria reported.	No evidence about significant illegal trade.	None reported	Smuggling can not be discarded. Common Caricom system of information about illegal trade is urged.	Limited quantities	None reported

Annex VII¹:

(a) Implications of Retrofitting to Alternative Refrigerants

This section summarises the advantages and disadvantages of HFC and HC refrigerants as replacements for CFCs in existing systems.

Issue	HFC	HC
Safety components	As CFCs	Flammable. Non sparking electrical devices are usually required, to be in line with international standards. Service procedures usually need review although in African countries servicing is usually done in a well ventilated area.
Conversion procedure	Oil needs changing to a polyol ester type which absorbs moisture more readily and is more expensive. Compressor change preferred, although in this case there will still be oil in the remainder of the circuit which needs to be changed.	Electrical devices usually need replacing, moving or sealing. Oil with lower miscibility or higher viscosity would improve but oil is rarely changed during conversion to HCs reliability.
Energy efficiency	Worse than CFCs.	Better than HFCs, similar to CFCs.
Reliability	Poorer than CFCs because of the oil. Greater care during servicing is needed, in particular better evacuation of systems.	Similar or better than with CFCs.
Availability	Widely available.	Not yet widely available in Africa.
Cost of refrigerant	More than CFCs.	In Senegal and Ghana less than for CFCs, although purity and moisture content must be checked. Limited commercial availability in most LVCs countries.
Other costs	Oil costs 5 times the price of mineral oils used with CFCs and HCs. Possible higher cost of servicing.	Cost of non sparking electrical devices where necessary (10-20 US \$).
Experience	Widely used refrigerants world wide.	Large-scale application in Cuba. Tests and initial experiences in some other countries (India, Senegal, Gambia, Ghana).
Training	Needed to cover better servicing procedures required.	Needed to cover flammability issues.

Issues for specific systems:

- HC cannot be used as retrofit for no-frost refrigerators.
- HC used for split and through the wall AC systems restricts the room size according to the quantity of HC charge (150 g). Charges greater than 150 g are allowed if leakage into a confined space would not exceed the practical limit of 8 g/m³.
- The use of HCs in direct expansion commercial and industrial systems (for example in conventional cold stores) is usually not feasible because in the event of a leak the practical limit can be exceeded.
- Outdoor mounted chillers are an example where HCs can usually be safely used in commercial/industrial systems because, in the event of a leak, the refrigerant is safely dispersed – it cannot accumulate in confined spaces.
- HCs are not usually recommended for car AC systems, although they have been used extensively in Australia and the USA.

¹ Source: Jane Gartshore, Consultant, Cool Concerns, Ltd.

(b) HCFC blend conversions

HCFC blends have been used extensively in Europe as interim substances to convert R12 and R502 systems. There has been a proliferation of these blends, each with slightly different characteristics. They are usually based on R22. For example, in the UK there are at least three R22 based interim alternatives to R12 and at least five R22 based interim alternatives to R502.

They are designed as drop-in replacements. In most cases compressor oil does not need to be changed. They are non flammable (although one of the components of the blend may be flammable), therefore electrical components do not need to be changed.

Where thermostatic expansion valves are used these should normally be re adjusted to give the correct superheat setting, although this is not always necessary.

In the UK the cost of these R22 based blends is usually significantly higher than R22 and HFCs.

Performance is usually similar to CFC performance.

There are issues associated with the use of blends:

- They cannot be used in systems where there are two evaporators running at different temperatures with one compressor (e.g. many fridge freezers);
- They must be removed from the cylinder in the liquid phase (this is not always the common practice for charging);
- Ice build up on evaporators may be uneven due to temperature glide in the evaporator.

R404A and R407C (HFC replacements for R502 and R22 respectively) are blends and also have these issues. R404A is already being used in Ghana.

Information about UK blends is summarised in the table below.

