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APPROACHES TO ODS PHASE-OUT IN SMALL AND MEDIUM SIZED ENTERPRISES: OVERALL RECOMMENDATIONS AND SUMMARY SECTORAL REVIEWS

(Submitted jointly by UNDP and UNEP)

EXECUTIVE COMMITTEE OF THE MULTILATERAL FUND FOR IMPLEMENTATION OF THE MONTREAL PROTOCOL
(19th Meeting, 8-10 May 1996, Montreal)

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A. INTRODUCTION AND GENERAL CHARACTERISTICS OF SMEs

1. Although small and medium-sized enterprises (SMEs) comprise important sectors in many developing countries, historically low levels of assistance have been provided to this enterprise category for environmental activities, including stratospheric ozone protection. Across all sectors, the majority of investment projects approved by the Executive Committee to date have benefitted larger enterprises. However, it is increasingly evident that SMEs in Article 5 countries require more assistance if they are to make the transition to non-ODS technologies avoiding severe economic and social dislocations.

2. The consequences of SMEs being left behind in the ODS phaseout process include:
   - o the global ODS phaseout will be delayed;
   - o many SMEs may be forced to close down and unemployment will rise, especially since SMEs have proportionately and in total more employees than do larger companies;
   - o increased dependence on larger companies or on multinational subsidiaries;
   - o some SMEs may witness an increase in their ODS consumption if larger companies shift some CFC usage to SMEs, which would result in more difficult ODS elimination; and
   - o consumption of ODS in SMEs may continue to grow so long as CFC technologies remain cheaper than ODS replacement technologies.

3. To avoid the negative repercussions from a slow transition to ODS alternatives, increased resources are needed to assist the SME sector from within and outside the Multilateral Fund; this should be coupled with special measures made at the country level to help the SMEs. Because of their smaller-scale, SME ODS phaseout investment projects will usually not be as cost-

effective as for larger companies. On the other hand, this very same SME feature provides greater flexibility and adaptability for SMEs to switch to new technologies and to respond to the requirements of their clients which, for example, could be either larger aerosol fillers themselves or companies with their own special brand products. Therefore, it is necessary to develop new approaches that would lead to reasonably cost-effective ODS phaseout activities and effective support services and legislative measures to accelerate ODS phaseout by SMEs.

4. While agreeing that projects which will eliminate large amounts of ODS should be given priority, the Executive Committee, at its 13th Meeting, recognized the significant problems being faced by SMEs in several countries and requested that Implementing Agencies propose efficient and feasible strategies to address this problem. This paper, prepared by UNDP in collaboration with UNEP, summarizes the result of agency efforts in this regard.

5. There is no universally acceptable definition of SMEs. At the policy level, many developing country Governments define SMEs in terms of a combination of investment level, number of employees, sales revenues, etc. We will thus characterize and identify SMEs on a sectoral basis under Section D. There are, however, several general characteristics that SMEs normally have:
   - o a small production capacity;
   - o a low level of investment;
   - o a higher number of employees per unit of production compared to larger companies;
   - o a generally low level of health and safety standards;
   - o low awareness about environmental issues; and
   - o dependence on larger industries for the supply of products, raw materials, and "technology feedback".

6. When taken as a whole, the SME sector can be generalized as:
   - o comprising a large number of small enterprises overall, often constituting up to 80% of the total industry in many developing countries;
   - o representing a politically important socioeconomic sector and providing a source of significant employment in several developing countries;
   - o being geographically scattered, which makes individual SMEs difficult to identify and communicate with; and
   - o often consisting of enterprises that can be classified as belonging to both to the formal and the informal sectors.

B. BARRIERS TO ODS PHASEOUT IN SMEs

7. Several of the above characteristics create or enhance conditions that lead to barriers to successful ODS phaseout in SMEs. Specifically, the following are the main barriers that can prevent or slow their adoption of and conversion to non-ODS technologies:

   a) <u>Low Cost Effectiveness</u> **Because there is a minimum cost to any technology conversion, the low ODS consumption of an SME does not render such a conversion project cost-effective. When judged against the current established cost-effectiveness threshold, the SME project will never get funded unless there is special dispensation granted to SMEs.**

   b) <u>Environment is not a priority concern</u> Environmental issues in general, and ozone layer protection specifically, are not considered priorities given limited time, budgetary and human resources. SMEs are often too busy solving immediate problems and cannot concentrate on technological developments including conversion to non-ODS technologies and products.

c) Reluctant to change Many SMEs are already at the "edge of survival" and resist changing existing operating methods and technologies due to fear of the unknown.

d) Lack of industry organizations SMEs in many countries do not have or belong to formal organizations to represent their interests and, as a consequence, they have no focal point to assist them identify, obtain and channel assistance for potential ODS phaseout projects.

e) Low-level internal resources SMEs do not benefit from the "economies of scale" of larger companies and thus do not have the internal human and financial resources to initiate ODS phaseout programmes on their own.

f) Inadequate information Due to their small size and limited human and financial resources, SMEs have great difficulties identifying information and financing sources, both of which are essential elements in the technology transfer process. Some progress has been made in this area. Virtually all of UNEP OzonAction clearinghouse services and publications have been disseminated to and used by SMEs. However, given their vast numbers, information on the need for ODS phaseout and its timing, how to access assistance from the Multilateral Fund and the National Ozone Units, technical options and sources of technology, equipment, and chemicals, etc. have not yet reached the majority of SMEs.

g) Inadequate technical skills The limited internal workforce in SMEs usually means that skills are focussed on narrow technical specialties required to meet immediate production runs. Little time is available to acquire the new skills required to undertake activities such as ODS phaseout projects. Examples of such missing skills include inadequate training in: CFC recovery and recycling; in the safety of alternative technologies, equipment and substances; in specifying technical assistance to design projects; and in lack of technology assessment capabilities. UNDP, UNEP and UNIDO have been assisting SMEs in this area.

h) Access to technology, equipment, and chemicals SMEs are usually ill-equipped to identify suppliers of new technology, equipment and chemicals. They often have to rely on their suppliers' advice about what new technology to adopt. Local dealers and importers often not very knowledgeable about new technologies. Additionally, SMEs do not always receive advice from larger suppliers since their small size and small sales potential does not merit the attention given to larger customers. SMEs therefore need improved access to mechanisms for technology transfer.

i) Access to financing The need of SMEs for financial assistance is large due to their small operating margins which makes them more risk adverse than larger companies when adopting new technologies. Financial institutions tend to not underwrite environmental technology transfer activities for SMEs. While SME awareness about available financial assistance under the Multilateral Fund is rising, the sheer number of SMEs involved requires more work in this area. Even when aware, the procedures for receiving assistance under the Multilateral Fund appear complicated for SMEs which desperately need a simpler application procedure.

