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UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

**UNIDO PROGRAMME OF COOPERATION WITH
DEVELOPING COUNTRIES TO ASSIST THEM MEET THEIR
OBLIGATIONS UNDER THE MONTREAL PROTOCOL:
AN OUTLINE OF THE WORK PROGRAMME FOR 1993**

**Prepared for Presentation to the
Executive Committee of the
Interim Multilateral Fund for the
Implementation of the Montreal Protocol**

October 1992

I. INTRODUCTION

UNIDO has the necessary capability to enable it serve as an implementing agency of the Multilateral Interim Fund. UNIDO's mechanisms to implement environment-related activities fall into four main categories:

- Programmes of technical co-operation including technology transfer, development and adaptation, enterprise development, capacity building, infrastructure development and research and development;
- Investment-related activities and services;
- Policy advice, statistical analyses and technical information services; and
- Policy formulation (including global and regional consultations and negotiations on technology acquisition).

At the operational level, UNIDO staff with expertise in the refrigeration, foam and electronics industries are available to manage the development and implementation of technical assistance projects in ODS phase-out.

UNIDO has devoted internal resources to creating the foundation upon which to design and build its ODS Programme. UNIDO's in-house staff possess the necessary skills related to ODS and their chemical substitutes (already existing and/or in research, development and testing phase) as industrial raw materials. UNIDO is staffed with experts familiar with technologies where ODS are used.

The following relevant measures have been taken to enhance the responsiveness of UNIDO to the environmental challenge:

- A Task Force has been established to 1) Draw-up an organization-wide strategy in response to the international agreements such as the Montreal Protocol, 2) set up and propose priorities for activities and 3) ensure organization-wide dissemination of information on the policies and priorities of funding sources for programmes and projects;
- An Environmental workshop for UNIDO Country Directors briefed field staff on ODS issues, such as Assessing the Viability and Cost of Cooperating with the Developing Countries to Meet the Requirements of the Montreal Protocol;
- Production of a document "UNIDO's Response to Agenda 21";

- Organization of an Ad hoc UNIDO Industry Meeting on Phasing Out Ozone Depleting Substances (1990);
- Expert Group Meeting on the Environmental Aspects of the electronic industry, in cooperation with UNEP, dealing, inter alia, with the CFC 113.

UNIDO would undertake its initiatives in co-operation with governments of the recipient countries, and in close association with private- and public-sector industry. Activities will follow on the country studies under preparation by UNEP, UNDP and the World Bank.

UNIDO will continue the series of Industry Meetings on Phasing Out Ozone-Depleting Substances which it launched in 1990, as well as the Technical Workshops (possibly organised jointly with other implementing agencies with a focus on CFC sub-sectors). Emphasis would be placed on the widest possible dissemination of results so as to realize the greatest possible multiplier effect.

A sequence of activities in a possible UNIDO ODS programme in a given country could be:

- > Analysis of country studies and programmes prepared by UNEP, UNDP and the World Bank;
- > Diagnostic Missions (Mapping) and Appraisals, which could draw on staff specialized in any or all of the different UNIDO instruments presented above;
- > Training and Management Programmes (including Retraining and Training of Trainers), which would focus on directly assisting enterprise managers and staff in industrial enterprises in adapting new, cleaner production technologies and processes;
- > Identification of Potential Investment Projects, where such pre-investment studies would lead to technology transfer, development and adaptation;
- > Transfer of Technology, with emphasis both on the development and implementation of new processes as well as on adaptation, design engineering and product development;
- > Monitoring the process of adaptation to cleaner production processes and dissemination of industrial information across developing countries;
- > Institution building including provision for further support to companies which acquire non-ODS technology.

UNIDO has ready access to the experts and private sector companies/NGOs which are necessary, (rather than large bodies of academic consultants), to support developing countries implement the Protocol on a practical enterprise level. The Organization can mobilize developed country expertise in support of developing country industry which is focused on actual needs.

