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Implementation of the Montreal Protocol

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PROJECT PROPOSALS: ARGENTINA

This document includes the following project proposals and the Fund Secretariat's Comments and Recommendations. The project proposals have been grouped by project sector. The agency responsible for the implementation of the project is also indicated. The project proposals are presented in the order indicated below. The Fund Secretariat's Comments and Recommendations are presented at the front of the document.

Foam

- Elimination of the use of CFC in the manufacture of sandwich polyurethane panels at CINTER S.R.L. — UNDP

Refrigeration

- Elimination of ODP in the production of household refrigerators at the Fribe La Rioja Plant — IBRD
- Elimination of CFC in two manufacturing plants of domestic refrigerators (Helametal S.A., and Helametal Catamarca S.A.) — IBRD
- Elimination of ODS in the production of domestic refrigerators in the Fribe, S.A. plant — IBRD
- Elimination of CFC in the domestic refrigerator manufacturing plant of McLean — IBRD
- Conversion to non-CFC technology in the production of heat exchangers for mobile air conditioning at Interclima, S.A. — IBRD
- Conversion to non-CFC technology in the production of condensers for mobile air conditioning at Simon Cachan, S.A. — IBRD
- Conversion to non-CFC technology in the production of complete mobil air conditioning systems at Mirgor, S.A. — IBRD

PROJECT EVALUATION SHEET

COUNTRY OR REGION:	Argentina	
PROJECT TITLE:	CINTER S.R.L. Elimination of CFC in the manufacture of sandwich polyurethane panels	
BUDGET:	Capital Costs: Operational Costs:	US $615,000 US $110,000
INCREMENTAL COST:	US $725,000	
ODS PHASE-OUT:	45 ODP tonnes	
COST EFFECTIVENESS:	US $16.1/kg	
PROJECT DURATION:	Two years	
IMPLEMENTING AGENCY:	UNDP	
NATIONAL COORDINATING AGENCY :	OPROZ - INTI	
TECHNICAL REVIEW COMPLETED:	YES _X_ NO _	

SECRETARIAT'S COMMENTS

1. This project covers the conversion of an enterprise manufacturing sandwich polyurethane-foam panels. The project proposes to replace the CFC-11 used as a blowing agent with cyclopentane.

2. The project proposal includes modification of existing equipment when possible, procurement and installation of safety equipment for the use of cyclopentane, trial runs, testing, and a training programme.

3. The incremental operating costs include the additional amount of polyurethane needed to attain the commercially required heat insulation values. Incremental operating costs are calculated for a two-year period.

4. Implementation of this project will result in the phase-out of 45 ODP tonnes of CFC-11.

5. The Secretariat reviewed the project proposal to assess the eligibility of the equipment requested in terms of the conversion to cyclopentane foaming technology and the cost items required for the conversion.

6. The equipment being requested in the project proposals is that necessary for the conversion to the new non-ODS technology. Cost levels have been discussed and agreed between the Secretariat and UNDP.

SECRETARIAT'S RECOMMENDATIONS

7. The Secretariat recommends approval of the requested project costs at US $725,000

PROJECT EVALUATION SHEET

COUNTRY OR REGION:	Argentina	
PROJECT TITLE:	Elimination of CFC in domestic refrigerator manufacturing plant of: a) Helametal (two plants) b) Fribe, S.A. c) Fribe La Rioja d) McLean	
BUDGET:	Capital Costs: Operational Costs:	US $5,399,670 US $3,148,872
INCREMENTAL COST:	US $8,710,532	
ODS PHASE-OUT:	199 ODP tonnes	
COST EFFECTIVENESS:	US $43.8/kg	
PROJECT DURATION:	Two years	
IMPLEMENTING AGENCY:	World Bank	
NATIONAL COORDINATING AGENCY :	OPROZ - INTI	
TECHNICAL REVIEW COMPLETED:	YES _X_ NO _	

SECRETARIAT'S COMMENTS

1. This project covers the conversion of four domestic refrigerator manufacturing plants. The projects propose to replace the CFC-11 used as a blowing agent in the production of insulation foam with cyclopentane, and the CFC-12 used as refrigerant with HFC-134a.

2. Conversion of two production plants of the same company is being proposed in the Helametal project proposal.

3. The project proposals include modification of existing equipment when possible, procurement and installation of new equipment or machinery including safety devices for the use of cyclopentane, redesign of assembly lines, redesign of refrigerator and freezer doors and cabinets, testing and development of prototypes, and a training programme.

4. The incremental operating costs include the additional costs of raw materials and the HFC-134a compressors. Incremental operating costs are calculated in each proposal for one year duration. Incremental operating costs might be adjusted subject to real prices at the time tests

and prototypes are completed. Disbursement will be required when the actual production of non-CFC refrigerators starts.

5. Implementation of this project will result in the phase-out of 199 ODP tonnes of CFC which represent 25 per cent of total CFC consumed in the refrigeration sector.

6. The Secretariat reviewed the project proposals to assess the eligibility of the equipment requested in terms of the conversion to cyclopentane foaming and HFC-134a refrigerant technologies and the cost items required for the conversion.

7. The equipment being requested in the project proposals are those necessary for the conversion to the new non-ODS technology. Cost levels have been discussed and agreed between the Secretariat and the World Bank.

SECRETARIAT'S RECOMMENDATIONS

8. The Secretariat recommends approval of the requested incremental capital and operating costs as follows:

Plant	Actual Production (units/yr)	ODS to be phased out (MT/year)	Capital Cost	Operating Cost	Total Cost (*)
a) Helametal	72,000	62	$2,038,890	$859,025	$2,959,085
b) Fribe, S.A.	54,000	37	$1,181,268	$606,042	$1,822,750
c) Fribe La Rioja	35,000	26	$1,063,422	$392,805	$1,488,127
d) McLean	110,000	74	$1,116,090	$1,291,000	$2,440,570
		199	$5,399,670	$3,148,872	$8,710,532

(*) Includes 3 per cent intermediary fee.

9. The Secretariat further recommends that the World Bank be requested to report back to the Executive Committee on the level of operating cost disbursements at the time production of non-CFC refrigerators commences.

PROJECT EVALUATION SHEET

COUNTRY OR REGION:	Argentina
PROJECT TITLE:	a) Conversion to non-CFC technology in the production of heat exchangers for mobile air conditioning, Interclima, S.A.; b) Conversion to non-CFC technology in the production of condensers for mobile air conditioning, Simon Cachan, S.A.; and c) Conversion to non-CFC technology in the production of complete mobile air conditioning systems, Mirgor, S.A.
BUDGET:	Capital Costs: a) Interclima US \$2,283,148 b) Simon Cachan US \$2,311,707 c) Mirgor US \$87,567 Operational Costs: c) Mirgor US \$1,882,187
INCREMENTAL COST:	a) Interclima US \$1,976,502 b) Simon Cachan US \$2,738,217 c) Mirgor US \$35,632
ODS PHASE-OUT:	180 ODP tonnes (indirect phase out by the three enterprises)
COST EFFECTIVENESS:	N/A
PROJECT DURATION:	One year
IMPLEMENTING AGENCY:	World Bank
NATIONAL COORDINATING AGENCY :	OPROZ - INTI
TECHNICAL REVIEW COMPLETED:	YES _X_ NO _

SECRETARIAT'S COMMENTS

1. This project covers the conversion of the following two mobile air conditioning (MAC) manufacturing plants to HFC-134a refrigerant:

a. Interclima plant currently produces tube and fin condensers and evaporators for CFC-12. The company is proposing to change the design of the condensers to a parallel flow, demanded by its European clients, for the new HFC-134a systems. The change to parallel flow design includes a Seco Warwick Aluminum Brazing System (flux application system, drying oven, brazing furnace), cut-off and tube straightener, wash paint process, degreasing system, leak test; and

b. Simon Cachan plant S.A., presently produces serpentine condensers for CFC-12 MAC systems. The company is proposing to change to parallel flow design to produce condensers for HFC-134a refrigerant which would be accepted by its customers. The change involves manufacturing of multi-channel tube, aluminum fins, aluminum tanks and heads, degreasing, washing and drying, preheating, furnace brazing, and cooling in nitrogen atmosphere, leakage test, and painting.

2. The project also includes the conversion of a hose assembly line for MAC systems and importation of HFC-134a compressors by Mirgor plant (the company also assembles condensers and evaporators provided by Interclima and Chacan enterprises, and imports condensers).