8. There are however, positive characteristics of SMEs which could be potentially utilized for expeditious phaseout:

- technology employed by SMEs is usually not complicated and so adapting to non-ODS alternatives may not be difficult;
- the decision-making process is normally faster in smaller companies;
- SMEs largely depend on and are responsive to suppliers and their buyers who are large

companies. Such large companies, through their corporate policies towards alternative non-ODS products, could play an important role in facilitating an early phaseout of ODS in the SMEs.

C. SUGGESTED MEASURES TO FACILITATE ODS PHASEOUT IN SMEs

9. Given the above constraints and the concern expressed by the Executive Committee to address the problems facing SMEs, the following approaches are suggested, including a different set of cost-effectiveness values valid for SMEs only as detailed under Sections D, E, F and G. Section H is the conclusion with a summary table of the various suggestions presented.

(i) Strategy

9. The limited experience to-date (ongoing projects in Malaysia, Jordan, Philippines) suggests that an umbrella or group approach is, at present, the only effective and efficient way to phase out ODS in SMEs. This includes the concept of regional manufacturing centre, wherever feasible, where a group of SMEs will share a common manufacturing facility to be set up.] The underlying principle is that the same technical approach using the most cost-effective commercially available retrofit technology will be applied to those SMEs covered under an umbrella project; a group implementation strategy will be applied; the sum total of ODS consumed by these SMEs in the sector or sub-sector will be considered; and that the respective country will take measures to control or prohibit ODS use in the respective sector, or sub-sector.

10. Under an umbrella approach, depending on the individual project framework, all SMEs may be considered and converted around the same time and be treated on the same and, wherever applicable, with equal share of project funding and, if applicable, the same level of responsibility. At the Executive Committee level, only one project review is required with full details on incremental costs to be funded. Only one implementing agency will be accountable for the project funds covering the entire sub-sector. The sector or sub-sector ODS phaseout can be completed in a more timely fashion (and cheaper) than with individual project approval.

11. In developing an umbrella project, the following factors should be considered:

- Most cost-effective commercially available ODS replacement technology. This may encompass (a) direct physical and "drop-in" replacements that require no (or very minor) process adjustments; (b) indirect chemical replacements that function on the same process equipment with minimal adaptations; and (c) innovative processes based on different process approaches that could eliminate the need for an ODS replacement or change the requirements for such a substance.

- Although in most cases there would be no technology upgrades from the baseline situation, such upgrades will be unavoidable in selected cases (e.g. aerosol sector where the use of hydrocarbons requires at least a pneumatic manual filling machine).

- The entire sub-sectors in each sector should be distinctly divided and their enterprises grouped under three main categories of enterprises - large, medium and small scale. The most appropriate ODS replacement technologies should then be recommended for each category of enterprises. In certain cases, more than one technology for a sub-sector may have to be considered.

- o When proposing special measures for SMEs, these have to be framed, to the extent applicable, within the existing guidelines and recommendations of the Executive Committee.

- o When considering ODS replacement technology, the special characteristics of SMEs should be borne in mind. The cost-effective factor should also be considered from the SME's perspective, in that SMEs should be able to safely and efficiently handle the proposed new technology without any severe financial consequences. In addition, the industrialization strategy of the respective country should be considered. These may require flexibility to existing guidelines of the Executive Committee.

- o The use of HCFC as a CFC alternative in some sectors (foams, refrigeration, etc...) is often recommended for use in SMEs because of its easier handling and applicability as opposed to hydrocarbons. However, given the decision of the Executive Committee that "Implementing agencies should note a presumption against HCFCs when preparing projects" (decision 17/17), this would correspondingly result in higher safety-related capital incremental costs to the Fund on the one hand, and presents a safety hazard for the SMEs which are used to simple, crude operations and facilities, and an increase in incremental operating cost.

Under the above premise, several models can be considered:

C.1 Approach 1: Entire sector or sub-sector approach

12. Under this model, only one umbrella project covering ALL ODS users in the particular sector (e.g. aerosol), sub-sector (e.g. Rigid PUF) or application (e.g. one type of product cleaning process) concerned will be developed by one implementing agency designated by the Government. This is the preferred option since it will allow easy evaluation of the cost-effectiveness of the national ODS phaseout plan. This option should be considered when the ODS users in this sector/sub-sector are already identified or can easily be surveyed and baseline data collected, and where the ODS replacement technology is established (e.g. hydrocarbons for aerosol sector). A pre-requisite for this option should be that the respective government will ensure full enforcement of legislation(s) to prohibit the use of ODS in this sector upon project completion, and to stop licensing new enterprises entering this sector to use ODS.

13. In some cases, this approach may entail the simultaneous two-pronged conversion of the formulations suppliers to SMEs on the upstream end, and at the SMEs at the users' end.

C.2 Approach 2: Multi-Phase approach to sectoral ODS phaseout

14. Under this model, the following sets of activities, to be carried out jointly by the respective Government and a designated implementing agency, are recommended:

Phase I:

- o a full survey of the size, characteristics, consumption level, etc. of the SME population in the sector be conducted nationally (broken down by sub-region in the case of large ODS-consuming countries) and baseline data gathered;
- o a sector-wide ODS phaseout plan be developed and proposed to the Executive Committee. This plan will include both technology selection(s), project approach, full

financial details for the comprehensive sector (or regional, sub-sector) phaseout, and implementation plans (whether in one or multiple phases).

Phase II:

- Development of investment project(s), possibly in various tranches, for approval by Executive Committee. It is likely that a first project can be submitted under Phase I, with other projects to be developed and approved later on. These will be based on the approved technical approach and budgetary plans outlined in the overall sectoral plan. In considering projects in this subsequent phase, it is possible that between phases, a new more cost-effective, commercially available ODS replacement technology may have emerged. In such instance, the project will be formulated with the new technology (instead of the one approved under Phase I) and the budget be revised (presumably downward).

C.3 Approach 3: Sectoral funding for ODS phaseout

15. This model is more complex to develop and manage. The following broad project concept can be considered:
    - a full survey of the size, characteristics, consumption level, etc. of the SME population in the sector be conducted nationally and baseline data collected. Where there are several sub-sectors or types of activities involved, one or more most cost-effective commercially available retrofit technologies could be proposed, and a financing plan for the sectoral phaseout is developed;
    - an overall funding level is then agreed upon by the Executive Committee;
    - the approved funding could be co-managed by the Government and the implementing agency concerned. The selection of qualified SMEs for grants under this programme will be done by the Government with approval/endorsement by the concerned implementing agency. The implementing agency will be primarily responsible for technical programme review and evaluation and the Government will be responsible for fund disbursement and overall project monitoring and implementation in full accordance with the implementing agency financial rules and regulations.