UNIDO's capability to implement smaller projects with budgets of tens of thousands of US dollars in a timely and efficient manner, will enable the Organization to assist the small and medium-scale enterprises employing ODS in foam blowing and solvent cleaning operations.

UNIDO has a support network of approximately 30 UNIDO Country Directors (UCD) and 60 Junior Professional Officers (JPO) in the field familiar with industrial development and aware of the ODS issue. This network will greatly enhance the efficiency of development and implementation of ODS-related projects.

Involvement in enterprise development and relevant optional financial and funding mechanisms to support the industry beyond the criteria of the Interim Multilateral Fund is another operational element of UNIDO.

In practical terms, the aforementioned means that UNIDO is able to manage the project cycle from identification through appraisal to implementation and follow-up, with very modest external contributions, such as limited short-term consultancy and advisory services.

II. UNIDO'S SECTOR-BASED AND RELEVANT EXPERIENCE

I. REFRIGERATION AND COLD STORAGE

UNIDO's technical co-operation with the Government of Viet Nam to strengthen the Mechanical and Electrical Refrigeration Centre of Seaprodex could provide a case as to how the Interim Multilateral Fund can realize objectives in technical co-operation. This project concerned maintenance of refrigeration systems in the country, training refrigeration system operators, designing and locally manufacturing prototypes of refrigeration system components, undertaking measures to raise the quality of the insulating panels and spare parts produced locally, operating extension services and training, and supervising the design, construction and commissioning of all new refrigeration systems and the rehabilitation of existing obsolete ones.

A 10,000 ton cold storage plant was established in Armenia under a UNIDO project using non-CFC technology. In the design and implementation of such a technical co-operation project, UNIDO directly contributed to reduced ODS consumption.

As a result of a UNDP/UNIDO project, The Qualifications, Acceptance Testing and Certification Centre for air conditioners and refrigerators (household electrical appliances) was established in China. Non-ODS

technologies could be transferred to Chinese air conditioner and refrigerator manufactures in the area of non-CFC working fluids through the Centre as national authority. However, for the immediate future this centre could play a major role in introducing stricter quality control measures during the manufacturing process of refrigerators and air conditioners in all China, which should lead to better reliability and higher life time of products, thereby reducing CFC consumption and repair works. New technologies in welding and brazing as well as the application of new materials would be looked at as well.

2. FOAMS

UNIDO has provided technical assistance to developing countries in polymers and plastics including polyurethane-based materials. Foam producers in developing countries are usually small, under-capitalized companies, which do not have the technological or financial capability to develop or adapt new formulations. At the same time the know-how for new formulations is in the hands of private, technically competent companies in industrialized countries.

To overcome the above difficulties, UNIDO can use experience gained from cooperation with the Polymer Institute at the University of Detroit. A number of new technologies and formulations for obtaining polyurethane foams in which CFCs are replaced by a primary foamer, i.e., water, were developed. The effect of other chemicals (Catalysts, flame retardants, etc.) on the foam properties has been tested. The pilot plant trials of these products proved to be satisfactory for these foams.

As a parallel measure UNIDO will strengthen ongoing activities aimed at promoting environmentally sound alternative materials to rigid polyurethane foams used as insulation material in construction. Mineral based materials with thermal conductivity similar to that of rigid foams include mineral wool, glass wool, both normally used as mats or in sandwich elements and expanded perlite used as a loose granulate or in the form of boards, blocks or specially shaped products such as pipe shells.

3. SOLVENTS

UNIDO has an extensive programme involving the design and implementation of projects in the electronics industry. These projects cover a wide area including design and manufacture of microelectronic components; mechanical, electrical and electronic parts (particularly, printed circuit board of all types); assembly and testing of electronic equipment and systems. While implementing these projects, UNIDO has been addressing environmental problems such as gas scrubbing/exhaust gas treatment; discharge water/waste treatment; application of cleaner technologies (such as high density/minimum etch PCB's, surface mounting, re-flow soldering, etc.).