3. Implementation of this project will result in the indirect phase-out of 180 ODP tonnes of CFC which represent 29 per cent of total CFC consumed in the country.

4. The Secretariat engaged a sector expert to assess the eligibility of the equipment requested in terms of the conversion to HFC-134a refrigerant and the cost items required for the conversion. Comments by the Secretariat focused on the request of those equipment and tools that seemed to be related more to technological improvements or customer requirements than to the conversion of refrigerant.

5. The Secretariat discussed the project proposals with the World Bank. The World Bank agreed with the Secretariat to revise the project proposals accordingly.

6. Interclima plant is proposing to change the actual tube and fin evaporator design to parallel flow design. The Sub-Committee on Project Review, in considering a similar request in another Article 5 country, recognized that part of the conversion costs associated with the evaporator component of the MAC, were due to technological advances and were not eligible as incremental costs. The Executive Committee then requested that an explanation of the methodology used for calculating incremental costs should be provided when submitting project proposals for MAC conversions to HFC-134a refrigerant, including a description of any technological advances provided to meet customers' new technical requirements (UNEP/OzL.Pro/ExCom/14/15 para.63).

7. The Government of Argentina and the World Bank jointly determined the eligible incremental costs of the evaporator line to be US $738,000 less than was requested.

8. The equipment and tools being requested in the Simon Cachan and Mirgor plants are those necessary for the conversion to the new refrigerant. Cost levels have been discussed and agreed between the Secretariat and the World Bank.

9. Incremental operational costs (US $1,882,187 for Mirgor plant) are associated with the importation of new HFC-134a compressors. These costs will be incurred only after the full production of non-CFC condensers and evaporators for MAC units has started. The incremental operational costs are likely to decrease within the coming year.

SECRETARIAT'S RECOMMENDATIONS

10. The Secretariat recommends approval of the requested capital costs as follows:

a.	Interclima	US $1,983,430
b.	Simon Cachan	US $2,738,217
c.	Mirgor	US $35,632

11. The approval of incremental operational costs at US $1,882,187 should be deferred. Full production of condensers and evaporators for HFC-134a MAC units by Interclima and Simon Cachan might start only by 1996. By that time, a more realistic calculation of the incremental cost for the HFC-134a compressor could be calculated, on the basis of market prices prevailing at the time when actual costs are incurred.

THE MONTREAL PROTOCOL ON SUBSTANCES THAT DEPLETE THE OZONE LAYER

PROJECT COVER SHEET

COUNTRY:	ARGENTINA
PROJECT TITLE:	Elimination of ODP (ozone depleting substances) in the production of household refrigerators at the FRIBE LA RIOJA Plant located in the Province of La Rioja.
SECTORS COVERED:	Refrigeration.
ODS CONSUMPTION IN AFFECTED SECTOR:	762 tons (1992).
PROJECT IMPACT:	20 ODP tons (14 tons CFC-11; 6 tons CFC-12).
PROJECT DURATION:	2.5 years.
PROJECT ECONOMIC LIFE:	10 years.
TOTAL PROJECT COST:	US$ 1,063,422 Capital Costs. US$ 392,805 Recurrent Incremental Costs.
INTERMEDIARY FEE:	US$ 31,900 (based on 3% of incremental capital costs)
PROPOSED ODS GRANT:	US$ 1,488,127 (incremental operating cost share to be considered in one year)
UNIT ABATEMENT COST:	US$/kg/year 8.65 - Capital Costs. US$/kg/year 28.29 - Total Costs.
IMPLEMENTING AGENCY:	World Bank.
COORDINATING NAT. AGENCIES:	Ozone Program Office and the National Institute of Industrial Technology
BENEFICIARY ENTERPRISE:	FRIBE LA RIOJA S.A. (Controlled by FRIBE S.A)

PROJECT SUMMARY

1. This Project will eliminate the use of CFCs in the manufacturing of household refrigerators at the FRIBE LA RIOJA S.A. plant, located in the province of La Rioja, Argentina. The CFC-11 used as foaming agent in the production of insulating foams will be replaced by cyclopentane, and the CFC-12 used in the refrigeration circuit will be replaced by HFC-134a. It is foreseen that 6 tons of CFC-12 and 14 tons of CFC-11 will be eliminated each year (20 tons of ODP). The funds required will be used to convert the production production lines and compensate for the incremental operational costs resulting from conversion for a one year period.

PROJECT OBJECTIVE:

2. The objective of this project is to eliminate the use of 20 tons annually of ozone depleting substances (ODS) including 14 tons of CFC-11 and 6 tons of CFC-12, in the production of domestic refrigerators manufactured by FRIBE LA RIOJA, S.A. The project does not intend to increase capacity of the company.

SECTOR BACKGROUND:

3. In 1992, 1441 tons of CFC-12 and 333 tons of HCFC-22 were consumed in the refrigeration sector in Argentina, in refrigeration circuit applications. This sector is the largest consumer of ODS. In the refrigeration sector, 440 tons of CFC-12 were consumed in the domestic sector, of which 190 tons are used in new equipment and 250 tons are used for servicing operations. With respect to the commercial refrigeration sector, the consumption is 668 tons of CFC-12 (68 tons for new equipment and 600 tons for servicing operations) and 333 tons of HCFC-22. Refrigerated transport and fleets consume 333 tons of CFC-12.

4. With respect to the foams sector, in 1992 the sector consumed a total of 1275 tons of CFC-11 and 209 tons of CFC-12 (second largest consumer), of which 322 tons of CFC-11 were consumed in the production of insulating foams for domestic refrigerators, and 21 tons for commercial refrigerators. The production of domestic refrigerators in 1992, as indicated in the Country Program, totalled 761,000 units. This number grew by 7% in 1993, and there is an estimated growth rate of 6% for the present year.

5. The domestic sector, which produces refrigerators and freezers, is composed of more than 22 enterprises. 7 of which control approximately 72% of the market. Of these 7 enterprises, 2 are of foreign capital and the other 5 are 100% national capital. The principal industries have expressed the will to immediately replace the CFCs. Some of them already use the reduced-CFC foaming process.

6. Some of the CFCs are produced locally and some are imported. With respect to compressors, the local industry provides 30% of the market and the remaining 70% is imported mostly from Brazil. The establishment of MERCOSUR (common market of the southern cone countries) is leading to greater integration with Brazil, resulting in the import of some components from Brazil.

7. An unrestricted demand of CFCs in the domestic refrigeration sector would result in estimated consumption of 1170 tons by the year 2000. The strategy of the Argentinian government for the phase-out of ODS consumption is clearly set forth in the Country Program, which considers the domestic refrigeration sector to be a priority. The program for reduction and elimination of consumption in the domestic refrigeration sector establishes the schedule for the reduction in consumption of CFCs to begin after 1995 for foam applications, after 1996 for

refrigeration circuit applications, and reaching total elimination of consumption in the production of new units in the year 2000. The approval of this project by the Multilateral Fund will undoubtedly contribute to the implementation of the planned strategy and the achievement of the objectives of ODS elimination.

ENTERPRISE BACKGROUND

8. FRIBE S.A. is one of the 7 leading companies in the sector. The company's present operation utilizes the reduced CFC-11 technology for foaming applications and CFC-12 for circuit refrigerant. FRIBA S.A. is 100% Argentinian owned, and the FRIBE Buenos Aires and FRIBE La Rioja operations are independent of one another. FRIBE Buenos Aires owns 90% of FRIBE La Rioja, with an installed capacity of 90,000 units per year in Buenos Aires and 72,000 units per year in the FRIBE La Rioja Company plant. FRIBE La Rioja commands approximately 4% of the market with a current production level of 50% of its capacity. It should be noted that the FRIBE La Rioja's operation serves national industrial policy objectives and any rationalization of the two operations is not possible within the Argentine context. It targets the local market as well as the countries in MERCOSUR. FRIBE uses technology developed locally, with the technical support of suppliers of raw materials and companies that manufacture the equipment used in the facility. These are Bayer (Germany), Dow Chemical (USA), Canon-Crios (Italy), Perros (Italy), Krauss Maffei (Germany), and Galileo (Italy).