16. The above approach is more suitable for large ODS-consuming countries where ODS phaseout activities in the sector(s) are just starting and where the SMEs remain to be identified. This will allow for a more thorough analysis of the types of replacement technology to be applied in a specific sector (e.g. foams) given the diversity of types of end products, the ODS users, their production facilities and the baseline situation. For example, on the basis of a comprehensive survey, umbrella projects can be developed grouping SMEs by types of products using a specific ODS replacement technology. Other approaches can also be developed. These, together, will enable all parties concerned to develop a realistic financing strategy and set priorities.

17. The advantages of this model include a reduced workload on the Executive Committee by eliminating the need to examine each tiny SME project individually; and it gives Governments, and particularly national ozone units, the opportunity and related responsibility for managing ODS phaseout in an important socio-economic enterprise category. Such an approach would require a detailed reporting requirement by the recipient Government through the implementing agency concerned.

(ii) Considerations for Project Implementation

18. Factors that impact on project costing include the baseline situation (equipment, facilities, technological capacity, product requirements, etc...), the ODS replacement technology selected (choice, application and adaptability), the equipment requirements (new versus retrofit), the extent of technical support that can be reasonably expected of the chemical suppliers, etc.... Through umbrella/group projects, experience with the few ongoing projects indicates that overall project incremental costs will definitely be reduced as compared to individual projects. Actions taken to reduce costs through a group implementation strategy should be indicated and described. In the case of investment projects in the refrigeration sector, group implementation may be very limited and for few activities only such as bulk purchasing, since individual design and testing etc. are required sat each enterprise level. Nevertheless, some savings is possible through appropriate scheduling of training programmes, etc.

19. The following considerations should be duly taken into account, wherever feasible, when formulating umbrella projects:

- o Bulk purchasing, shipping and installation arrangements;
- o Local manufacturing of needed formulations and equipment instead of imported equipment. Wherever feasible, local manufacturing of some parts should also be considered;
- o Use of local expertise wherever possible;
- o Group installation and local works;
- o Group training, technology transfer and safety audit.
- o Alternative least-cost method to achieve the retrofit should be fully explored and documented.

The project review should take into account all the savings that will be realized from the proposed group implementation.

(iii) Possible Measures to be Taken at the Country Level

20. At the country level, through the Technical Committee or other organizations (e.g. Aerosol Association), the possibility of securing technical/financial assistance and other forms of cooperation from larger companies which have successfully completed their ODS phaseout should be explored. For example:

a) Awareness raising is key to initiate ODS phaseout activities in SMEs. Government, industry associations, buyers/suppliers of materials and products to SMEs, and NGOs could all play a vital role in awareness raising programmes which should be encouraged and financed in Article 5 countries.

b) Technology cooperation workshops which aim at sharing experiences on ODS phaseout in SMEs between developed and developing countries on the one hand, and among the Article 5 countries themselves on the other, should be encouraged.

c) Government policies and their role in ODS phaseout in SMEs are of paramount importance. Identification and surveys of ODS use in SMEs should be undertaken by Governments as a priority.

d) For ODS phaseout plans to be successful, it is essential that Government ensures the sustainability of ODS phaseout efforts by devising appropriate incentives and legislative and regulatory techniques applicable specially to SMEs in that sector.

(iv) Special measures to be considered by the Executive Committee

21. It has been recognized that special measures should be taken when dealing with SMEs projects. This involves cooperative efforts, commitment, and special considerations at all levels - the Government, the SME community, the implementing agency, and the Executive Committee. While it is stressed that strong Government legislative measures are required, this has to be accompanied by a reciprocal reassurance on the part of the Executive Committee that there is a minimum incremental costs for SME projects and special considerations are required. It is suggested that any SME projects brought forward for review be considered based on their own merits, and that flexibility will be considered. This will include recognition that a set of cost-effectiveness values quite distinct from the present established ones may be required, and that in exceptional cases, some SME projects may have to be approved in spite of their being beyond the usual cost-effectiveness range due to valid mitigating circumstances.

22. Special measures adopted for SMEs will need to be reviewed periodically and updated as required. For this purpose, it is recommended that demonstration umbrella projects in each applicable sector or sub-sector be designed and approved so that future updates and adjustments could be based on experience gained.

D. SECTOR-SPECIFIC OVERVIEW AND RECOMMENDATIONS: FOAMS

23. At its 14th Meeting, to address the small ODS consumer sectors in a cost-effective manner, the Executive Committee approved at its 14th meeting development of a strategy in the foam sector. Of the over 90 approved foam investment projects, 8 showed an ODS phaseout of 10 tonnes or less but they were not very cost effective. This foam strategy paper was prepared by UNDP's foam sector expert in close cooperation with the Fund Secretariat, was discussed at the Interagency Consultants Meeting during 5-7 July 1995 in Paris and was formally submitted to the 17th and 18th Executive Committee meetings. At the 18th Executive Committee, it was decided that the analysis, conclusions and recommendations contained in the foam strategy paper should be integrated in the present paper on SME.

24. In foam, CFCs are mainly used as a blowing agent (non-insulating foams) or as a combined blowing/thermal insulation agent (insulating foams). Auxiliary functions include acting as a softener, as a heat sink, as a viscosity cutter and to impact the product surface. Due to these different functions, a universal replacement is not possible. Production equipment needs vary depending on whether the production process is continuous or discontinuous. In processing, the main distinction is between thermoplastic foams (polystyrene, polyethylene) and thermoset foams (polyurethane, phenolic) since the two groups have different equipment requirements: extruders/ expanders for thermoplastic foams and reactive mixture dispensers (and some handmix operations) for thermoset foams.

25. ODS replacement technologies in foams cover (a) direct physical and "drop-in" replacements needing no (or very minor) process adjustments; (b) indirect chemical replacements that function on the same process equipment with minimal adaptations; and (c) innovative processes based on different process approaches that could eliminate the need for a CFC replacement or change the requirements for such a substance.

26. As of January 1995, 104 foam investment projects (grant amount $51 million) had been approved, excluding polyol production and projects with refrigerant components (commercial/ domestic refrigeration), to phaseout 10,600 tonnes ODP. The four main categories of foam projects are:
- o extruded polyethylene/polystyrene foams (XPS/PE)
- o flexible polyurethane foams (slabstock/boxfoam process) (FS/B-PUF)
- o flexible/semi-rigid polyurethane foams (molded/integral Skin) (F/IS-PUF)
- o rigid polyurethane foam (molded, spray, panels, boardstock) (R-PUF)

27. It was decided not to include the latest 1995 project approvals since numerous projects are being cost-shared by the respective enterprise in order to improve the project's cost-effectiveness value. Given the low level of capitals that characterizes the SME enterprises, the possibility of any direct cost-sharing contribution by the recipient enterprise is hardly evident. Therefore, a prudent course has been taken to show the closest cost-effectiveness value of an SME project.

