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Executive Committee of the
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Implementation of the Montreal Protocol

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Montreal, 23-26 June 1992

PROJECT PROPOSAL: TUNISIA

OZONE LAYER PROTECTION THROUGH THE REDUCTION OF CONSUMPTION OF OZONE DEPLETING SUBSTANCES

THE MONTREAL PROTOCOL ON SUBSTANCES THAT DEPLETE THE OZONE LAYER

PROJECT COVER SHEET

COUNTRY:	Tunisia	
SECTORS COVERED:	All (Refrigeration, foams, aerosols and other smaller user sectors)	
ODS CONSUMPTION IN AFFECTED SECTOR(S): (1991 data)	Refrigeration:	250 t/y
	Foam:	585 t/y
	Aerosol:	230 t/y
	Others:	10 t/y
PROJECT TITLE:	Ozone Layer Protection through the Reduction of Consumption of Ozone Depleting Substances	
PROJECT DURATION:	3 Years	
PROJECT IMPACT:	ODSs PHASED-OUT: 27,000 tons over allowable phaseout period (refer to Annex A for details)	
PROPOSED BUDGET:	$2.20 million	
IMPLEMENTING AGENCY:	World Bank	
COORDINATING NATIONAL AGENCY:	Ministère de l'environnement (Agence nationale de protection de l'environnement)	

PROJECT SUMMARY

Please refer to attached Executive Project Summary

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DETAILS ON PROJECT SUB-COMPONENTS

A. Refrigeration Sector

(a) Engineering Assistance For Design, Testing and Introduction of HFC-134a Technology in the Production of Domestic Refrigerators (A New Technology Investment Project)

1. Project Description

Background

The domestic refrigerator industry in Tunisia produced over 300,000 units in 1991, of which 2/3 were exported. The production use of imported refrigerants, compressors, and other key components. The production operation involved the in 1991 consumed about 60 tons of CFC-12 as refrigerant, corresponding to 6% of the total ODS consumption.

The refrigerant HFC-134a is considered the best and most probable CFC replacement for domestic refrigeration applications. Today, several international manufacturer produce limited series of refrigerators employing HFC-134a as refrigerant, and it is generally foreseen that the major producers in developed countries will convert to HFC-134a technology within 2-3 years.

As a consequence of this development, the refrigerants, lubricants and components for HFC-134a technology will become generally available. Thus, the production of refrigerators using this technology becomes a realistic and viable option.

Regulations and market forces in Tunisia's primary export markets will force the Tunisian refrigerator producers to adopt ODS-free refrigeration circuit technology based on HFC-134a refrigerant for the exported units by 1996 or perhaps even earlier. In the Government's Action Plan for ODS Phaseout it is recommended that new production of CFC containing refrigerators is phased out by January 1st, 1996.

A period of 2-3 years will be required for redesign, prototype production and testing before full scale commercial production of HFC-134a based refrigerators can be commenced. Hence, a project designed to support the testing of new refrigerators is recommended.

Purpose of the Project

The purpose of the project is to familiarize domestic refrigerator manufacturers and refrigeration technicians with HFC-134a technology and allow testing of new refrigerator models in time for actual production.

The objective is achieved through technical support and an investment project.

Project Elements

The project comprises the following elements:

- engineering support for review of the detailed project program, monitoring of progress and evaluation of the results obtained;

- an investment project to cover equipment and operational expenses for a development and test facility at Tabrid for new refrigerator models with HFC-134a refrigeration circuits.

The project will be carried out in the following phases:

- phase A: detailed planning: work plan, list of equipment, and detailed budget for investment and operational expenses to be prepared by Tabrid with technical support.

- phase B: design, development and procurement: development of HFC-134a refrigeration circuit design for 2-3 refrigerator models with support from compressor manufacturer(s). Setting up of testing facility and procurement of testing equipment and refrigeration circuit components.

- phase C: prototype production and testing: testing of production of prototype(s) in small series (5-10 units), steady state performance testing, energy consumption and reliability testing, and adaptation for production. Quality monitoring of refrigerants, lubrication oil, and circuit components.