DESCRIPTION OF THE PROJECT

9. The project consists of converting the existing production lines, which use reduced CFC-11 and CFC-12 technology for foaming agent and refrigeration respectively, to permit production with cyclopentane as foaming agent and HFC-134a as refrigerant, without increasing capacity.

10. Presently, the refrigeration circuit plant is equipped with a cabinet preassembly line with leak controls for CFC-12 and two final assembly lines with CFC-12 charging lines (Leybold), with leak controls for CFC-12 in low- and high-pressure refrigerant, by means of Leybold leak detectors. There is no equipment for the recovery and recycling of CFC-12. CFC-12 will be replaced with HFC-134a in all applications of domestic refrigerators and freezers. The necessary modifications in the product will include changes in the capillary, drying filter, and compressor suitable for HFC-134a with polyol-ester oil. The change-over will be introduced gradually in the production process, with 20% of the line after approval of the field tests, which will last one year, to complete 100% after the third quarter of approval of the field tests (see the annexed calendar). The engineering technology of the product is FRIBE's own, and the compressors would be imported primarily from Brazil (Sicom Ltd, Lic. Tecumseh). FRIBE does not have a formal technology transfer agreement with any industrialized country domestic refrigerator manufacturer. However, the proposed project includes the services of an international expert to guide the company in the HFC-134a conversion process (Refer to Annex 1).

11. The project scope includes: i) procurement of new machinery and equipment; ii) modifying the presently used equipment, such as pumps; iii) redesign of assembly lines; iv) redesign of refrigerator and freezer doors and cabinets; and v) installation, supervision, and training for foam injection systems.

12. The change in equipment in the refrigeration circuit will include (i) the adaptation (possible acquisition) of charging equipment for HFC-134a, (ii) the acquisition of 4 leak detectors for HFC-134a (Yokogawa or Leybold), and (iii) the adaptation of existing vacuum pumps. Once the project is approved, testing will start on the refrigerant and the existing foaming process (50% CFC-11) which yields appropriate comparator material due to the similar conductivity of the proposed foaming

technology. The insulation foams system presently has an installation for cabinet foaming which consists of (i) one low-pressure foaming machine, Viking brand, with a maximum capacity of 60 kg/min, 1:1 ratio, (ii) and a carousel with 9 molds rotating at 9 min/turn, resulting in a production capacity of 7800 cabinets/month, considering a shift of 8.5 hours, and a yield of 0.77, 20 work days/month. Total production capacity of the plant is limited to 6,000 units/month due to the existence of only one assembly line.

13. The foaming system for doors uses open-mold foaming of the "book type", has a production capacity of 300 freezers/8.5 hr. shift, and is designed for a curing time of 4.5 minutes, and 5 fixed positions in the installation.

14. The implementation of the cyclopentane technology will involve the modification of several parts of equipment. Included in the project are ventilation devices for each line (cabinets and doors) recommended by independent experts under contract with the World Bank who considered such modifications important in the interest of safety concerns with cyclopentane technology in the Fribe facilities. Also recommended by these experts was mold heating through warm water rather than an electric source.

a) First, a high-pressure PU injection machine suitable for the cabinet foaming system. This will eliminate the use of chlorinated cleaning solvents used in low-pressure machines for cleaning the injection heads after every shot of components. The maximum capacity of delivery is 90 kg/min, and 1:1 ratio.

b) A system for cabinet foaming designed for cyclopentane will also be necessary. The system will include: (i) preheating ovens, (ii) loading and unloading machine, and (iii) injection heads. Contemplated production characteristics are: 270 seconds of polymerization time, 50 seconds for servicing, 320 seconds for cycle, and 300 parts from the effective production of the installation in 8 hours, and 90% efficiency.

c) The procurement of a high-pressure PU injection machine is required with one injection head, to serve the door foaming plant. The maximum capacity of delivery is 40 kg/min, and 1:1 ratio.

d) Another modification involves the installation of the door foaming system designed to work with cyclopentane, capable of injecting sandwich doors. It comprises the mold transportation, rotation structure for six stations, transport of heads, electrical connections, and a set of door molds. Contemplated production characteristics include: 270 seconds for polymerization, 50 seconds for servicing, 320 seconds for the cycle, and 325 sets from effective production of the installation in 8 hours with a 90% efficiency.

e) The ventilation and extraction system for the installation of cabinet foaming will require cabins for closing the molds, tubes, and heads, and 2 ventilators, one for normal function and another on reserve/for emergencies, 20 ren/hr during normal function and 40 ren/hr for emergencies, for each cabin.

f) The ventilation and extraction system for the installation of doors requires a cabin for the door foaming system, tubes, and injection head, and two ventilators, one for normal functioning and another for emergencies, 20 ren/hr during normal function and 40 ren/hr for emergencies.

g) Adequate sensors and safeties for the cabinet and door foaming installations will also be required.

h) A feeding and pre-mix of raw materials group will be necessary, and it should include: (i) one complete Easy-Froth Multi Unit of closing box and extraction, (ii) one deposit for pure polyol with heat exchanger, (iii) two discharge pumps, (iv) one pressurizing group with nitrogen for the cyclopentane tanks, and (v) one group of two ventilators and tubing for 20/40 spare parts for the Easy-froth cabin (20 spare parts with normal function and 40 in emergency, 10% LEL).

i) Finally, assistance for the installation and start-up will include assistance in assembly and start-up, a training manual, supervision and control of the installation during the start-up by a security expert technician, and a technician with responsibility for all safety measures (period estimated at one week). Most of the installation and start-up assistance costs assume cost savings due to the timing and use of the same for the FRIBE Buenos Aires facility project which will be implemented concurrently.

PROJECT IMPLEMENTATION

15. Project Implementation, including product line redesign and testing, rearrangement of assembly lines, installation of equipment for foam injection and refrigerant circuit installation, and technology transfer, will take place over a period of 30 months. The project implementation schedules are included in Annexes 3, 4, and 5.

JUSTIFICATION FOR SELECTION OF ALTERNATIVE TECHNOLOGY

16. The two options for replacement of CFC-12 as a refrigerant are HFC-134a and hydrocarbons. HFC-134a has been selected for replacement of the CFC-12 refrigerant in domestic refrigerators because it is presently accepted worldwide, and its technology has been thoroughly developed and introduced commercially in many developed countries. There are numerous suppliers of gas, oils, and components of the circuit, and it appears to be a vialbe solution in other subsectors such as commercial refrigeration and the automotive industry. There are certain doubts concerning its GWP, but there are no nearby dates for its limitation. The option of using hydrocarbons as refrigerants has been developed in Germany and units are being manufactured for isobutane. It may appear to be a promising technology, but FRIBE believes its development has not been completed, and obtaining the adequate components for its operation is not easy.

17. In the case of foaming technologies, there are presently three replacements for insulation in domestic refrigerators: i) water/HCFC-141b; ii) water/HCFC-22 and -142b blend or HFC-134a and -152a blend; and iii) cyclopentane. The first solution is an aqueous solution whose technology is similar to the one used now, but it is a transitional substance because HCFC-141b is a transition substance, and as such is controlled by the Montreal Protocol, and the government policy is to support projects with definite solutions that are feasible. The second solution uses blends of foaming gases, requires totally new equipment, and its start-up is difficult and troublesome. The third solution, the one proposed in this project, is cyclopentane technology, which has been successfully introduced in European countries, especially in Germany. The installation of cyclopentane requires special considerations for safety problems due to its flammability, but there is considerable experience in Argentina in the handling and storage of hydrocarbons, since Argentina has a considerable production of hydrocarbons, used as fuel, including automobiles.

18. Cyclopentane is available in the market at a cost approximately 50% of HCFC-141b. In addition, there is experience in the country in operating high-pressure machines for foaming. The supplier of the high-pressure equipment will guarantee the proper technology transfer of cyclopentane to FRIBE, S.A. (offering an "Operational Safety Statement"), as well as the global guarantee on the safety of installation by sending safety experts who will audit the installation. The

safety aspects and the involved risks will be analyzed per the recommendations of the World Bank in its implementation of the proposed installations. Cyclopentane technology, with a ODP = 0, is the most efficient in relation to its function as an environmentally neutral agent and in relation to the operating costs, although it presents a challenge in terms of economic, technical, and health and safety efforts, it is compatible with the HIPS.

19. The proposed project therefore aims to implement a definite solution using a non-fluorocarbonated substance, and ensure the possibility of external competitiveness, taking into account that there are markets that only accept cyclopentane as technology.