28. Project costs comprise equipment, trials, technology transfer, training, installation of new/retrofitted equipment, contingencies and incremental operating costs/benefits. Aggregating these into two categories, equipment costs were 75%-80%, technology costs 11%-15% and contingencies 9%-10%. The effect of baseline ODS consumption on project cost-effectiveness shows a weak relationship for large ODS-users and a strong relationship for small ODS-users, thereby justifying special consideration for small sized ODS-users.

29. Based on the analysis of the 104 approved projects, the enterprise size is categorized as follows (in tonnes/yr):

ODS USERS	XPE/PS	FS/B-PUF	F/IS-PUF	R-PUF
LARGE-SIZE	> 150	> 150	> 30	> 30
MEDIUM-SIZE	25-150	25-150	10-30	10-30
SMALL-SIZE	< 25	< 25	< 10	< 10

30. For the above categories, the following are the cost-effectiveness thresholds or threshold ranges in US$ per kg.

ODS USERS	XPE/PS	F-PUF S/B	F-PUF M/IS	R-PUF
LARGE-SIZE	< 2	< 1	< 6	< 8
MEDIUM-SIZE	2 - 9	1 - 8	6 - 11	8 - 20
SMALL-SIZE	> 9	> 8	> 11	> 20

31. **Recommendations** The following are recommended based on experience gained to-date in the foam sector:

Option A: Cost-effectiveness values by sub-sector and enterprize size It is recommended to divide the foam sector into four categories and three ODS enterprise sizes, with different recommended cost-effectiveness thresholds:

ODS USERS	XPE/PS		F-PUF/SB		F-PUF M/IS		R-PUF	
	size	C.E.	size	C.E.	size	C.E.	size	C.E.
LARGE-SIZE	>150	< $2	>150	< $1	>30	< $6	>30	< $8
MEDIUM-SIZE	25-150	< $9	25-150	< $8	10-30	< $11	10-30	< $20
SMALL-SIZE	<25	$11-15	<25	$10-14	<10	$11-15	<10	$22-25

Option B: Cost-effectiveness values by type of process and enterprize size It is recommended to divide the foam sector for the purpose of a fair judgement of the ODS Volume Effect (OVE) into two process categories and three ODS user groups and to assign specific cost effectiveness thresholds as follows:

ODS USERS Group	CONTINUOUS PROCESS		DISCONTINUOUS PROCESS	
	size (t/y)	C.E. threshold	size (t/y)	C.E. threeshold
LARGE ODS USER	> 150	3.00	> 30	6.00
MEDIUM ODS USER	25-150	6.00	10-30	12.00
SMALL ODS USER	< 25	12.00	< 10	24.00
CURRENT LIMIT		8.22/6.23		16.86/7.83

32. While the thresholds for large and medium ODS users are based on statistical findings, the proposed threshold for small users cannot be based on such information. It includes a challenge to improve the cost effectiveness through innovative measures. Demonstration projects prepared along those lines have shown the potential to cost reduction that allows to meet the proposed threshold.

33. In exceptional situations, such as small users in small countries, it may not be feasible to meet the proposed thresholds because no similar enterprises exist locally or regionally. It is recommended to grant in such cases exemption of the application of a threshold if and when it is shown that all cost-reducing measures have been evaluated and applied to the extent possible.

34. Projects for SMEs should be grouped by foam sub-sector. If a country has over five SMEs per foam sub-sector, a group phaseout project per sub-sector should be prepared.

35. The following commercially available technologies are recommended and a deviation requires justification:

	Category	Technology
a)	XPE/PS	LPG or butane
b)	F-PUF S	Methylene chloride
c)	F-PUF B	Methylene chloride, if needed supplemented with forced cooling
d)	F-PUF M/IS	Water-blown or HCFC-141b
e)	F-PUF	Water-blown or HCFC-141b

36. Wherever feasible, existing equipment has to be used with reasonable retrofit costs. If no baseline pouring equipment is available (relevant for boxfoam and molded), the following equipment can be provided:
    - Boxfoam (pumps for transfer of hazardous chemicals)
    - Molded (air-operated dispensing equipment)

37. In specifying project equipment needs, considerations should be given to possible impact of recent technology developments on equipment needs. For example, is the use of high pressure equipment still justified given the availability of permanent zero-ODP technologies? What are the differences in equipment requirements between the different types of molded foams (flexible, rigid/general and refrigeration, integral skin/rigid/semi-rigid)? What additional zero ODP technologies besides water, pentane and gaseous HFCs can be anticipated with sufficient assurance that present project equipment needs could be specified to also cater to such future likely permanent technology?

E. SECTOR-SPECIFIC OVERVIEW AND RECOMMENDATIONS: REFRIGERATION

38. The refrigeration sector plays an increasingly vital role in the economies of every developing countries due to its importance in improving the national food distribution chain. Many developing countries also generate much-needed foreign exchange through the production and export of agricultural, horticultural, and fishery products, which require refrigeration both for storage and transportation in order to preserve product quality.

39. Tourism also makes an important contribution to the economies of many developing countries, especially small island countries, and air-conditioning for hotels and tour buses is growing in importance as these countries' tourism industry is developed.

40. The refrigeration sector accounts for a relatively large share of the overall ODS consumption in many Article 5, para 1 countries. This is especially true for the low-volume ODS-consuming countries, where the refrigeration sector often represents 70% or more of the countries' total ODS consumption. For example, the refrigeration sector's share of national ODS consumption (based on ODP tonnes) is 94% in Guatemala, 93.4% in Cuba, 71.2% in Ghana, 61.2% in Zimbabwe and 53.1% in Uruguay.

41. ODS consumption in the refrigeration sector in developing countries can be broadly categorized as follows:

42. Original Equipment Manufacturers (OEMs) who consume ODS in the manufacture or installation of new refrigeration or air-conditioning equipment.

43. Refrigeration service companies who service and repair existing, installed industrial, commercial, domestic, and mobile refrigeration and air-conditioning equipment.

44. The consumption of ODS by the service sector is considerably in excess of the consumption by the OEMs, the ratio being usually 10:1 or greater. **This is a feature which distinguishes the refrigeration sector from the other ODS consuming sectors.**

45. a) Original Equipment Manufacturers (OEMs) These enterprises can be subdivided into

three general categories:

OEM Sub-sector 1: Enterprises manufacturing unitary domestic or commercial refrigeration equipment (which may include PU foam insulation blown with ODS) which is charged with an ODS refrigerant by the enterprise in the OEM factory.

Typically in the low-volume ODS-consuming countries, these enterprises import hermetic compressors. Other components such as evaporators, condensers, capillary tubes and filter/driers may be locally produced, or imported.