Project Participants

The project is proposed at Tabrid as this company develops its own refrigerator designs, is the dominant manufacturer on the local market and the only Tunisian exporter of domestic refrigerators.

Other refrigerator manufacturers (much smaller production volume) in Tunisia are foreign-owned and produce under license from multinational companies, and it is expected that ODS-free technology will be automatically transferred to them from their licensees.

Source of Assistance

The source of know-how for HFC-134a refrigeration technology will be selected compressor manufacturers collaborating with Tabrid. Assistance from the supplier of the data acquisition system (testing and quality control) will also be required.

In addition, the service of an independent consultant with relevant background from outside Tunisia will be required for review, monitoring, audits, and reporting to the ODS Committee.

Time Schedule

This project is proposed to start 4th quarter of 1992 in order for Tabrid to commence production of new ODS-free refrigerators by 1995/96.

The planned duration of the project phases is:

-	A: Detailed planning	0.3 year
-	B: Design, procurement	0.7 year
-	C: Prototype production and testing:	1.5 year
	Total:	2.5 years

Project Organization and Management

The project will be carried out within the organization of Tabrid. Tabrid will appoint a project manager, who will be responsible for regularly reporting on the project to the ODS Phaseout Committee.

The project will be initiated by the ODS Committee, who will employ the consultant and commission Tabrid to prepare the detailed plan and budget (phase A).

At the end of each year, Tabrid shall submit a report containing an evaluation of the results obtained, an account for expenses, and an adjusted plan and budget for the following year. The report will be reviewed by the independent consultant, who will advise the ODS Committee on its acceptance. The consultant will also carry out a technical audit at Tabrid once a year.

Disbursements

Based on the project cost estimate in section 3 below, the budget for the project by year is:

-	1992	25,000 USD
-	1993	270,000 USD
-	1994	55,000 USD
-	1995	10,000 USD
Total		360,000 USD

2. Incremental Costs of the Project

Equipment

The following is a preliminary list of equipment for the test facility; the list will be completed during project phase A:

- Instrumentation	10,000 USD
- Data acquisition system	12,000 USD
- Evacuation pump	2,000 USD
- Charging station, tools, etc.	15,000 USD
- Compressors, circuit parts	15,000 USD
- Test cells	90,000 USD
- Quality control equipment	25,000 USD
- Miscellaneous equipment	6,000 USD
Total	175,000 USD

Materials

- refrigerant	5,000 USD
- lubricating oil	5,000 USD
Total	10,000 USD

Personnel

Local personnel at Tabrid (employed over the total project period of 2.5 years (4th quarter 1992 - 1st quarter 1995):

- One engineer and project manager half time	40,000 USD
- One technical full time	50,000 USD
Total	95,000 USD

Technical Support

Outside consultant for review, monitoring and technical audits:

- 4 visits of 2 weeks	50,000 USD

Contingencies

- 15% of project costs	45,000 USD

3. Benefits of the Project

Partly as result of this project, the total consumption of CFC-12 of 60 cons/year as refrigerant for new units should be discontinued from 1995/96. The stock of refrigerators in Tunisia will start to be replaced by HFC-134a technology units, thereby minimizing the need for forced scrapping as the Montreal Protocol limit is approached.

(b) Introduction of Low-CFC and No CFC Rigid Foam (An Early ODS Phaseout Technical Support Program)

1. Project Description

Background

In 1991, the domestic and commercial refrigeration industry used 175 tons of CFC-11 as blowing agent for cast-in-place insulation. This corresponds to 16% of total ODS consumption.

Existing alternatives which are recommended to reduce or eliminate the consumption of regulated CFCs in rigid foam application includes:

1. replacing 50% of CFC-11 consumption with CO_2/water blowing. This will typically produce an insulation which, at present, is 5-10% less energy efficient. The formulation is in current use at several European manufacturers, and their experience shows that the loss in insulation efficiency can be compensated by minor redesigns of the refrigerator.