4. HALONS

UNIDO does not have practical experience regarding halons manufacture and use. UNIDO's experience with improved industrial safety may be the most feasible and cost-effective way for UNIDO to contribute to minimizing halon use.

5. RECOVERY AND RECYCLING OF ODS (CROSS-SECTOR)

UNIDO has implemented projects in Kenya, Egypt and Nigeria evaluating the viability of designing systems for recycling and recovery in refrigeration and air conditioning. Working directly with enterprise owners and managers, an extension of this UNIDO programme of work is currently underway with the same countries to calculate the incremental cost for pilot enterprises to convert from present CFC-based technologies to non-CFC-based technologies. Based on these analyses, submissions will be prepared for interested countries for submission in February 1993 to the Fund's Executive Committee. Parallel work is proceeding at the national level - stressing the need for policies on environmental conservation - and at the institutional level - assisting in licensing, industrial sub-contracting and other support and extension services.

It is planned to implement a similar project in selected Asian countries drawing on the methodology developed for Africa.

6. INFORMATION EXCHANGE AND DISSEMINATION

UNIDO, in cooperation with OzoNet, ICPIC and ICOLP activity, could also foresee expanding programmes in industrial information service to accommodate ODS. UNIDO could repackage information and data from existing sources and disseminate these packages in appropriate forms and formats.

7. STATISTICAL ANALYSIS

Recently completed work in statistical analyses made quantitative estimates of the impact of environmental regulations on production costs in specific industrial sub-sectors and then assessed the possible resulting shifts in international competitiveness between countries.

8. TECHNOLOGY ACQUISITION AND TRANSFER

UNIDO has consistently been implementing programmes to promote the flow of technology and to assist developing countries concerning issues of technology acquisition and transfer, namely through educational programmes, advisory services on technology selection and negotiation and institutional support to relevant government institutions.

In this connection, UNIDO is paying special attention to the environmental implications associated to the acquisition of technology by developing countries and is endeavouring to include environmental issues in its technology acquisition and transfer programmes as well as to assist and advise on the selection and contracting for environmentally-sound technologies.

III. CRITERIA FOR THE SELECTION OF COUNTRIES, PROJECTS AND PROGRAMMES

Target countries will be selected based on UNIDO's field experience, gained from projects and programmes closely related to ODS phase-out, as well as on close follow-up on the development of ODS issue through technical publications, reports, negotiations etc.

Concerning the countries eligible for funding (operating under Art. 5.1. of the protocol) and being Parties to the Protocol, UNIDO is basing its proposals on the information issued by the Ozone Secretariat in August 1992 (Status of the Ratification, Sixteenth Issue). UNIDO is also aware that the other implementing agencies are active in most Party countries (under art. 5.1).

To avoid overlapping with the other implementing agencies and to reach a rational and cost-effective division of work, UNIDO assumes that negotiations with other implementing agencies will be conducted between October 1992 - January 1993 to define in detail the content of the programmes and projects.

The UNIDO target countries can be roughly divided in three categories as follows:

1. Low ODS-consuming countries importing both ODS and most of the ODS using equipment. UNEP and UNDP have started to support the compilation of baseline surveys as well as country programmes in most of these countries.

UNIDO could carry out the base line surveys and compile the country programmes in the following Party Countries: Cyprus, Slovenia and Cuba, Bahrain and Libya. UNIDO is envisioning to start the same procedure in the following Non-Party countries provided they ratify the Protocol: Albania, North Korea, Yemen, Kuwait, Oman, Romania, United Arab Emirates, Saudi Arabia. These countries have some industrial base and run some ODS using production and/or maintenance facilities to which UNIDO can provide cooperation and support.

UNIDO is aware that UNEP is supporting the compilation of country programmes in the following countries; Fiji, Maldives, Syria, Malawi, Zambia and Uganda. UNIDO may be best placed to follow-up and support the implementation of the country programmes which, in most of these countries, will include the establishment of an ODS recovery, recycling and re-use mechanism supported by equipment and hardware which UNIDO is well placed to implement.