It is a feature of these enterprises, irrespective of their size, that they will require investment to change from the existing technology to a non-ODS technology. This investment will typically be both for replacing the CFC-11 in the PU insulation foam, and for replacing the CFC-12 (or R-502) refrigerant. The latter technology change requires not only new equipment but also technical assistance in developing the new non-ODS refrigerant based refrigeration equipment design, but also training and reliability test trials. The technology change has to be developed and implemented by the enterprise.

OEM Sub-sector 2: enterprises who design, fabricate, and install non-unitary commercial and industrial refrigeration and air-conditioning equipment. This equipment is either purpose-made to suit a particular application, or a standard design which will provide the required performance.

These enterprises almost invariably import compressors and some components from developed countries, but they will also manufacture some components themselves. This equipment will be charged on-site, following installation, usually, but not always by the equipment manufacturer.

Installers of mobile air-conditioning systems would also be covered by this category.

There are inevitably some enterprises who consume ODS in the manufacture of non-unitary refrigeration equipment who are difficult to categorize definitely between the refrigeration sector and the foam sector. An example would be an enterprise making refrigerated food display cases for supermarkets which incorporate the evaporator, and the enterprises consumes CFC-11 in producing the PU insulation foam. The enterprise may also carry out the complete installation of these display cases involving a central refrigeration plant. On the other hand, the enterprise may supply the display cases to the supermarket who will use another company to do the installation and complete the refrigeration part of the task.

These enterprises differ significantly from enterprises in the above category in the investments needed to change to non-ODS technology. If they are consuming CFC-11 for the manufacture of PU insulation foam, there will be similar investments costs to move to non-ODS technology. In this case, the project should be treated as a foam sector project. However, replacement of the CFC refrigerant should involve little investment cost. Refrigerant charging on-site uses relatively simple equipment and the semi-hermetic, or open, compressor systems are less susceptible to the chemical stability related issues arising from moisture and chemical contaminants in hermetic systems with capillary tube expansion devices. Reliability test trials are not then required.

It is true to say that in this category, if the enterprise is not consuming CFC-11 for PU insulation foam production, then the incremental capital costs for the conversion to non-ODS refrigerant will be so small, maybe US$ 5-10,000, that even the preparation of a project proposal is of doubtful economic value.

- **OEM Sub-sector 3:** enterprises who import non-unitary commercial and industrial refrigeration and air-conditioning equipment which they install, charge with ODS refrigerant, and co mission. This category includes both the larger items of equipment used for cold stores, industrial cooling and processing, as well as smaller equipment for refrigerated trucks.

  This OEM sub-sector will change to non-ODS based equipment as the equipment suppliers change their technology. No investment projects would normally be foreseen in this sub-sector.

46. b) Refrigeration servicing sector This is generally a highly fragmented sector in developing countries without any larger-sized enterprises specifically established for the purpose of providing maintenance and service facilities for the refrigeration sector.

47. Typically, the refrigeration service sector in developing countries can be divided into two sub-sectors:

- the "organized" sub-sector which involves the same enterprises who have been described above as OEMs, who also service and repair the equipment that they manufacture, or import and install. The larger enterprises may have several small service centers throughout the country to serve major cities or industrial centers. Spare parts, usually compressors, are imported and hence the repairs usually involve some warranty.

- the "un-organized" sub-sector which is comprised of many very small, even "one man" enterprises, and which are usually involved in the service and repair of older, small scale, equipment such as domestic refrigerators and commercial refrigeration equipment which is no longer under any warranty from the OEM. There are exceptions, notably in the mobile air-conditioning sector where enterprises in the "un-organized" sector may service relatively new mobile air-conditioning systems.

48. SME enterprises can be found in both the "organized" and "un-organized" sub-sectors of the refrigeration service sector. Good quality data on the division of ODS consumption between the "organized" and the "un-organized" sub-sectors is generally not available and it is difficult to obtain. There is a very general assumption that consumption in the "un-organized" sub-sector may be of the order of four times that in the "organized" sub-sector.

49. **Definition and Cost-Effectiveness for SMEs in the Refrigeration Sector**

The following classification scheme is recommended for the OEM Unitary Refrigeration Equipment Manufacturing Sub-sector:

Classification	Production Volume	ODS Tonnes consumed per year
Small-size enterprises	< 10,000 units/yr	< 10 tonnes/yr
Medium-size enterprises	< 100,000 units/yr	< 100 tonnes/yr
Larger-size enterprises	> 100,000 units/yr	> 100 tonnes/yr

50. **Cost-effectiveness of SME Refrigeration Investment Projects:**

a) Background. In March 1995, the Executive Committee adopted threshold values for the cost-effectiveness of domestic and commercial refrigeration sector investment projects of US$13.76/kg and US$15.20/kg, respectively. At the present time, other refrigeration sub-sectors do not have formal established cost-effectiveness threshold values.

b) OEM - Unitary Equipment

o It should be recognized that there will always be a minimum entry cost for an ODS elimination project for SMEs in this sector. For an SME investment project involving both refrigeration and foam components, based on projects approved in low ODS-consuming countries to-date, the incremental cost for a small OEM in the domestic refrigeration sector ranges between US$197,208 (Mauritius), US$ 229,816 (Peru), and US$250,114 (Sri Lanka), with cost-effectiveness value averaging at US$60/kg. For the commercial refrigeration sector, projects approved to-date carries a cost-effectiveness value of US$35-$40/kg.

o For an SME which has a consumption of up to 1 tonne of CFC-12 only and with no CFC-11 consumption (e.g. insulating panels are purchased ready-made), a cost-effectiveness threshold value of US$50/kg could be considered.

c) OEM - Non-unitary Equipment

o For enterprises consuming CFC-12 or R502 refrigerant, it is proposed that investment projects are not necessary due to the very low costs. Awareness programmes and maybe a technology workshop could be considered if a large number of SMEs are identified in this category.

o For enterprises consuming CFC-11 for the manufacture of PU insulation foam, an investment project may be required and if so, it should be treated as a foam project. The very modest costs of a portable vacuum pump, hand-held leak detector, and a manifold gauge charging set may be considered within the project if the project comes within the SME cost-effectiveness value.

d) OEM - Importers of Non-unitary Equipment It is proposed that no investment projects are required for SMEs in this category.

e) Servicing Sector For SMEs in this sub-sector, the following equipment and supporting activities could be provided: recovery/recycling equipment; leak detectors; information and training (e.g. better practices and maintenance procedures for operation and servicing of refrigeration and air-conditioning equipment, preventive maintenance, improved leak testing procedures and frequency, refrigerant containment through purge capture systems, and recovery/recycling techniques, all aimed at reducing unnecessary emissions and containing recoverable refrigerant).