2. replacing the remaining 50% of CFC-11 with a mixture of the non-regulated HCFC-142b/22. This change will reduce the insulation efficiency by an additional 5-10%. The formulation is likely to be selected by most manufacturer today if they were faced with a total ban on regulated CFCs. It is generally considered that the present insulation thickness in domestic refrigerators can be maintained, provided the cabinet is redesigned to eliminate other cold bridges.

3. replacing all CFC-11 with CO_2/water blowing. This formulation produces an insulation which is inferior to the above, but which can be adequate for several applications in commercial refrigeration where energy efficiency and space requirements are not binding constraints (such as in cold food carts and buffet's).

The application of these foam formulations requires modification of the foam casting machines currently employed in Tunisia.

It is recommended to introduce the conversion stepwise, starting with option 1 and continuing to option 2 - or option 3 where applicable - on the basis of the experience obtained. However, the conversion of machinery shall be prepared for all options from the start.

Because of complete phaseout of CFCs in domestic refrigerators is recommended by 1996 a project aimed at replacing CFC-11 as foam blowing agent should be given high priority.

Purpose of the Project

The purpose of the project is to support a stepwise conversion to CFC-free refrigerator insulation technology.

The objective of the project is achieved through technical support and investment projects.

Project Elements

The project will be carried out in the following phases:

- phase A: seminar and consultations: an introductory seminar giving information on low CFC technology options, and of the ODS Committees initiative to support conversion projects. To be supplemented with individual consultations with the manufacturers;

- phase B: conversion: modification of foam casting machinery by the manufaccurers in collaboration with the suppliers of foam formulations. The financing option is available for the duration of phase B.

Project Participants

The project primarily involves the main domestic refrigerator manufacturer (TABRID) with its three production lines. The project also includes the manufacturers of commercial refrigeration units: CSR, Sogima, Almia and Isofrigo and possibly others.

Source Assistance

The main source of assistance will be the suppliers of insulation foam formulations and associated companies with know-how on production of cast-in-place insulation.

Assistance will also be required from an outside consultant with relevant background, who shall assist the ODS Committee in negotiations with the manufacturers, review of proposals and monitoring of modification projects.

2. Project Execution

Time Schedule

As the required technology is available, the project should be initiated immediately, i.e. 1st quarter of 1993. The planned duration of the project phases is:

- A: seminar and consultations	0.2 year
- B: conversion	0.8 year
Total	1.0 year

Project Organization and Management

The project will be initiated and monitored by the ODS Committee in collaboration with the Association of Domestic Appliance Manufacturers and other relevant industry organizations.

The conversion projects shall be organized by the manufacturers, who shall appoint a project manager responsible for reporting to the ODS Committee.

Each manufacturer develops - in collaboration with his supplier of foam system - a conversion project with a budget to be submitted in the ODS Committee. After review by the consultant, the project can be approved and a line of credit is opened. Following completion of the project and acceptance by the consultant, final payment is released.

Budget

Based on the cost estimate in section 3 below, the project budget by year is:

-	1993	Total	300,000 USD

The budget includes 15% contingency allowance for unforeseen expenses.

3. Incremental Costs of the Project

Equipment

It is tentatively assumed that 15 production lines shall be converted at an average cost of 15,000 USD per line:

-	modification of foam machines	225,000 USD

Project Support

-	hosting of seminars	10,000 USD

Technical Assistance

-	3 visits of 1 week	25,000 USD

Contingencies

-	15% of project costs	40,000 USD

4. Benefits of the Project

As a result of the project, the consumption of regulated CFC for cast-in-place insulation of appliances can be reduced stepwise over 1-2 years from the present level of 175 tons/year, and should be eliminated by 1995/96.

(c) & (d) Maintenance of Domestic, Commercial and Industrial Refrigerators

DOMESTIC REFRIGERATION

1. Project Description

Background

In 1991, there were about 800,000 domestic refrigerators in use in Tunisia containing a total of about 200 tons of CFC-12 refrigerant. Servicing accounted for an estimated consumption of 125 tons of CFC-12, corresponding to 12% of the country's total ODS use.