PROJECT TOTAL CAPITAL AND INCREMENTAL COSTS

20. The total estimated project cost is US$ 1.46 million, of which incremental capital costs are US$ 1.06 million. Costs include equipment costs, technical assistance, training, and international experts.

PROJECT COST SUMMARY	
REFRIGERATION SYSTEM	
Equipment	US$ 68,805
Tests and Prototypes	0
International Expert, Training and Technical Assistance	27,000
SUBTOTAL	95,805
FOAM SYSTEM	
Equipment	803,910
Tests and Prototypes	0
External Consultants	25,000
SUBTOTAL	828,910
REFRIGERATION AND FOAM	924,715
CONTINGENCY (15%)	138,707
TOTAL	1,063,422

NOTE: Includes Insurance and Freight

Given that the FRIBE S.A. Buenos Aires plant produces the same line of products, field test results, prototypes, and significant (76%) use of external consultants from that project are expected to serve adequately the needs of FRIBE La Rioja. These costs are not included in this project. Technical assistance, training and internatinal experts will be used for FRIBE La Rioja's specific requirements. Estimated cost for international experts costs have been adjusted, in both projects, to reflect travel expenses savings.

21. All costs specific to supply and installation of new technology, and which would otherwise not be incurred if the existing fabrication line continued operating, are considered incremental capital costs. The total capital cost was calculated based on current information, including OMS (Italy) foaming system. Additional costs may occur from a need to remodel the plant after determinations by safety experts (from the equipment supplier and the external consultant that will monitor the implementation of the project).

INCREMENTAL OPERATING COSTS

22. The units produced after the conversion will be more expensive (by approximately $12.5). The incremental operating costs include the additional costs of raw materials, and the cost of the more expensive compressors necessary to handle the HFC-134a refrigerant. The calculation was made taking into consideration a production rate of 35,000 units, the average over the 1987 to 1994 period.

INCREMENTAL OPERATING COST SUMMARY	
Cost Due to Changeover to HFC-134a Refrigerant	$5.5
Cost for Foam	6.97
Total Cost per Unit	12.47
TOTAL INCREMENTAL COST	$436,450
NPV (10% discounted)	$392,805

23. Annex 2 contains a complete breakdown of the incremental cost calculation. The incremental operating costs estimate is based on input prices which will be re-evaluated and additional quotations sought. The re-evaluation will also be subject to the results of the final product and protoype tests. The Government of Argentina has requested the project to be submitted with operating incremental cost as calculated, subject to re-evaluation once tests and protoypes are completed. It is noted that all approved incremental costs in Montreal Protocol projects funded through the World Bank implementation operations will be disbursed only against against actual expenditures and that these will have to be verifiable in strict accordance with World Bank disbursement policies.

PROPOSED OTF GRANT

24. The proposed OTF grant request of US$ 1,456,227 is based on 100% Argentinian ownership of FRIBE La Rioja S.A., covers the incremental capital costs for one year, and includes a 15% contingency over capital costs. Total project incremental capital and incremental operating costs for the FRIBE project in La Rioja are $ 1,456,227. A 3% intermediary fee of US$31,900 has been calculated based on the incremental capital costs of US$1,063,422, and is being requested. Once incremental operating costs are reconsidered, the corresponding 3% financial intermediary fee will also be determined and requested.

25. The unit abatement cost calculation is shown below. The annualized capital cost is US$8.65/kg ODP. The annualized total cost is US$ 28.29/kg ODP.

A) **CAPITAL COST:** US$ 1,063,422

B) **RECURRENT INCREMENTAL COSTS:** US$ 392,805

C) **CAPITAL RECOVERY FACTOR:** 0.16275

D) **ODS CONSUMPTION:** 20,000 Kg

UNIT ABATMENT COST (UAC):

UAC - Capital Costs (A x C)/D = (US$/kg. ODP/year) = $8.65
UAC - Total Costs (A x C + B)/D = (US$/kg. ODP/year) = $28.29

ANNEX 1: DETAIL OF INVESTMENT (EQUIPMENT)

I. REFRIGERATION SYSTEM

A. Equipment

1- Galileo Unit Charge p/134a (See proforma COMP/EST 9870)	
Digifill b 150 F1	US$ 36,980
Spanish Display	US$ 439
RPI Refrigerant Transfer Pump	US$ 7,852
2- Freight and Insurance (DM 5,500 + 2.5% FOB)	US$ 3,000
3- Adapting existing Galileo vacuum pumps (4 pumps x US$300 each). Estimate	US$ 1,200
4- YOKOGAWA Leak Detectors Model H25-C Quantity = 4 (see proforma 10/8/94) TOTAL CIF BUENOS AIRES	US$ 19,334
Subtotal	US$ 68,805

B. International Expert, Training, and Technical Assistance

5- International expert to assist in HFC-134a conversion from implementation to start-up	US$ 15,000
6- Training of FRIBE La Rioja personnel during implementation and start-up.	US$ 7,000
7- Start-up of Galileo and A'Gramkow equipment (estimates including lodging, food, and trip expenses)	
Galileo technician for 1 week	US$ 5,000
Subtotal	US$ 27,000
Subtotal Refrigeration (A and B)	US$ 95,805

II. POLYURETHANE FOAMING SYSTEM

1-	Impianti OMS Polyurethane Foaming System Including: Cyclopentane tank Intermediate tank Premixing system Cabinet foaming machine with mixing head Door foaming machine with mixing head	US$425,000
2-	Preheating oven (2)	40,000
3-	Rebuilding foam fixtures for cabinets (9)	27,000
4-	Rebuilding foam fixtures for doors (15)	30,000
5-	Rebuilding foam plugs (9)	9,000
6-	Ventilation and exhaust system for cabinet foaming installation	55,000
7-	Ventilation and exhaust system for door foaming installation	20,000
8-	Sensor and safety set for cabinet and door foaming installation	80,000
9-	Assistance for installation and start-up	60,000
10-	Freight (4 cont. 40' US$ 3,600 each) Insurance (2.5% FOB + Freight)	14,190 43,720
	Subtotal	US$803,910

B. External Consultants

External Engineering Study. Layout development, area classification, safety surveys, municipal approval, plant modifications, works control and monitoring, in accordance with budget	US$ 25,000
Subtotal Foam (A and B)	US$828,910
TOTAL COST OF PROJECT	US$924,715
CONTINGENCIES (15%)	US$ 138,707
TOTAL CAPITAL COST	US$1,063,422

NOTE: Total estimated costs were made based on current information and does not include additional costs which may occur following the recommendation made by safety experts both by the supplier company and by the external consultants monitoring project progress.

NOTES TO ANNEX 1

1. CHARGE UNITS

The proposals of the companies listed below are available in the comprehensive World Bank project files:

A'Gramkow (Denmark)
Galileo (Italy)
CEMA (Argentina)

CEMA has provided documentation certificates that justify the renovation of one of the Leybold Hereeus chargers that presently exist in the plant (Also available in the World Bank FRIBE La Rioja project file).

Considering the confidence that Fribe has in Galileo equipment, and that presently there is Galileo equipment that needs to be adapted to R-134a, Fribe has tentatively accepted the Galileo proposal.

NOTE: FRIBE is continuing discussions of the quotes in an effort to negotiate better prices.

2. LEAK DETECTORS FOR R-134a

The proposals from the companies offering their equipment is available in the World Bank Fribe project file.

Yokogawa (Japan, Imported from the USA)
Leybold-Inficon (Germany)

The Yokogawa equipment has been selected, due to its reliability and lower price.

3. EVACUATION EQUIPMENT AND HELIUM CHARGING

The approval of this item is in the control of the experts from the funding authorities. However, the criteria to propose the approval is to extend the recovery of helium gases during the control operation. The proposal from A'Gramkow is in the World Bank Fribe project files.

4. INTERNATIONAL EXPERT AND TRAINING

The cost of the international refrigeration expert has been reduced by $5000 on the assumption of reduced international travel expenses due to implementation of the two Fribe projects simultaneously. Training will be done in conjunction with technicians of Galileo, CEMA, SICOM-TECUMSEH and other parts suppliers.

5. LABORATORY THERMODYNAMIC TESTS

The INTI proposal is available in the World Bank Fribe project file.