51. It is recognized and accepted that SME projects involving investment in refrigerant recovery and recycling equipment should fit into the country's national strategy for ODS refrigerant recovery, recycle, and reclaim.

52. In summary, the cost-effectiveness threshold for SMEs in the refrigeration service sector could be established at US$ 20-40/kg (depending on the type of business engaged in by the SME).

53. **Recommendations**: The Executive Committee may wish to consider:

a) **Investment Projects for SME OEMs - Unitary Equipment Manufacturers**:
- o for an SME investment project involving both refrigeration and foam components, a cost-effectiveness threshold value of $35-40/kg.
- o for an SME investment project involving only a refrigeration component, a cost-effectiveness threshold value of US$50/kg.

b) **Investment projects for SME OEMs - Non-unitary Equipment Manufacturers:**
- o for enterprises in this category consuming CFC-11 for PU insulation foam, to treat the project as a rigid foam project. Where additional small items of equipment associated with the elimination of an ODS refrigerant can be accommodated within the cost-effectiveness threshold for the project proposal, that such equipment may be included.

c) **Support Projects for SMEs in the Service Sector with limited investment components related to demonstration projects** that would include:
- o provision of recovery and recycling equipment and leak detection equipment for demonstration purposes.
- o promotion of better practices and maintenance procedures for operation and servicing of refrigeration and air-conditioning equipment. This will include emphasis on preventative maintenance, more frequent and improved leak testing, refrigerant containment, purge capture, and recovery and recycle techniques. This could include developing practical and easy-to-understand technical information expressly for the servicing sector audience on a sub-sector by sub-sector basis. It could be disseminate at the local level through outreach campaigns, seminars and workshops organized by SME-oriented industry associations or technical assistance programmes involving enterprises with practical experience from the developed countries, NGOs and national ozone units.

54. The cost for such support activities in the service sector would be quite low and difficult to quantify in terms of ODS elimination, therefore, such projects should be considered without employing any limiting threshold values.

F. SECTOR-SPECIFIC OVERVIEW AND RECOMMENDATIONS: AEROSOLS

55. The cost of ODS phaseout in the aerosols sector on a per kg. basis is, in general, lower than in other sectors for mid-to-larger size enterprises. This fact has resulted in implementing agencies and countries being encouraged to target CFC usage in the aerosols sector as soon as possible so as to provide a very cost-effective use of available funding resources.

SME in the aerosol sector

56. In many Article 5 countries, the aerosols sector often comprises a large number of small-scale enterprises, many of which are family-owned. These SMEs operate in both the formal and informal economy. (It is proposed to classify an enterprise in the formal sector if it is registered with either a Business Association or an appropriate body.) Many countries have a large informal aerosol industry, which frequently serves as an important source of employment. In Indonesia, for example, many aerosol enterprises are SMEs that operate in the informal sector, requiring a different approach to reach and convert them to non-ODS alternatives. Since SMEs operating in the informal sector are reluctant to become legal entities, which is a precondition for receiving financial assistance, a different approach to reaching them is needed.

57. The conditions of these SME aerosol plants in developing countries are characterized by very simple, congested and crude production facilities, often consisting of manual filling machines with propellant feeding pumps driven by non-explosion-proof motors. Ventilation and lighting facilities in such conditions are not suitable for filling operations using flammable propellants. No special measures exist to control exposure or fire hazards. In majority of cases, the existing production facilities are not safe for conversion to use of hydrocarbons. Relocation to new site will be required.

58. The size of individual SME aerosols enterprises can vary considerably. For example, in Ecuador, SMEs with approved Multilateral Fund investment projects have a consumption range of 0.1 - 60 tonnes CFC per year. SMEs often form a large percentage of enterprises operating in this sector; in China, most of the country's 150 aerosol product enterprises have a small production capacity (under 500,000 cans/year, and some produce only 100,000 cans/year). A further complication that arises is that many aerosols SMEs are small family-operated businesses and access to these SMEs is extremely difficult.

59. It is difficult to arrive at a universal definition of an aerosols SME. Enterprise size, the number of cans filled per year, and the weight of the CFC used jointly define an aerosols SME. This complexity is illustrated by the following examples:

Description	**Company A**	**Company B**
Product	Contact cleaner	Perfume
Cans filled per month	10,000	100,000
CFC used (tonnes/yr)	60	9.6
Type of equipment	Manual	Manual
Total employees	10	40-60
Sales (US$/year)	< 400,000	> 1,000,000
Size	Small company with large consumption	Large company, low consumption

Source: UNDP Aerosols Workshop

60. Another example has two enterprises with identical CFC consumption levels, but different size characteristics:

Description	**Company A**	**Company B**
Product	Aerosol	Perfume
Units filled per year	100,000	5,000,000
CFC used (MT/year)	50	50
Type of equipment	Semi-automatic	Automatic
Total employees	5	10-15

61. **Definition of an SME in the aerosols sector** The following classification scheme for aerosols enterprises is recommended:

Classification	Tonnes consumed per year
Small-size enterprises	upto 20 tonnes
Medium-size enterprises	20 - 100 "
Larger-size enterprises	above 101 "

62. **Cost-effectiveness of SME aerosols investment projects** At present, the most acceptable cost-effective CFC alternative is hydrocarbon technology, which entails stringent safety measures that have to be taken by the enterprise and a different (higher) level of skills that employees need in order to run the new equipment and handle the new formulations with hydrocarbons. The retrofit will require the use of an appropriate hydrocarbon propellant filling machine, a water bath and some essential safety-related installations and equipment. The minimum net investment cost involved for a small SME is estimated at between US$ 50,000 - 110,000. This implies a cost-effectiveness range of US$ 7-10/kg could be considered for SMEs in the aerosol sector.

63. **Recommendations** The Executive Committee may wish to consider:

a) For SMEs operating in the formal sector: investment projects
   - o adopting a cost-effectiveness threshold value for SMES of US$ 7-10/kg as compared to the US$4.40/kg figure used for larger enterprises. The funding has to be enough to cover the safety costs involved in the conversion.
   - o in limited cases and wherever feasible, establishing local filling centres to assist SMEs.

b) For SMEs operating in the formal and informal sectors: support activities
   - o organizing safety training workshops on ODS replacement technologies and equipment requirements; "matchmaking" workshops to facilitate industry partnerships; and "case study" workshops to transfer peer experiences from developed countries or more advanced developing countries.
   - o developing practical and easy-to-understand technical information expressly for formal and informal SME audiences, and disseminate it to SMEs at the local level through outreach campaigns, seminars and workshops organized by: SME-oriented industry associations; SME-oriented technical assistance programmes (e.g. APCTT); NGOs; and national ozone units.