Service companies' experience indicates that the average refrigerator is serviced twice during its lifetime of 15-20 years (either because the compressor is replaced or repaired or because of a leak in the refrigeration circuit) and that 1 kg CFC is used on each repair (150-250 g to replace the original charge and the balance for flushing, purging, and leak testing).

The described servicing practice implies that 100 tons/year of CFC-12 is blown off to the atmosphere in connection with repair work. This unnecessary consumption can be eliminated through modified and improved procedures:

1. Usage of nitrogen instead of CFC for flushing of the circuits. As the cost for nitrogen is well below the cost for CFC, this procedural change is economically viable in itself, and can be carried out at all repair locations. The use of nitrogen for purging is a well established technique in Europe and elsewhere.

2. Recycling of refrigerants by using recovery and recycling machines. This procedure is primarily recommended for repairs carried out under workshop conditions.

Servicing of refrigerators is accrued out at the manufacturer's service workshops at the plants, and in the major cities by representatives workshops, independent workshops and at the owners homes. The work is carried out by semi-skilled workers or by personnel engaging in general servicing of household appliances.

It can be estimated that the refrigerator repairs involving recharging of refrigerant represent about 800 man-years annually. As some of the personnel will do other jobs as well, it is tentatively assumed that 2000 persons are engaged in this activity.

The consumption of CFC can be reduced through a training program teaching improved servicing practices. It is considered realistic to plan a program that will reach 50% of the estimated workforce over a 4 year period. As the improved techniques are profitable in themselves, their use can be expected to spread further through word of mouth.

Purpose of the Project

The purpose of the project is to improve the servicing procedures for domestic refrigeration, to increase awareness of the ozone issue among service personnel, and to conserve the use of CFC-12 through recycling and by adopting nitrogen for flushing and purging.

The objective will be achieved through a study, training program, technical assistance, and investment in equipment.

Project Elements

The project comprises the following elements:

- An initial study describing the present domestic refrigerator service sector and giving a more detailed plan for the actual training;

- a training program comprising first the education of a number of Tunisian instructors, and with the help of three courses in Tunisia aimed at teaching adequate ODS handling skills. The training program should be coupled with the issuance of an ODS license/certificate as proposed under Government Actions;

- technical assistance from an institution which has already developed a program on proper servicing practices. The advisor shall prepare the preliminary study, propose a training plan, organize instruction abroad, suggest teaching materials, and monitor the project at regular intervals;

- investment in equipment and necessary training materials, including a number of CFC recovery and recycling machines to be placed at the larger service shops and used for demonstration during the training programs.

The project will be carried out in the following phases:

- phase A: study and detailed planning: the study shall describe in detail the service sector for domestic refrigerators, registration of service workshops, number and education of employees, type of repairs based on a series of interviews (number and age of units services, use of CFC, reason for recharging, where repairs take place, etc.). Further, the study shall review existing authorization schemes for servicing companies and personnel (if any), and recommended as suitable set-up for such a scheme. On the basis of the study, a detailed plan for the actual training shall be prepared. During phase A, employment procedures for the instructors shall be initiated.

- phase B: training of instructors: it is planned to employ two teams of instructors, each comprising one professional refrigeration technician and one skilled service worker. The instructors shall receive extensive training in servicing (especially leak testing, recharging and recycling techniques), partly at a technical school in Tunisia and partly during 1 month training abroad at the institution of the advisor or equivalent.

- phase C: training program: training will be offered as 1 week on-the-job courses in field maintenance work, and as 2 week workshop courses with classroom instruction including recycling techniques. Assuming that each team of instructors can carry out 32 on-the-job courses per year with 5-6 students and 4 workshop courses with 20 students, it is tentatively estimated that 1000 service workers can pass the ODS training courses during the 2 years duration of the program.

- phase D: evaluation and follow-up: after termination of the two years training program, a final evaluation report shall be made by the advisor, and it shall be considered whether and how the project should be extended.