6. POLYURETHANE FOAMS EQUIPMENT

Proposals from the main equipment vendors are available at the World Bank in the Bank's project files. The complete proposals are available for:

Canon-Crios (Italy)
Hennecke (Bayer Germany)
OMS (Italy)

The company Perros (Italy) did not complete the modifications requested by the safety experts from the World Bank during their visit in August to Argentina, by the due date for presentation of this project.

FRIBE will probably choose the offer from Hennecke (Germany) because it appears that the company can provide the best technical assistance in the country after the entry to production, through the group Bayer, who is a major supplier of polyurethane components.

Capital cost estimates provided are based on the data provided by OMS.

7. EXTERNAL CONSULTANTS

Proposals from the following firms are available in the World Bank's project files:

Espacios Verdes y Labranzas, S.A.
Dow Chemical

The quote offered by Dow Chemical has been used for calculating the capital costs of the project, and was the lowest cost option offered to FRIBE. The reliability of the company is prized at FRIBE and will faciliate the execution of the project. DOW, in effect, will be contracted as an external partner for transfer of technology.

ANNEX 2: BREAKDOWN OF RECURRING INCREMENTAL COSTS

INCREMENTAL COST CALCULATION FOR FOAM-TYPE FREEZER

Price of formulation of PV system based on CFC-11-50% reduced.

PRODUCT	WEIGHTED PART	US$/KG
Polyol	100	2.20
CFC-11	17	2.45
Isocyanate	150	2.20

Price per kg of foam: US$2.20/kg

*Part: According to system use documents.
**Prices: Polyol-Isoc-CFC-11 according to purchase orderes enclosed.

OBSERVATION

Actual molded density: 34Kg/m^3
Kgs. per refrigerator: 7 Kg. (cabinet + door)
Price of formulation for PU system based on cyclopentane: US$2.88 (see Attachment A, Dow Chemical offer).

INCREMENTAL COST (AC)

CFC 50% reduced refrigerator = 7 Kg.
Cyclopentane refrigerator = 7.77 Kg. (molded density 38Kg/m^3 for dimensional stability)

AC = 7.77 x 2.88 - 7.70 x 2.20 = US$ 6.97

TOTAL INCREMENTAL COST

AC = AC1 + AC2 + AC3 = US$ 5.5 per refrigerator

INCREMENTAL COST CALCULATION (AC) FOR REFRIGERANT-TYPE FREEZER

Compressor for R-134a refrigerant (see Sicom offer in Attachment C)
AC1 = 30.47 - 34.08 = US$ 2.39

Refrigerant gas R-134a (see DuPont offer in Attachment B)
Charge in freezer = 180 gm
AC2 = 0.180 Kg x US$15.60/Kg - 0.180 x US$3.60/Kg = US$ 2.16

Changes to capillary and molecular filter
AC3 = US$ 1 (estimate which will be reviewed). This cost per unit takes into account the capillary, the filter, and some small heat exchanger changes - evaporator and condenser. The need for the latter will be re-evaluated with the review of the estimate.

ANNEX 3: IMPLEMENTATION TIMETABLE - REFRIGERANT

Refrigerant Circuit

IMPLEMENTATION TIMETABLE - REFRIGERANT CIRCUIT

QUARTERS		1	2	3	4	5	6	7	8	9	10	11
Project Approval	xxx											
Order/Payments/LC		xxx										
Delivery Time			xxx									
R & D Studies		xxxxxxxxxx										
Shipping and Customs				xx								
Assemblage				xx								
Test				xx								
Pilot Production (100 Units)					xx							
Field Test (100 Units)						xxxxxxxxxxxxxxxxxxxxxxx						
Start Production (20% of total)									xxxxxxxxxxxxxxxxx			
Start Production (100%)												xxx

ANNEX 4: IMPLEMENTATION TIMETABLE - POLYURETHANE FOAMS

QUARTERS		1	2	3	4	5	6	7	8	9	10	11
Project Approval	xxx											
Order/Payments/LC		xxx										
Delivery Time			xxxxxxxxxxxxxxxx Approx. 7 months									
Test (Country of origin)				xx								
Disassembling/Packing					xx							
Shipping and Customs					xx							
Assemblage						xx						
Start-up						xxxx						
Pilot Production						xx						
Field Test						xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx						
Adjustments										xxx		
Start Production											xxx	

ANNEX 5: SCHEDULE

Activity (Quarters)			1	2	3	4	5	6	7	8	9	10	11
Project Description		xxx											
Final Draft Project		xxx											
Transmittal of legal document	xxx												
Project Approval													
Financial Negotiations		xxx											
Signing of Documents		xxx											
Disbursements		xxx											
Procurement			xxx										
Construction - Delivery Time			xxx	xxx	x								
Engineering and Development Studies			xxx	xxx									
Shipping and Customs					xxx								
Installation and Tune-up						xxx							
Pilot Production and Field Test						x	xxx	xxx	xxx	xxx			
Adjustments											x		
Production Start-up/foams start-up												xxx	
Production Start-up/beginning refrigeration C. 100%													xxx

ARGENTINA - FRIBE LA RIOJA

TECHNOLOGY

The technology chosen by the enterprise for the manufacture of foam for refrigerators is based on cyclopentane as a replacement for CFC 11. This is now a well proven technology in use in many countries. The enterprise also considered HCFC 141b but did not pursue this option because it is a transitional substance and is more expensive (per kg) than cyclopentane.

ENVIRONMENTAL ISSUES

Cyclopentane has zero ODP and very low GWP and hence constitutes a long term replacement.

The enterprise should confirm with relevant national / local authorities that any relevant regulations on VOC emissions are complied with.

The main issue regards safe operation with highly flammable cyclopentane. The equipment is proposed to purchase will meet the needs of safe operation and external experts will assist.

It is noted that the letter of assurance will be obtained from the equipment supplier.

PROJECT COSTS

The cost effectiveness is very poor because of the small output of the enterprise compounded by the fact that the enterprise has already switched to reduced CFC 11.

The capital costs are also very high which result in an extremely high UAC. However, having stated these points, there are no real options which would significantly reduce these costs.

TIMEFRAME

This is well set out and acceptable.

RECOMMENDATION

Approved.

GMFJ/kd/16/11/94

Country of origiARGENTINA

Project title: Elimination of ODP in the production of household refrigerators at the FRIBE, La Rioja plant located in the Province of La Rioja

Sector/sub-sector Domestic refrigeration
Relationship to country pr(World Bank)

Note This review addresses only the refrigerant conversion part does not address the part related to the foam blowing agent

Technology

- In this project HFC-134a is selected as the substitute refrigerant for CFC-12. In domestic refrigeration HFC-134a technology is a proven and acceptable (nontransitional) technology to reduce CFC-12 consumption.
- The company FRIBE LA RIOJA S.A. does not have a formal technology transfer partner. However, the company intends to develop the HFC-134a technology with assistance from compressor, refrigerant and equipment suppliers. Furthermore, provisions for external support are present. Due to these facts, a successful project implementation can be expected.
- Other technologies than HFC-134a were considered (hydrocarbons) but were not selected because of the lack of commercially available compressors and the development state. From the zero ODP technologies HFC-134a is one of the most cost effective solutions.

Environmental impact

HFC-134a has an ODP of zero and a GWP of 0.27. For domestic refrigeration a GWP of this magnitude is negligible.

Project costs

Incremental investments:

- The helium evacuation and charge system is not a necessity and must be eliminated (only the helium leak detectors were eliminated after the first review)
- The rest of the equipment requested is essential for the conversion process and costs claimed are reasonable.
- Costs of training, testing and external support are reasonable (part of the costs are shared with FRIBE, S.A.)

Incremental operational costs:

- Operational costs are claimed for one year.
- Operational costs are claimed for 35000 units which is the average of the production from '87 to '94.
- The price of HFC-134a is high (15.6 USD) but is based on demonstrated quotations.
- Charge reduction from CFC-12 to HFC-134a is not taken into account.
- USD 1 estimate for capillary / filter / heat exchanger modifications might be too high. This item must be re-evaluated after project implementation as is indicated in the project proposal.

The UAC value, calculated for the refrigerant part separately, amounts to 38.7 USD which is high compared to similar projects.

Implementation timeframe Reasonable

Relevance and adequacy of information provided

The project description, together with comments of the World Bank officers, provided sufficient information for a judgment.