G. SECTOR-SPECIFIC OVERVIEW AND RECOMMENDATIONS: SOLVENTS

64. The solvent sector consists of solvent users engaged in the manufacture of products such as jewelry, cardiac pacemakers, airplane parts, belt buckles, printed circuit boards, artificial limbs, etc. It also has various service industry users such as nuclear cleanups, PCB spill remediation, medical/surgical preparation, custom breast replacement, cleaning large electric motors while in operation, etc. The user base in most countries has a few large users, a large number of mid-sized users, and often significant numbers of very small users.

65. While the definition of "small user" varies from country to country, generally in developing countries it has been estimated that 2/3 of solvents consumption is by enterprises whose annual consumption is less than 2.5 tonnes of CFC-113 and 10 tonnes of TCA. In the China country

programme, 63% of the users were considered to be "small" users, and the India CP estimates that about 70% are small users, outside of the pharmaceutical sub-sector. Because markets have developed in this manner, it is a common practice to move solvents from producer to industrial consumers through a distribution chain. As a result, there is a general difficulty in identifying the small users.

66. Prior to the Montreal Protocol, the mid-sized CFC-113 user in a batch vapor degreaser was consuming 10-20 tonnes/yr (8-16 tonnes/yr ODP), depending on volume of manufacture and conservation practices. The average in-line, or continuous, vapor degreasing operation consumed 25-30 tonnes/yr (20-24 tonnes/yr ODP). After the Montreal Protocol, developed country users employed conservation measures to control losses and wasteful emission uses, and found they could reduce their consumption by 20-40% on a sustainable basis. The comparable usage rates of TCA were 5-10 tonnes/yr for batch units (0.5-1 tonne/yr ODP) and 15-20 tonnes/yr for in-line units (1.5-2 tonnes/yr ODP).

67. While developing countries had similar equipment in well capitalized factories, often they did not have some of the containment features, nor did they have good control of other emissive uses. There was also locally produced equipment which did not always meet international standards in the area of emission control. Thus, the losses were higher for the average user, and especially so in tropical countries.

68. An analysis of approved CFC-113 investment projects shows that about half are in the low to middle part of the range, and half in the upper end of the range. Since the larger users are often multinationals, only a few large users should be expected. The few projects for the smaller users gives strong support to the ExCom's concern on how to address this sub-sector.

69. Analysis of approved TCA investment projects shows that the "average" usage range (corresponds closely to the mid-sized range) only contains three projects. All the rest are larger, and there are none approved in the small-size range. Thus, prior to the cost effectiveness guidelines, there was little effort to develop projects for the SME TCA users. The new cost effectiveness guidelines will virtually eliminate efforts to develop projects to phaseout SME TCA usage, the reason being the very low ODP of TCA mathematically reduces the cost effectiveness of projects to a substantial extent. For example, if two identical aqueous replacement processes to clean metal parts were placed in two separate enterprises, one using TCA and one using CFC-113, each project would have essentially the same cost, but when cost effectiveness is calculated, the TCA project would be at least 8 times less cost-effective than the CFC-113 project.

70. The analysis also shows that for CFC-113, cost effectiveness begins to transition upward when usage falls below about 20 tonnes/yr ODP, and breaks out asymptotically when usage falls below about 5 tonnes/yr, which encompasses the small consumers and the lower range of the mid-sized consumers. It is difficult to define a transition level for TCA, but the cost effectiveness breaks upwards asymptotically when consumption falls below 3 tonnes/yr, which is within the full range of the small and mid-sized consumers.

71. Since ODS solvents are relatively expensive as compared to the many non-ODS industrial grade cleaners, they are often used only when necessary by the small scale sector, and there is usually some form of equipment involved in order to contain them and control any wasteful use. These small users can consume from 1-3.5 tonnes/yr ODP of CFC-113 and under 0.3 tonne/yr ODP of TCA. Below this consumption level, there are also a large number of very small users who use no equipment, buy their needed materials by the bottle or pail, and have very little knowledge

or resources available regarding how to substitute safely.

72. **ODS Replacement Technologies** They are usually not "drop in" replacements. Normally equipment must be replaced or retrofitted to accommodate the new cleaning agents. The only real "drop ins" are extremely expensive PFCs, HCFCs, and HFCs, and due to their high cost, the equipment must usually be retrofitted anyway, to contain the losses and thus minimize the operating costs. The replacements are no-clean, aqueous, semi-aqueous, non-chlorinated solvent, and chlorinated solvents. No-clean usually requires upstream process and materials changes. Aqueous and semi-aqueous normally require new equipment and water treatment facilities (inlet and/or outlet), non-chlorinated solvents are either flammable, toxic, or very costly and require new or retrofitted equipment, depending on the circumstances. Chlorinated solvents are normally more toxic, and require modifications to contain or control personnel exposure. Many of the technologies have safety and environmental issues that have to be addressed.

73. **Cost Effectiveness** The cost effectiveness of solvents projects has been an issue in general, and in the small user sub-sector in particular. The CowiConsult report (March 1995) in their analysis of 225 investment projects, of which 10% (23) were in the solvents sector, showed that the cost effectiveness for the solvents sector averaged US$44/kg.

74. Analysis of approved projects to date shows that the current limit of US$19.73/kg ODP is adequate for projects eliminating over 20 ODP tonnes/yr of CFC-113. However, with respect to TCA, the number of approved projects are too few to statistically derive suggested CE values for various TCA consumption volumes. The current limit of US$38.6/kg ODP could be nearly adequate for volumes over 7 ODP tonnes/yr. In the lower range (under 1 ODP tonne/yr), the data is insufficient to reach a conclusion on an effective CE limit (a limited aqueous technology could run US$ 50-70/kg. ODP while a chlorinated solvent retrofit at $38.6/kg. ODP would be adequate.

75. There are also issues regarding safety and environmental impact. Chlorinated replacements are many times more toxic than the ODS they are replacing. Without training or education and without projects, many SME TCA users are simply converting to trichlorethylene (TCE) or perchlorethylene (PCE) which is environmentally wrong. The use of water/detergent can cause heavy metals in the waste streams which must be removed. The use of semi-aqueous solutions must address flammability on the solvent side. The use of flammable solvents can be effective with safe equipment designs.

76. **User Identification** In many countries the large multinational users have phased out or are doing so, and larger identified users are generally joint ventures with activities underway. They have the engineering resources to identify alternative technologies, and make a selection based on their safety, environmental, quality and cost needs. SMEs are still unidentified in general, and the issue is how to reach and address their phaseout needs.