Project Participants

The number and names of service shops to participate in the project will be determined during the initial study phase. However, Tabrid's servicing facility in Tunis is a natural place to start and may serve as demonstration site throughout the project period.

Source of Assistance

Technical assistance in providing training manuals and other teaching materials is required from an advisor associated with a refrigeration institute or relevant teaching institution from outside Tunisia. The duties of the advisor shall include preparation of the study, planning, collaboration on education of instructors, advice on the training program, and assistance in evaluation and reporting to the ODS Committee.

A positive synergy effect will be achieved from having the same advisor for projects R-2 and R-3.

The recycling machines must be imported. There are several companies in Europe, USA and Asia which supply recycling machines of various types and quality. It is essential that the machines meet accepted international standards for recycled CFC (ARI standards).

2. Project Execution

Time Schedule

The project is proposed to start from the beginning of 1993. The planned duration of the project phases is:

- A: study and detailed planning	0.3 year
- B: training of instructors	0.5 year
- C: training program	2.0 years
- D: evaluation and follow-up	0.2 year
Total	3.0 years

Project Organization and Management

It is assumed that the training program will be carried out by the ODS Committee. Alternatively the program can be attached to a relevant professional association or a vocational training center.

The project will be initiated by the ODS Committee, who will employ the advisor as well as the team of instructors. The committee will procure equipment and training materials with support from the advisor.

When the instructors have been employed, one will become training program manager. His duties will include scheduling, accounting of operational expenses and regular reports to the ODS Committee.

Evaluation of the training program shall be done periodically to enable adjustment of the project if necessary.

Budget

Based on the project cost estimate in section 3 below, the budget for the project by year is:

- 1993	200,000 USD
- 1994	75,000 USD
- 1995	50,000 USD
Total	325,000 USD

3. Incremental Costs of the Project

Equipment

The number of recovery recycling machines to be provided shall be determined during the initial study, but for the purpose of this project proposal 25 machines are considered appropriate.

- 25 recovery and recycling machines	75,000 USD
- spare parts	15,000 USD
- tools	10,000 USD
- servicing car	20,000 USD
Total	120,000 USD

Materials

- training manuals, books	10,000 USD
- nitrogen, miscellaneous	5,000 USD
Total	15,000 USD

Personnel and Project Support

Instructors for the training program (employed during a period of 2.75 years):

- 2 refrigeration technicians	60,000 USD
- 2 service workers	40,000 USD
- 1 clerk/secretary	10,000 USD
- rent, office expenses	20,000 USD
Total	100,000 USD

Technical Assistance

- 3 man-months study	50,000 USD
- 1 month instruction abroad	10,000 USD
Total	60,000 USD

4. Benefits of the Project

The current servicing practices indicate that up to 100 tons/year of CFC-12 can be saved (given the present stock of refrigerators) by shifting from CFC-12 to nitrogen for flushing and by recovery and recycling CFC released during purging and leak testing. In practice, the expected benefit of the project will be around 50 tons/year of CFC not consumed.

COMMERCIAL AND INDUSTRIAL REFRIGERATION

1. Project Description

Background

There is an important and growing number of large commercial and industrial refrigeration systems used in Tunisia for food presentation, processing and cold storage, central air conditioning and other applications. An important number of these installations employ CFC refrigerants.

It is estimated that 40 tons of CFC were used in 1991 for installation and servicing of these units.

The larger units are installed and serviced with the participation of refrigeration technicians. Training of these technicians in improved servicing practices for handling CFC refrigerants, and in non-CFC refrigeration technologies including retrofitting, will reduce the consumption of CFC gases and

facilitate the introduction of ozone friendly refrigeration technology in the commercial and industrial sectors.

Purpose of the Project

The purpose of the project is to introduce improved service practices, teach retrofitting technology, and prepare for introduction of CFC free refrigeration technology.

The project objective is achieved through a study, training program, technical assistance and demonstration projects.