Recommendations Approval provided the helium equipment is eliminated

Janssen M.J.P., OORG MM338, Eindhoven, The Netherlands, 4-November-1994

THE MONTREAL PROTOCOL
ON SUBSTANCES THAT DEPLETE THE OZONE LAYER

PROJECT COVER SHEET

COUNTRY:	Argentina
PROJECT NAME:	Elimination of CFC in two manufacturing plants of domestic refrigerators.
SECTORS COVERED:	Domestic refrigeration
ODS CONSUMPTION IN AFFECTED SECTORS:	762 tons (1992)
PROJECT IMPACT:	Phase out of annual consumption of 20 tons of CFC-12 and 42 tons of CFC-11 (62 tons/yr total ODP eliminated)
PROJECT DURATION:	2 years
PROJECT ECONOMIC LIFE:	10 years
TOTAL PROJECT COST:	Total capital cost: US$ 2,038,890 Incremental operating costs: US$ 859,025
INTERMEDIARY FEE:	US$ 61,170 (based on 3% incremental capital cost)
PROPOSED ODS GRANT:	US$ 2,959,085 (incremental operating cost share to be considered in one year)
UNIT ABATEMENT COST:	Annualized capital cost: US$ 6.35/kg ODP Annualized total cost: US$ 19.05/kg ODP
IMPLEMENTING AGENCY:	World Bank
COORDINATING NAT. AGENCIES:	Ozone Program Office / National Institute of Industrial Technology
BENEFICIARY ENTERPRISE:	Helametal S.A. / Helametal Catamarca S.A.

PROJECT SUMMARY

. This program will eliminate the use of CFCs in the manufacturing of domestic refrigerators at the Helametal, S.A. plant, located in Lomas del Mirador, Buenos Aires, and at Helametal Catamarca S.A., located in San Fernando del Valle de Catamarca, Pcia. de Catamarca, both in the Republic of Argentina. The CFC-11 used as foaming agent in the production of insulating foams will be replazed with cyclopentane, and the CFC-12 used in the refrigeration circuit will be replaced with HFC-134a. It is anticipated that 20 tons of CFC-12 and 42 tons of CFC-11 will be eliminated per year (62 tons of ODS). The funds required will be used to retrofit the production lines, the start-up and tests of the new models, the training of personnel, and the incremental operating costs resulting from the changeover for a period of 1 year.

COUNTRY BACKGROUND

. The Country Program of the Republic of Argentina for the protection of the ozone layer was presented and approved during the XII meeting of the Executive Committee of the Multilateral Fund of the Montreal Protocol. This Country Program reflects the objectives of the Government and Industry to reduce the consumption of substances that deplete the ozone layer. The Program foresees the total elimination of ODS for the year 2006, before the date established by the Montreal Protocol and its ammendments. The reasons for this policy are the environmental impact of this decision and the restrictions that the global agreement will impose on the industrial product that contains ODS in its production. Argentina has consumed in 1992, the base year for the Country Program, 1338 tons of CFC-11 and 2408 tons of CFC-12. Due to the growth in the sectors, we estimate that consumption has increased by 7% during 1993, and will increase an additional 6% during 1994. Both substances are produced domestically (660 tons of CFC-11 and 772 of CFC-12), and are also imported (1048 tons of CFC-11 and 1990 of CFC-12).

PROJECT OBJECTIVE

. The objective of the project is the fast and complete elimination of the use of chlorofluorocarbonated compounds in the manufacturing of domestic refrigerators in the plants of the company Helametal S.A., located in Buenos Aires, and the company Helametal Catamarca S.A., located in the Provincia de Catamarca, in the Republic of Argentina. CFC-11 used as a foaming agent in the production of polyurethane foams used in thermal insulation will be replaced by cyclopentane, and CFC-12 used as a refrigerant will be replaced by HFC-134a in the domestic refrigerators. It should be noted that the company's operation in Catamarca serves national industrial policy objectives and any rationalization of the two operations is not possible within the Argentine context. The project does not intend to increase capacity of the company.

SECTOR BACKGROUND

. In 1992, 1441 tons of CFC-12 and 333 tons of HCFC-22 were consumed in the refrigeration sector in Argentina, in the refrigeration circuit. This sector is the largest consumer of ODS. In the refrigeration sector, 440 tons of CFC-12 were consumed in the domestic sector, of which 190 tons are used in new equipment and 250 tons are used for servicing operations. With respect to the commercial refrigeration sector, the consumption is 668 tons of CFC-12 (68 tons for new equipment and 600 tons for servicing operations) and 333 tons of HCFC-22. Refrigerated transport and the fleets consume 333 tons of CFC-12.

. With respect to the foams sector, in 1992 the sector consumed a total of 1275 tons of CFC-11 and 209 tons of CFC-12 (second largest consumer), of which 322 tons of CFC-11 were consumed in the production of insulating foams for domestic refrigerators, and 21 tons for commercial refrigerators. The production of domestic refrigerators in 1992, based on the Country Program, was equal to 761,000 units. This number grew by 7% in 1993, and there is an estimated growth rate of 6% for the present year.

. The domestic sector produces refrigerators and freezers. It is basically composed of more than 22 enterprises, of which 7 control approximately 72% of the market. Of these 7 enterprises, 2 are of foreign capital and the other 5 are 100% national capital. The principal industries have expressed the will to immediately replace the CFCs. A part of them already use the CFC-reduced foaming process.

. Some of the CFCs are produced locally and some are imported. With respect to the compressors, the local industry provides 30% of the market and the remaining 70% is imported mostly from Brazil. The establishment of MERCOSUR (common market of the southern cone) is leading to increased integration with Brazil, resulting in the import of some components from Brazil. An unrestricted demand of CFCs in the domestic refrigeration sector would result in estimated consumption of 1170 tons by the year 2000. The strategy of the Argentinian government for the phase-out of ODS consumption is clearly set forth in the Country Program, which considers the domestic refrigeration sector to be a priority. The program for reduction and elimination of consumption in the domestic refrigeration sector establishes the schedule for the reduction in consumption of CFCs to begin after 1995 for foam applications, after 1996 for refrigeration circuit applications, and reaching total elimination of consumption in the production of new equipment in the year 2000. The approval of this project by the Multilateral Fund undoubtedly will contribute to the implementation of the planned strategy and the achievement of the objectives of ODS elimination.

ENTERPRISE BACKGROUND

. Helametal is one of the 7 enterprises that participate in the sector. It is presently working with CFC-11 reduced foams, and as mentioned previously, it has two manufacturing plants in Buenos Aires and Catamarca, each one with a production capacity of 60,000 units per year. The enterprise consumed 62 tons of ODS per year, in the production of 72,000 units in 1994. The consolidated Helametal controls 10% of the local market, and also exports to Bolivia, Paraguay, and Uruguay. The technology used has been developed locally, but the technology for foams production used is from Cannon (Italy). Helametal is 100% Argentinian owned.

PROJECT DESCRIPTION

. This project is designed to replace CFC-11 with cyclopentane for foams, CFC-12 with HFC-134a for refrigeration circuit refigerant, and eliminate methylene chloride as a cleaning agent. Project implementation, personnel training necessary to operate the new technologies, will take 24 months. See Annex 3 for implementation schedule.

FOAMING SYSTEM

. To replace the blowing agent of the polyurethane foams, Helametal has decided to eliminate the step with a transition substance, and transform its installations and processes to use cyclopentane. Presently, Helametal mixes the CFC-11 with the polyols through a lot classification and a mixer with a mechanical agitator. This mix, called component B, is pumped to the low-pressure injector Cannon C30. The components are re-circulated from the machine drums to the head, through gear pumps to a pressure of 4 to 6 bar. At the time of injection, both flows are conducted to a mixing chamber, where mechanical agitation is used to produce the reaction. Since the chamber has a considerable volume, it should be cleaned after the injection process, which is done with methylene chloride, a substance controlled by the Montreal Protocol.