77. One option to reach SMEs is through seminars, surveys, and questionnaires to known users or industry groups. The results have not been productive to date. Also, there have been mixed results from requesting distributors to cooperate by sharing their customer lists. Another technique, being considered by Indonesia and discussed in Malaysia, is to involve the various suppliers and distributors in training the retailers regarding the safe and environmentally secure way to use the replacement products. This programme impacts primarily upon small users who use no equipment and those who use cold cleaning equipment. With appropriate training material that the retailers can take with them, it is possible for the end users to be converted by the

retailers. When the users return to purchase a container(s) of ODS, the retailer can: (a) refer to the applications literature and show the end user the options to be tested by the user for that particular application; and (b) inform the user of the deadline when the current ODS will no longer be available.

78. There are some large corporations (among others) who are still using small quantities of ODS contained in some "custom blends" that they purchase from local chemical supply houses. These local "formulators" make these proprietary, specialty blends to meet very specific needs for end users. Rather than trying to identify and then phaseout the various end users, an umbrella programme is being discussed in the Philippines, where the formulators can be phased out with minimal, but appropriate, safety and ventilation equipment installed so that they can adopt the flammable and more toxic substitutes into their custom blends.

79. **Recommendations** It is recommended that solvents users be divided into 3 categories for both TCA and CFC-113. There are insufficient data for CTC classification.

a) For CFC-113, it is recommended that the breakpoint for volume be as shown below, together with the thresholds as indicated. The ODP cost-effectiveness threshold for large users could remain at US$19.73/kg, and that for medium-size users should be raised to US$26/kg. and for small-scale users should be set at US$35/kg.

ODS Users Group	CFC-113 ODP t/yr	C.E.
Large	>17	20
Medium	3.5 to 17	26
Small	<3.5	35

b) For TCA, it is recommended that the existing CE limit of US$38.6 be maintained for large users, that the CE limit for medium size enterprises be set at US$65/kg. and that for small-scale enterprises be set at a maximum of US$100/kg. The proposed CE limits for mid and small scale enterprises should be considered as demonstration projects until we have a significant number of approved and implemented projects to test these limits.

ODS Users Group	TCA ODP t/yr	C.E.
Large	>2	38.6
Medium	>0.6 to 2	65
Small	>0.15 to 0.4	100

80. For a medium-size TCA operation (0.6-2.0 ODP tonnes), the cost of an aqueous cleaning machine including a transport system and a DI plant costs $80,000, giving a CE range varying from $40-130/kg. The average value has been set at $65/kg. pending the results from projects that would be approved under this recommendation. Based on the same criteria, the average CE level for small-scale TCA users (under 0.4 ODP tonnes) should be set at $100/kg., the same

maximum level as in mid-1994, pending the conclusion of approved projects in this area.

81. It is recommended that some projects be prepared, per the above options, especially for the small user who has no equipment, using the upstream retailer training approach, with the assistance of producers and distributors to ensure that the retailers are identified and trained. For the small user who has equipment, it is recommended that the Malaysian model be developed for the users with very low consumption of TCA (under 0.2 MT ODP) and CFC-113 (under 1 MT ODP). This should give economies of scale through volume purchases.

82. For the small users who are using specialty formulations containing ODS, it is recommended that an umbrella project be developed as a pilot in which the custom formulation user sub-sector is phased out by offering substitutes to the blenders and having them change the formulations to meet both the needs of their customers and the needs of the environment.

H. CONCLUSION

The SMEs, when taken as a collective, can have a significant volume of ODS consumption that has to be eliminated in conjunction with other ODS phaseout activities in any given country. Unless special measures are taken at the Executive Committee level to particularly address the special needs of SMEs, this sector will continue to be by-passed. If SME phaseout is not funded concurrently, it is highly probable that ODS consumption in SMEs will increase rapidly, thereby negating the country's ODS phaseout efforts in larger enterprises and resulting in no net national ODS phaseout even though Multil fund resources have been spent in those countries. Tables 1 and 2 below summarize the various recommendations that could be considered.

Table 1: Approaches to ODS Phase Out in SMEs

Options	SME Identification and coverage	Technology selection*	ODS Consumption base	Sectoral Applicability*
One time sectoral/sub-sectoral approach	Survey conducted and all SMEs identified. Project will cover all SMEs in the sector/sub-sector.	Only one technology to be applied in the entire sector/sub-sector.	Total ODS amount for the entire sector/sub-sector will be taken to calculate the project cost-effectiveness (CE).	Potentially applicable only to foam sector in medium-size countries. Solvent and aerosol sectors possible, but SMEs are more difficult to identify.
Multi-phase approach	Survey of the whole sector/sub-sector required. ODS Consumption to be calculated/estimated and all SMEs will be identified to the extent possible. Phaseout projects to be developed in several tranches.	More than one technology may have to be selected to take into consideration types of products, applications, sub-sector, etc.	Total ODS of those SMEs covered in any one umbrella porject will be used to calculate CE value. Total ODS of all umbrella projects should not exceed the estimated consumption indicated in the survey. If different, this should first be justified.	All four sectors covered.
Sectoral funding strategy approach	Survey of the entire sector required to obtain accurate total ODS consumption. An overall funding level will be determined. Modalities for this type of funding mechanism is being developed by the World Bank.	Different cost-effective proven technologies may be applied based on products, applications, sub-sector concerned.	Total ODS of the entire sector will be used to determine the overall funding level.	All four sectors covered.

* Criteria for selection are defined in table 2

Table 2: Application Criteria

Criteria	Most Cost-Effective Technology	ODS Limit	Recommended Cost-Effectiveness Threshold	**Special support activities required**
Flexible Foam	Methylene chloride	<25 MT/yr	$10-14/kg	None
Rigid Foam	Water blown & HCFC-	<10 MT/yr	$22-25/kg	None
XPE/XPS Foam	LPG	<25 MT/yr	$11-15/kg	None
F/IS Foam	Water blown & HCFC-	<10 MT/yr	$11-15/kg	None
Solvents	no-clean; aqueous; semi-aqueous; non-chlorinated solvents; chlorinated solvents.	CFC-113: <4.4 MT/yr ; TCA: <4 MT/yr	CFC-113: $35/kg; TCA: $100/kg.	Training in containment and recycling.
Aerosol	Hydrocarbons	<20 MT/yr	$7-10/kg.	Safety training workshops on ODS replacement technologies and "Matching" workshops to facilitate industry partnerships; "Case study" workshops to transfer peer experiences from developed countries or more advanced developing countries. Developing practical and easy-to-understand technical information expressly for formal and informal SME
Refrigeration	HCFC-141b and R134a	OEM: <10,000 units/yr or <10 MT/yr. Servicing sector: <1 MT/yr.	For SME in OEMs with both foam and refrigeration components: $35-40/kg; For SMEs with	Provision of recovery and recycling equipment and leak detection equipment for demonstration purposes; Promotion of better practices and maintenance procedures for operation and servicing of refrigeration and air-