Project Elements

The project comprises the following elements:

- A preliminary study describing the sector for installation and servicing of large commercial and industrial refrigeration systems;

- a training program for refrigeration technicians, directed towards students as well as professional technicians from the industry.

- technical assistance from a professional school which has already developed a program on proper servicing practices and CFC free refrigeration technology. The advisor shall prepare the preliminary study, propose a training plan, suggest teaching material, and monitor the project at regular intervals.

- demonstration projects as part of the education: retrofitting of existing installation to non-CFC technology: planning, execution, follow-up. Owner obtains upgrading of facility in return for accepting training classes and subsequent visits. It is assumed that one retrofitting/demonstration project can be carried out at each school for each class.

The project will be carried out in the following phases:

- phase A: study and detailed planning: the purpose of the study is to provide a registration of servicing organizations and of large refrigeration installations in Tunisia, and to review and evaluate current regulations for mandatory regular service, reporting requirements, and existing authorization schemes for service technicians.

- phase B: training of instructors: the instructors shall be teachers of refrigeration technology at the technical schools. During the 6 months preparation period they shall be trained in ODS related subjects through discussions and individual studies tutored by the advisor, as well as 1 month instruction abroad at the advisor's home institution, or equivalent.

- phase C: monitored training program: the training program shall be offered as an element in the courses for refrigeration technicians at the technical schools, and a continued education courses with accreditation for professional technicians. For the students at the technical education

centers, instruction in ODS related subjects and participation in a retrofitting project (see demonstration projects above) shall be included in the regular curriculum. For professional technicians, a continuing education program of 1 week duration on CFC replacement/conservation shall be offered by the technical schools.

- phase D: evaluation and follow-up: after termination of the two years training program, a final evaluation report shall be made by the advisor, and it shall be considered whether and how the project should be extended.

Project Participants

The majority of the refrigeration technicians are today educated at:

- Center d'instruction professionnelle, Tunis
- Center d'instruction professionnelle, Kairouan

Education of refrigeration technicians directed towards the needs of the fishing industry is planned at:

- L'Ecole de formation de pêche, Sfax

It is assumed that the training program can be offered at all three schools.

The proposed demonstration projects will be carried out at companies selected from the relevant industry sectors.

Source of Assistance

Technical assistance from outside Tunisia is required from an advisor associated with a refrigeration institute or relevant teaching institution with a curriculum in ODS free technology. The duties of the advisor shall include preparation of the study, planning, collaboration on education of instructors, advice on the training program, evaluation and reporting to the ODS Committee.

Participation form the original equipment manufacturers may be required for the demonstration projects.

2. Project Execution

Time Schedule

The project shall be planned to start the training program from the academic year 1993/94, i.e. the initial project phase should be initiated during the 4th quarter of 1993. The planned duration of the project phases is:

- A: study and detailed planning	0.3 year
- B: training of instructors	0.5 year
- C: monitored training program	2.0 years
- D: evaluation and follow-up	0.2 year
Total	3.0 years

Project Organization and Management

The training program will be operated by the three technical schools involved. Each school will designate one chief instructor to be responsible for the ODS courses.

The program will be initiated and monitored by the ODS Committee with the support of the advisor. The committee will allocate funding for one academic year at a time. At the end of the year, the schools will submit a brief report with accounts to be verified by the external advisor.

Budget

Based on the project cost estimate in section 3 below, the budget for the project by year is:

- 1993	125,000 USD
- 1994	50,000 USD
- 1995	10,000 USD
Total	185,000 USD

3. Incremental Costs of the Project

Equipment

- laboratory equipment, etc.	10,000 USD
- demonstration projects (6)	60,000 USD
Total	70,000 USD

Materials

- training manuals, books	5,000 USD
- refrigerants	6,000 USD
- lubrication oil	4,000 USD
Total	15,000 USD

Personnal and Project Support

It is assumed that the schools will include the training course in the normal curriculum, and that there will be no personnel salaries carried by the project. There will however be travelling and living expenses for 2 instructors from each of the 3 schools for 1 month each.