2. Medium size ODS consuming countries manufacturing ODS using equipment and/or ODS containing products. UNIDO could support the implementation of phase out measures in the following Party Countries: Egypt, Philippines, Turkey and Malaysia, which countries already have country programmes approved or in advanced stage, and Indonesia, which is to start the implementation of the Protocol. Taking into consideration UNIDO's ODS related experience (especially refrigerants), UNIDO could be the lead agency in the implementation of the Protocol provisions in Indonesia.

The compilation of the country programmes is underway in the following non-party countries: Vietnam, Pakistan and Sudan, which have extensive manufacturing facilities in several sectors using ODS. UNIDO could take the responsibility to follow-up and implement the country programmes in these countries.

3. Large countries both producing at least some ODS and ODS consuming/containing equipment/product. UNIDO could support the implementation of the country programme in China, in cooperation of the World Bank. UNIDO's extensive involvement in the development of the industrial sector in China and UNIDO's presence through its investment promotion office in China would result in implementation of cost-effective smaller projects.

India is soon to start the implementation of the Protocol. UNIDO is well placed to support ODS phase out in India, which needs both technical assistance as well as combined policy and economic measures.

IV. TECHNICAL APPROACH AND SELECTION OF SECTORS

Within its proposed programme, UNIDO can develop and implement projects which address the following technical aspects of ODS phase-out in the major ODS-using industries.

Solvents

Reduction of loss from equipment and emissions by:

- Operational/organizational measures
- Improved equipment construction
- Process changes (more automation)
- Reclaiming (condensation, absorption)
- Substitutes (make cleaning unnecessary, aqueous cleaning, non-halogenated solvents, CFC's)

Foams

1. Flexible polyurethane

- Reclaiming
 - Alternative blowing agents
2. Rigid polyurethane foams
 - Substitute for CFC-11 as blowing agent
 - Dismantling equipment (refrigerators) recycling
 3. Rigid polystyrene foams
 - Substitute

Refrigerants

Semi-hermetic or open compressors

- Commercial refrigeration
- Cold storage
- Transport
- Auto Air conditioners
- Central air conditioners
- Heat pumps
- Design & production
- Operation & servicing (existing equipment)
- Reuse & disposal (existing equipment)
- Substitutes (new equipment/existing equipment)

Many developing countries, as they are progressively unable to import controlled substances, will be obliged to eliminate ODS use in industrial processes and products. Three technical options are available:

1. Conservation (improved housekeeping, improved equipment design, better maintenance and recycling);
2. Use of products and processes which do not use controlled substances (water in polyurethane foams, aqueous cleaning systems);
3. Alternative substances (HCFC's, HFC's).

As regards option 3 (alternative substances), conversion to HFC's and HCFC's will be market-driven, and supported through the supply chain. Importers usually procure from one substance supplier and deliver to a captive market. Suppliers will be competing for customer base and will provide advice and support to customers on conversion techniques and processes. Larger industries, which use controlled substance in their products and processes will turn to overseas parent companies affiliates or trade organizations for advice and support. Consequently, the UNIDO programme of activities will focus on those niches of opportunity which arise from the needs for both conservation and also new products/processes which avoid the use of controlled substances. (the first two technical options)

Transfer of technology will be needed for smaller manufacturing enterprises with no direct link with overseas technology suppliers, e.g. in the foam industry and the many different solvents application sectors. The transfer of technology to these users may involve both the acquisition of patents, licences or property rights and the acquisition of capital equipment as well as training of personnel in handling the new technology.

Immediate assistance will be given to companies where conservation is the best option for emission reduction. Examples would be improved maintenance procedures in commercial and industrial refrigeration plants or recycling solvents used in general metal cleaning. Similar direct support will be given to firms where a switch to products and processes which avoid controlled substances is a technical option. Examples are aqueous cleaning or no-clean processes in the electronics industry, and alternative blowing agents for foam production.