. The replacement of CFC-11 for cyclopentane requires the changes listed below and that are part of this project: i) a tank for the bulk reception of cyclopentane that complies with the safety requirements corresponding combustible liquids; ii) cyclopentane detection installation with sufficient sensors and located in storage areas as well as work areas; iii) fire extinguishing installation adapted for the handling of flammable and explosive substances; iv) pre-mix equipment for cyclopentane with polyol adapted for the use of flammable and explosive substances; v) change of the low-pressure injector for high-pressure injector able to handle cyclopentane, which eliminates the need for methylene chloride; vi) replacement of the electrical heating of the foaming jigs with water heating; vii) each jig will have an injection head with a nitrogen sweeping valve and it will be contained inside a chamber with its own functioning and emergency ventilation chamber; viii) the individual jigs for doors will be modified and an independent ventilation system added; ix) all machinery and installations shall be explosion proof and grounded; x) safety technicians will study the requirements for the installations before execution of the project and will audit the construction and the start-up; and xi) the beneficiary will negotiate a comprehensive technology partnering agreement in order to ensure appropriate technology transfer and assign responsibility for the overall safety of the installation.

. Helametal's plants each have one injection machine currently. These injection machines have a single moving injection head which is used alternatively for cabinets and doors. A World Bank safety expert has recommended the installation of fixed injection heads and two injection machines in each plant separately dedicated to injection of doors and cabinets. The experts have taken into account that these injection machines must be confined to a determined location in the plant lay-out where ventilation has to be provided. The project requests one machine for door and cabinet foaming in each Helametal plant. The old and foaming plant production parameters are specified in annex 2.

REFRIGERATION SYSTEM

. The current charging process of CFC-12 consists of the injection in liquid state of the pressured liquid (12 bar) after the machine senses the correct previous vacuum. The charging process of HFC-134a is similar, but the materials of the charging machine have to be resistant to HFC-134a. At the time of disconnecting the injection head, there has to be a way of eliminating the habitual gas purge of the residues in the hose. The injection head necessary for the project has to comply with this requirement. It is also common that defects will appear during the assembly process that will require the evacuation of the charged gas. A recovery system for HFC-134a will be installed for this function. Also, the leak detectors should be replaced because the current ones are sensitive to chlorine molecules. The vacuum pumps can be used after undergoing an adequate cleaning process. The refrigeration circuit should be optimized to use HFC-134a, through the test of new compressors, dehydrating filters, and new capillaries due to the lower flow of refrigerant at low temperature. The use of ester-type oil in the compresors require greater care in terms of humidity and cleanliness. The greater facility of losses in the soldering requires a stricter scheme of leak control, and therefore helium detectors are necessary as a previous step to the realization of vacuums in the units. All the refrigerator models should be tested for compliance with IRAM 2120, Parts 1 to 4, national standards that are in effect for Argentina.

. Assistance will be necessary in the refrigeration circuit for: i) the purchase of equipment and installations; ii) the adjustment and redesign of our products; iii) training of personnel in the new technologies; iv) trials and field testing; and v) for equipping the laboratory for the control of the new compressors and refrigerators. Helametal does not have a formal technology transfer agreement with any industrialized country domestic refrigerator manufacturer. However, the proposed project includes the services of an international expert to guide the company in the HFC-134a conversion process and to interface with equipment suppliers (see Summary tables on pages 6 and 7, and Annex 1, for technical assistance and training cost breakdown).

JUSTIFICATION FOR SELECTION OF ALTERNATIVE TECHNOLOGY

. For the foaming technology, there are presently three replacements for insulation in domestic refrigerators: water/HCFC-141b, water/HCFC-22 and -141b blend or HFC-134a and -152a blend, and cyclopentane. The first solution is an aqueous solution whose technology is similar to the one used now, but it is a transitional substance because HCFC-141b is a transition substance, and as such is controlled by the Montreal Protocol, and the government policy is to support projects with definite solutions when feasible. The second solution uses blends of foaming gases, requires totally new equipment, and its start-up is difficult and troublesome. The third solution, the one proposed in this project, is cyclopentane technology, which has been successfully introduced in European countries, most notably in Germany. The installation of cyclopentane require special considerations for safety problems due to its flammability, but there is considerable experience in Argentina in the handling and storage of hydrocarbons, since Argentina has a considerable production of hydrocarbons, used as fuel, including automobiles. This substance is available in the market at a cost approximately 50% that of HCFC-141b. In addition, there is experience in the country in operating high-pressure machines for foaming. The supplier of the high-pressure equipment will guarantee the proper technology transfer of cyclopentane to Helametal, S.A. (offering an "Operational Safety Statement"), as well as the global guarantee on the safety of installation by sending safety experts who will audit the installation. The safety aspects and the involved risks will be analyzed by the World Bank experts, who will revise the proposed installations.

. There are two options for replacement of CFC-12 as a refrigerant: HFC-134a and hydrocarbons. HFC-134a has been selected for replacement of the CFC-12 refrigerant in domestic refrigerators because it is presently accepted worldwide, and its technology has been developed thoroughly and has been introduced commercially in many developed countries. There are numerous suppliers of gas, oils, and components of the circuit, and it appears to be a unique solution in other subsectors such as commercial refrigeration and the automotive industry. There are certain doubts concerning its GWP, but there are no nearby dates for its limitation. The option of using hydrocarbons as refrigerants has been developed in Germany and units are being manufactured with isobutane. It may appear to be a promising technology, but it is technology that is still in a developmental stage, and obtaining the adequate components for its operation is not easy.

PROJECT TOTAL CAPITAL AND INCREMENTAL COSTS

. The total investment necessary to cover the procurement of the new equipment, installations, development and training costs, detailed in Annex 1, is US$ 2,038,890, for both plants including 15% contingency. For the imported equipment, three different figures are detailed: i) F.O.B. value according to the supplier's quotation - copies are available in the World Bank Helametal project file; ii) C.I.F. cost, considering the insurance cost equal to 1% of F.O.B., and a cost of US$ 3,300 per 40-foot container, and US$ 2,500 per 20-foot container for shipping fee Europe - Buenos Aires; and iii) internal transport or shipping fee, equal to the C.I.F. cost plus internal shipping fees to the installation location. These costs may require adjustment as required by independent experts in the course of project implementation. A project cost summary is included below.

EQUIPMENT	Buenos Aires Plant	Catamarca Plant
1. Foam	$ 633,400	$ 633,400
2. Refrigeration	114,981	85,015
4. Technical Assistance	73,000	73,000
5. Technical Assistance	30,000	30,000
5. Training - Foams - Refrigeration	17,000 20,650	17,000 7,800
6. Testing - Foams - Refrigeración	31,200 6,500	- -
7. Contingency (15%)	139,010	126,932
TOTAL	1,065,741	973,147
TOTAL BOTH PLANTS	$2,038,888	

TRAINING:
COST BREAKDOWN

DESCRIPTION	COSTS
1. FOAMING:	
1.1. Testing and training on safety system (1 technician from supplier, 2 weeks).	5,000
1.2. Testing and training on injection machines, pre-mixing unit, and door drum (2 technicians from supplier, 2 weeks).	9,500
1.3. Fire fighting instruction	2,000
SUBTOTAL FOAMS	**$17,000**

2. REFRIGERATION SYSTEM:	
2.1. Study by suppliers for assistance in the development of new refrigeration circuit (2 technicians, 3 trips, 5 weeks).	7,350
2.2 International expert, suppliers, and Helametal technicians jointly develop comprehensive HFC-134a technology training program.	5,500
2.3. Testing and training on charger and recovery machine (1 technician, 1 week).	7,800
SUBTOTAL REFRIGERATION SYSTEM	**$20,650**

TECHNCIAL ASSISTANCE:
COST BREAKDOWN

DESCRIPTION	COSTS
1- FOAMING SYSTEM	
1.1- Preliminary Safety Study	25,000
1.2- Assistance for assembly and plant start-up (2 technicians, 2 weeks); supervision and control of installation during start-up by safety expert (1 technician, 1 week).	48,000
SUBTOTAL	**$73,000**

DESCRIPTION	COSTS
2- REFRIGERATION SYSTEM	
2.1- International expert review of concept	4,000
2.2- Assistance for refrigerations systems engineering, installation, and start-up (1 technician, 2.5 weeks).	26,000
SUBTOTAL	**$30,000**

INCREMENTAL OPERATING COSTS

The units produced after conversion will be more expensive because the use of cyclopentene as a foaming agent increases the cost of the polyurethane foam by US$ 6.64 per unit produced. In the refrigeration circuit, the new refrigerant, HFC-134a is more expensive than CFC-12, and the modifications to the filters, capillaries, and evaporators make the domestic refrigeration units more expensive by US$ 6.48 per unit. The total increase in the cost of producing a refrigeration unit with HFC-134a and cyclopentene is US$ 13.12. The two manufacturing plants produce 72,000 units per year; therefore, the total incremental cost is US$ 859,025 (NPV at 10%). Operating cost estimate will be re-evaluated on the basis of input price changes. However, the Goverment of Argentina has requested the project to be submitted with operating incremental cost as calculated, but subject to re-evaluation once tests and protoypes are completed. It also noted that all approved incremental costs in projects funded through World Bank Montreal Protocol implementation operations will be disbursed only against actual expenditures and that these will have to be verifiable in accordance with World Bank disbursement policies. See attachments A, B, C, D, E, and F for price quotations included in the calculation. The incremental cost calculation is shown below.