- travelling abroad	25,000 USD
- travelling Tunisia	5,000 USD
Total	30,000 USD

Technical Assistance

-	3 man-months study	45,000 USD
-	1 month instruction abroad	10,000 USD
-	2 visits of 1 week	15,000 USD
Total		70,000 USD

4. Benefits of the Project

Reduced consumption of CFC in the industrial sector from the present level of 40 tons/year, through improved servicing practices, gradual retrofitting (when possible) of existing units, and familiarization with CFC free technology.

B. PROJECTS IN THE FOAM SECTOR

(e) Technical Seminar, Consultations and Demonstration in the Flexible and Rigid Foam Sector (An Early ODS Phaseout Technical Support Program)

1. Project Description

Background

The manufacturers of mattresses, furniture cushioning and similar flexible foam products and rigid insulation foam in Tunisia used approximately 400 tons/year of CFC-11 as foam blowing agent in 1991. This corresponds to 37% of total ODS consumption. The purpose of the CFC in the manufacturing process is to facilitate the production of the lighter (and less durable foam) qualities used for low cost products.

Standard foam formulations are presently available using new polyols suitable for CO_2/water blowing. This allows CFC-free production of flexible foam of any specification in the range 18-50 kg/m^3. The production can be carried out with the existing slab stock production machines operated in Tunisia with minimal or no adjustments.

This will not allow a production which is in all respects identical to the current line of products. The experience from developed countries indicate, however, that mattresses and cushions manufactured with the alternative formulations five equal utility to the consumer, and production costs do not increase.

It is envisaged that the flexible foam manufacturers can be induced by the government to enter a joint voluntary agreement to:

- abolish the production of low density flexible foam below 18kg/m^3;
- discontinue the use of CFC as blowing agent.

Based on this agreement, the manufacturers can switch to CFC free production after familiarization with the alternative foam formulations.

For background on rigid foam, please refer to project b).

Purpose of the Project

The purpose of the project is to introduce CFC free technology and facilitate the abolition of CFC while avoiding the option of methylene chloride (toxicity, possible human carcinogenity)in the flexible foam sector.

The project will achieve the objective through technical assistance and production demonstration.

Project Elements

- technical assistance to the ODS Committee for the negotiations of a voluntary ban on the use of CFC by the flexible foam industry;

- technical assistance to the manufacturers of flexible and rigid foam in the form of a seminar and individual consultations by specialists in CFC-free flexible foam formulations;

- demonstration projects with test production at the major manufacturers.

The project will be carried out in the following phases:

- phase A: seminar and consultations: an introductory seminar giving information on CFC-free technology options and presentation of the ODS Committee's initiative to support test production. This will be supplemented with individual consultations by the manufacturers. Negotiation of a voluntary ban on the use of CFC for flexible foam.

- phase B: test production: demonstration of CFC free production at the major manufacturer's plants in collaboration with the suppliers of foam formulations. The financing option is available for the duration of phase B.

Project Participants

The project participants are the current manufacturers of flexible foam products in Tunisia, including:

- Polymousse
- Sotumousse
- SOTIM
- Sud Intermousse
- Isofrigo (rigid foam)

Source of Assistance

The main source of assistance will be the suppliers of flexible foam formulations.

Assistance will also be required from an outside consultant with relevant background, who shall assist the ODS Committee with the technical seminar, negotiations with the manufacturers, review of proposals and monitoring of possible modification projects.

2. Project Execution

Time Schedule

The project shall be started immediately, i.e. 4th quarter of 1992. The duration of the project phases is:

- A: seminar and consultations	0.2 year
- B: test production	0.6 year
Total	0.8 year

Project Organization and Management

The test production projects shall be organized by the manufacturers, who shall appoint a project manager responsible for reporting to the ODS Committee.

Each manufacturer develops - in collaboration with his supplier of foam systems - a test production project with a budget to be submitted to the ODS Committee. After review by the consultant, the project can be approved and a line of credit is opened. Following completion of the project and acceptance by the consultant, final payment is released.