Alternatives for R12

Blend	Composition	Refrig capacity % R12	COP % R12	UK cost compared to R22 %	UK cost compared to R134a %
R401A (MP39)	R22/152a/124	107	100	470	180
R401B (MP66)	R22/152a/124	108	98	Not known	Not known
R409A (FX56)	R22/142b/124	109	99	440	170

Alternatives for R502

Blend	Composition	Refrig capacity % R502	COP % R502	UK cost compared to R22 %	UK cost compared to R404A %
R402A (HP80)	R22/125/290	109	100	500	140
R402B (HP81)	R22/125/290	99	98	500	140
R403A	R22/218/290	105	99	Not known	Not known
R403B (Isc69L)	R22/218/290	112	100	850	240
R408A	R22/143a/125	98	100	310	90

(c) Conversion to Hydrocarbon Refrigerants

Simple drop in conversion

This is only possible where there are no sparking electrical devices on or close to the refrigeration circuit. This will be the case in domestic fridges where:

- The evaporator is sealed from the inside of the fridge so that refrigerant cannot leak into the fridge (it is reported in Senegal that 75% of fridges have the evaporator exposed) or there is no light inside the fridge and the thermostat is a sealed type or outside the fridge;

and

- The relay and overload protector on the compressor is the sealed type.

In this case the cost of conversion should be no more than re charging with R12. The remaining R12 must be removed from the system by evacuation – it is assumed that this would also be done if the system was being re charged with R12.

Low cost conversion

In this case sparking electrical components are either eliminated (in the case of on / off switches, lights and light switches) or sealed / placed in a sealed box (in the case of thermostats, relays, overload protectors and lights / switches). Silicon sealant is usually an acceptable seal material.

The cost is minimal.

Full scale conversion

In this case sparking electrical components are replaced with sealed or solid state types where available. According to Infrac, the cost for this is approximately US\$20 per appliance.

No frost fridges

As a general rule it is simplest and safest to recommend that no frost fridges are not converted to HCs. More specific advice would depend on the type of defrost method. Some fridges use a "heated wire" the temperature of which is a concern in the event of HC leakage. No frost fridges are probably more common in America than Europe. As most second hand fridges in West Africa are from Europe, no frost technology is probably not a major issue.

Overview of Conversion Options

Options are summarised for eliminating the hazard from sparking electrical devices are summarised in the following table.

Component	Simple drop in conversion	Low cost conversion	Full scale conversion
Fan motor ¹	OK if induction type	OK if induction type	OK if induction type
Thermostat body within fridge	Not possible	Seal	Replace
Thermostat body outside fridge	OK	OK	OK
Compressor relay sealed type	OK	OK	OK
Compressor relay open type	Not possible	Seal	Replace
Compressor overload protector sealed type	OK	OK	OK
Compressor overload protector open type	Not possible	Seal	Replace
On / off switch ²	Eliminate	Seal or move	Replace
Light starter, sealed or outside fridge	OK	OK	OK
Light starter, unsealed inside fridge	Eliminate light	Seal or move	Replace
Light switch outside fridge or sealed	OK	OK	OK
Light switch, inside fridge, unsealed	Eliminate light	Seal or move	Replace
Electrical wiring	Ensure connections are tight	Ensure connections are tight	Use ring or spade types with plastic sleeve

1. Where fans are used they are usually the induction type.

2. On / off switches are not usually provided.

Refer to the chapter on conversion to HCs in the Ecofrig manual for the full procedure.

Annex VIII: Technical Information About Refrigerant Recovery, Recycling and Reclamation, Destruction and Conservation¹

(a) Recovery and Recycling

Recovered refrigerant can be re-used without recycling when it is not contaminated with substances such as acids, water, oil and air which would reduce the reliability of the system it is charged into. Refrigerant recovered from mobile AC systems and from other systems which have leaked is usually uncontaminated and can be re-used. Refrigerant recovered from systems which have had a compressor motor burn out will contain acids and must be recycled.

Compressor motor burn outs are the most common cause of failure of domestic fridges due to unreliable electrical supplies (significant voltage variations). In this case recycling is required. However the quantity of refrigerant recovered per system is in any case very low (100 to 150 gr). The following should be taken into account when assessing the benefits of recycling:

- Local availability of recycling machines;
- Distance required to transport refrigerant to central recycling plant, with the associated financial and environmental cost;
- Purity of recycled refrigerant and its impact on the reliability of systems it is charged into;
- Commercial arrangements for recycling refrigerant;
- Handling of mixed refrigerants.

In many cases the recycling of refrigerant is not technically, commercially or environmentally viable.

(b) Reclamation or Destruction

Reclamation cleans refrigerant to a specific purity, usually to the standard to which virgin refrigerant is supplied. This requires more sophisticated equipment than recycling where the refrigerant is cleaned, but to no specific standard. Usually a distillation process is used for reclamation, whereas recycling is usually achieved by a filtration and oil separation.