Where information is not already available, UNIDO will undertake surveys (mapping) in selected developing countries of the distribution of ODS-using industries to determine their requirements for eliminating the use of controlled substances.

Enterprises will be categorized according to investment required for conversion and the appropriate technical option (conservation, not-in-kind product/process, alternative substances).

UNIDO will offer technical assistance to enterprises where conversion will require application of options 1 and 2.

Feasibility studies will be proposed for plants where expected investment in conversion warrants prior analysis of various technical options and determination of financial impacts.

For cleaning solvents, UNIDO could provide advice in the selection of replacement solvents, cleaner technologies and associated equipment, the adaptation of existing equipment to replacement solvents, the modification of existing processes to use replacement solvents, and the local manufacture of parts and equipment for this adaptation and modification.

There are four basic issues which must be tackled in order to reduce and eventually eliminate the use of CFC 113 in the electronics industry:

- Changing customer's standards and specifications which dictate the use of CFC's;
- Reducing the amount of CFC's by using low-CFC blends. Such replacements normally require minimum process and equipment change;

- Totally replacing CFC's with safer chemicals, for example some water-based or natural solvents. Such replacements require new process designs and equipment;
- Developing and applying new technologies which eliminate the need for solvents, such as non-residue soldering technology.

Finally, additional training and information support will be provided to local and regional institutions to enable them to assist enterprises through research and development and dissemination of information on elimination of ODS from products and processes.

V. PRELIMINARY BUDGET

UNIDO's approximate total budget is based on an internal assessment of UNIDO's available capacity to develop and implement projects for the Interim Multilateral Fund taking into account UNIDO's existing pool of knowledge and experience with related technical assistance (section II).

The finalized budget, to be presented to the Fund's Executive Committee in February 1993 will be prepared following discussions with National Authorities in target countries, the Fund's Executive staff and the other implementing agencies.

Proposed UNIDO ODS-related activities cover a total of approximately 30 countries out of which nine are not, as of August 1992, Parties to the Protocol.

The total estimated cost of the UNIDO's annual work programme will be approximately US\$ 4 million out of which US\$ 3 million in countries being Parties in August 1992 and US\$ 1 million in countries envisioned to ratify the Protocol in 1993 or earlier.

PRELIMINARY BUDGET BY COUNTRY

AREA/COUNTRY	Refrig.	Foams	Solvents	Halons	Cross-S	Total
[AFRICA]	500	50	-	-	50	600
Burkina Faso	50	-	-	-	-	50
Botswana	50	-	-	-	-	50
Cameroon	50	-	-	-	-	50
Egypt	50	50	-	-	-	100
Malawi	50	-	-	-	-	50
Sudan*	100	-	-	-	50	150
Togo	50	-	-	-	-	50
Uganda	50	-	-	-	-	50
Zambia	50	-	-	-	-	50
[ASIA and PACIFIC]	600	1100	200	200	200	3300
China	-	1000	-	-	-	1000
Fiji	50	-	-	-	-	50
India	-	-	-	-	1000	1000
Indonesia	100	-	-	-	100	200
Malaysia	-	-	-	100	-	100
Maldives	50	-	-	-	-	50
North Korea*	-	-	-	-	100	100
Pakistan*	200	-	200	100	-	500
Philippines	100	-	-	-	-	100
Vietnam*	100	100	-	-	-	200
[EUROPE and MIDDLE EAST]	-	-	100	-	310	410
Albania*	-	-	-	-	30	30
Bahrain	-	-	-	-	30	30
Cyprus	-	-	-	-	30	30
Kuwait*	-	-	-	-	30	30
Oman*	-	-	-	-	30	30
Romania*	-	-	-	-	50	50
Saudi Arabia*	-	-	-	-	50	50
Slovenia	-	-	-	-	30	30
Turkey	-	-	100	-	-	100
U.A.E.*	-	-	-	-	30	30
GRAND TOTAL	1100	1150	300	200	560	4310

*) Non-Party, August 1992

Parties Total 3140
Non-Parties total US\$ 1170

Figures in US\$1000