Budget

Based on the cost estimate in section 3 below, the project budget by year is:

- 1992	25,000 USD
- 1993	75,000 USD
Total	100,000 USD

3. Incremental Costs of the Project

Equipment

There are no equipment cost, as it is expected that the CFC free flexible foam formulations can be produced with the existing slab stock casting machines.

Materials

It is assumed that all six manufacturers will want to carry out two test production runs of 50 m^3 each:

- polyols	30,000 USD
- isocyanate	20,000 USD
- other	10,000 USD
Total	50,000 USD

Project Support

- hosting of seminar	10,000 USD

Technical Assistance

-	2 visits of 2 weeks	25,000 USD

Contingencies

-	15% of project costs	10,000 USD

4. Benefits of the Project

As a result of the project, the consumption of ODS in Tunisia can be reduced by 400 tons/year of CFC-11 which is today released to the atmosphere from the blowing processor for flexible foam.

Additional savings will be achieved in the rigid foam sector, although total CFC usage is much smaller.

C. PROJECTS IN THE AEROSOL SECTOR

(f) Technical Seminars and Consultations (An Early ODS Phaseout Technical Support Project

1. Project Description

Background

The aerosol industry in Tunisia used 230 tons of CFC in 1991 for the production of aerosol cans. This corresponds to 21% of total ODS consumption. The CFC serves as propellant for the active ingredient in the product.

There exists a wide selection of alternatives which may replace CFC for specific products:

- LPG, DME, compressed gases, HFCs, and other replacement propellants;
- pump sprays, bag cans;
- solid sticks, roll-ons, brushes, and other non-aerosol technologies.

Adoption of any of these solutions will, in most cases, involve expenses such as safety precautions, modification of replacement of can filling equipment, and/or relocation of plant.

Several industrialized countries have banned CFC for aerosol cans more than a decade ago, and there is today a vast experience on selecting suitable non-CFC technology for specific applications. Some of the options, such as replacing CFC with LPG or CO_2 where this is acceptable, are actually cheaper than the CFC solution.

Purpose of the Project

The purpose of the project is to assist the aerosol products manufacturers in selecting the most appropriate CFC free technology.

The project objective is achieved through technical assistance and investment projects.

Project Elements

The project comprises the following elements:

- technical support for a seminar on CFC-free options for the aerosol manufacturers and consultations on appropriate technology for individual manufacturers;

- investment projects to finance the cost of aerosol plant conversions, where these cannot be shown to be paid back by operational cost savings within two years;

and a line of credit is opened. Following completion of the project and acceptance by the consultant, final payment is released.

Budget

Based on the cost estimate in section 3 below, the project budget by year is:

- 1992	70,000 USD
- 1993	330,000 USD
Total	400,000 USD

3. Incremental Costs of the Project

Equipment

The requirements for equipment investment cannot be assessed with any precision at the present time. The 3 largest aerosol producers are known to use about 75% of all CFCs consumed in the sector. This implies that the remaining about 10 aerosol companies use less than 5 tons ODS per year on average. New equipment and conversion of production facilities is assumed to cost about USD 50,000 per plant, corresponding to an annual cost of approximately 25,000 over a 2 year period. ODS savings are calculated at 2.5 USD/kg equivalent to an annual saving of USD 12,500 for a user of 5 tons/year. Incremental costs are, thus, estimated at about 12,5000 USD per year over 2 years for each of 15 small producers:

- new equipment and plant modifications	275,000 USD

Project Support

- hosting of seminars	10,000 USD

Technical Assistance

Outside experts for the technical seminar, consultations and follow-up:

- 1 visit of 1 week (planning)	10,000 USD
- 3 visits of 3 weeks (seminar)	55,000 USD
- 3 visits of 1 week (follow-up)	20,000 USD
Total	85,000 USD

Contingencies

- 15% of project costs	70,000 USD

4. Benefits of the Project

The project will enable complete elimination of the present consumption of 230 tons/year of CFC as aerosol propellant.

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