The equipment required for reclamation is more expensive and is normally centrally located. For example, in the UK these are operated by six refrigerant supply companies in an industry which employs an estimated 100,000 refrigeration engineers (working in all sectors including MAC). However, there are small reclamation machines for about US \$6,000 which would suffice on workshop levels.

It is difficult to be clear about the purity of recycled refrigerant as it depends on the degree of contamination in the original refrigerant and the operation of the recycling machine. It will rarely be recycled to the purity of virgin refrigerant. The use of refrigerant which is not adequately cleaned has implications on the reliability of the systems it is used in. In particular it will lead to compressor motor burn outs. For this reason the purity of recycled refrigerant is usually acceptable for MAC systems as these do not have hermetic or semi hermetic compressors where the refrigerant is in contact with the compressor motor.

Source: Jane Gartshore, Consultant, Cool Concerns, Ltd.

If recycled refrigerant cannot be re-used the options are reclamation or destruction if either facility exists. The cost of a small scale reclamation machine is of the order of US\$6000. Safe disposal of refrigerant requires incineration at approximately 1200°C. Destruction cost in the UK are calculated to be about US \$7/kg.

(c) Recovery machines

There are various issues with recovery machines, outside the question as to whether it is viable to use such a machine to recover refrigerant from small systems where the refrigerant is contaminated by a compressor motor burn out (e.g. typical domestic fridge repair).

Electrical supply

The wide fluctuation in voltage in West Africa will increase the failure rate of the recovery machine's compressor motor.

Recovering acidic refrigerant

Refrigerant from a system which has suffered a compressor motor burn out will be contaminated with acidic oil. Unless there is an effective filter drier at the inlet to the recovery machine, this contaminated refrigerant will pass through the recovery machine's compressor, increasing the probability of its failure. Some recovery machines have an internal filter drier, others require that this is added by the user. Whichever type is used, the filter drier must be changed when necessary – the frequency of replacement will depend on the condition of the refrigerant recovered.

Recovery machine type

The development of recovery machines with oil free compressors was initially driven by the need to use one machine with different refrigerants. Oil free machines do not need to be evacuated when switching to a different refrigerant. With standard machines evacuation would be needed to prevent contamination of one refrigerant with another type.

In general oil free machines are much faster than the oil based models. The later versions of the oil free machines are more reliable and require less maintenance. The earlier versions were OK when recovering refrigerant from systems as the oil entrained in the refrigerant lubricated the seals. However, when these machines were used to decant refrigerant from a larger cylinder to a smaller one the seals failed, and the compressor might be damaged due to lack of lubrication.

Speed of recovery

Speed of recovery has been an issue in Senegal when using the machines on larger systems. The ITE Maxi R is reported to recover refrigerant at a rate of less than 10% of that published. ITE have suggested ensuring all schraeder valves are removed in connections to the system, and that additional filters are not used.

Where recovery machines are made locally, a forced air condenser can be included to speed up the recovery process. In addition, the use of open drive compressors will increase reliability (although the cost will also be increased).

Locally produced machines

It should be possible to develop a recycling machine that could be produced locally as the additional components required are widely available (e.g. filter driers and oil separators). Such a machine would at least be able to clean refrigerant to a purity acceptable for MAC systems. The machine would be able to recover and recycle (as most recycling machine can). The recycling components could be added as a module to a recovery machine (and might be available already for the recovery machines provided in Ghana and Senegal).

(d) Conservation of Refrigerant

Where possible, improved conservation of refrigerant is a better technical, commercial and environmental approach. This is achieved by:

- Elimination of the practice of flushing systems with refrigerant. This necessitates the use of an evacuation procedure or flushing with nitrogen;
- Improved leak detection. This requires:
 - Use of appropriate leak test methods, soapy water is often the simplest, cheapest and most accurate;
 - Introduction of leak testing as part of a routine maintenance regime for all but small appliances;
 - Education of end users and technicians in the importance of leak reduction to system performance (leaking systems use more energy and often don't meet temperature requirements) and overall service cost.
- Elimination of the use of flared joints (brazed joints are a much more reliable seal);
- Replacement of copper tube for pressure switch connections with flexible hose.

An example of where refrigerant conservation is an issue is in the fishing fleet where large R22 systems are used with a high incidence of leakage. This probably also applies to cold store and chiller systems.