INCREMENTAL COST CALCULATION

The elimination of CFC-11 as a foaming agent in polyurethane foams results in the following changes in operating costs:

Actual Foam Composition:
Weight x Unit: 6 Kg.

Isocyanate	145p.p.	67%	3.33 kg.	US$ 2.11	US$ 7.026
Polyol	100p.p.	38.3%	2,30 kg.	US$ 2.11	US$ 4.853
CFC-11	16p.p.	6.13%	0.37 kg.	US$ 2.42	US$ 0.895
			Total		US$ 12.774

Composition replacing CFC-11 for cyclopentane:
Weight x Unit: 6.7 Kg.

Isocyanate	144p.p.	56.25%	3.77 kg.	US $2.90	US$ 10.93
Polyol	100p.p	39%	2.62 kg.	US$ 2.90	US$ 7.598
Cyclopentane	12p.p.	4.68%	0.31 kg.	US$ 2.87	US$ 0.89
			Total		US$ 19.418

Total elimination of CFC-11: US$19.418 - US$12.774 = US$6.644

The elimination of CFC-12 involves the following changes in operating costs:

Replacement of CFC-12 compressor for HFC-134a compressor:
Difference: US$3

Replacement of CFC-12 for HFC-134a:
Actual average charge: 200 grams
CFC-12 0.200 kg x US$ 3.50/kg = US$ 0.7
HFC-134a 0.180 kg x US$ 16/kg = US$ 2.88
Difference: US$ 2.18

Modification molecular filter:
Current CFC-12: US$0.34
HFC-134a: US$0.39
Difference: US$ 0.05

Capillary modification:
(Estimate 1 m. longer)
Difference: US$ 0.15

Modification of heat exchangers:
Difference: US$ 1.10

Total elimination CFC-12: US$ 6.48

Total per unit: US$ 13.12

Total per year (base 1994): 13.12 x 72,000 = US$ 944,928
NPV at (10% discounted): US$ 859,025

TOTAL COST OF THE PROJECT

I. The total capital costs plus the total operational costs (discounted) equal:

2,038,890 + 859,025 = US$ 2,897,915

UNIT ABATEMENT COST

II. The unit abatement cost of the project is equal to US$ 19.39/kg. ODP calculated as follows:

a) Capital costs: US$ 2,038,890
b) Capital recovery factor, 10% per year, 10 year investment: US$ 0.16275
c) Recurrent incremental costs, 10% discount rate, 1 year: US$ 859,025
d) ODS reduction: 62 tons

U.A.C. for capital costs: (AxB)/D = US$ 5.35 kg/year
U.A.C. for total costs: (AxB+C)/D = US$ 19.05 kg/year

PROPOSED OTF GRANT

The proposed OTF grant request of US$ 2,959,085 is based on 100% Argentinian ownership of Helametal S.A., and covers the incremental capital costs, including a 15% contingency, 3% financial intermediary fee, and incremental operating costs to be considered in one year. The corresponding 3% financial intermediary fee will also be determined in one year.

ANNEX 1: PROJECT COST ESTIMATE FOR EACH HELAMETAL PLANT
(Costs reflect Buenos Aires plant, but not necessarily Catamarca)

Equipment Specification and Cost Breakdown

Description	Qty	Unit Cost US$	Total Cost US$		
			F.O.B.	C.I.F.	CIF + Fees
I. EQUIPMENT PROCUREMENT AND ADJUSTMENT					
1. FOAMS SYSTEM					
1.1 Feeding and pre-mix group	1	68,600	95,000		77,550
Pre-mix unit "Multi-Easyfroth TM" Cannon Efros with chamber Pure polyol deposit with exchanger Pumping group Pentane pressurizer group Ventilation group Spare parts/packing					
1.2 Cabinet injection unit	1	180,000	180,000		187,800
Pumping group with chamber Deposits group 2 injection heads Connection tubing Water cooler Electric panel control 4 nitrogen sweeping valves Ventilation group Spare parts/packing					
1.3 Rebuilding of door moulds	6	2,000	12,000		12,000
1.4 Cabinet ventilation system	1	95,000	95,000	98,450	99,150
Chamber design and plans Eight ventilators for ventilation Grounding Electrical panel modifications Mold adaptation to water heating Water heating unit					
1.6 Individual chamber for cabinet molds	4	10,000	40,000		43,680
1.7 Door ventilation system	1	30,000	30,000	32,800	33,500

Description	Qty	Unit Cost US$	Total Cost US$		
			F.O.B.	C.I.F.	CIF + Fees
Chamber design and plans Two ventilators for ventilation Grounding Modification to electric panels					
1.8 Door chamber	1	18,000	18,000	20,680	21,380
1.9 Gas detection system	1	79,000	79,000	82,290	82,990
18 sensors 4 flow sensors Control panel System testing Spare parts/packing					
1.10 Installation of piping	1	28,500	28,500	28,500	28,500
Pentane storage/pre-mix unit Pre-mix unit/injection machines					
1.11 Cyclopentane storage	1	10,090	10,090	10,090	10,090
Cyclopentane tank Pumping system					
1.12 Fire protection system	1	38,000	38,000	38,000	38,000
Subtotal for Foams System					633,400
2. REFRIGERATION SYSTEM					
2.1 HFC-134a charger	1	42,200	42,200	45,122	45,822
2.2 Over-pressure pump	1	7,490	7,490	7,565	7,565
2.3 Vacuum pumps adjustment	18	300	5,400	5,400	5,400
2.4 Halogen detector	4	5,700	22,800	25,528	26,228
2.5 Vacuum & laboratory charge unit	1	16,600	16,600	19,266	19,966
2.6 Laboratory instruments	1	10,000	10,000	10,000	10,000
Subtotal for Refrigeration System					114,981

Description	Qty	Unit Cost US$	Total Cost US$		
			F.O.B.	C.I.F.	CIF + Fees
II. TRAINING					
A. FOAMS PLANT					
1- Testing and training on safety system (1 technician from supplier, 2 weeks)		5,500			
2- Testing and training on injection machines, pre-mixing unit, and door drum (2 technicians from supplier, 2 weeks)		9,500			
3- Course on fire fighting		2,000			
Subtotal Foams Plant		17,000			
B. REFRIGERATION SYSTEM					
1- Study by suppliers for assistance in the development of new refrigeration circuit (2 technicians, 3 trips, 5 weeks)		7,350			
2- International expert, suppliers, and Helametal technicians jointly develop comprehensive HFC-134a technology training program.		5,500			
3- Testing and training on charger and recovery machine (2 technicians, 1 week)		7,800			
Subtotal Refrigeration System		20,650			

Description	Qty	Unit Cost US$	Total Cost US$		
			F.O.B.	C.I.F.	CIF + Fees
III. TECHNICAL ASSISTANCE					
A. FOAMS PLANT					
1- Preliminary safety study		25,000			
2- Assistance for assembly and plant start-up (2 technicians, 2 weeks); supervision and control of installation during start-up by safety expert (1 technician, 1 week)		48,000			
Subtotal for foams systems		73,000			
B. REFRIGERATION SYSTEM					
1- International expert review of concept		4,000			
2- Assistance for refrigeration systems engineering, installation and start-up (1 technician, 2.5 weeks)		26,000			
Subtotal for Refrigeration Systems		30,000			
IV. TESTING AND TRIALS					
A. FOAMS PLANT					
1- Foam testing in cabinets, 30 units per model, 6 models, total 180 units		21,600			
2- Foam testing in doors, 30 sets per model, 6 models, total 180 sets		3,600			
3- Follow-up cost for field test, 50 units injected with cyclopentane foam		3,000			
4- Tests of supplier samples		3,000			
Subtotal Foams Plant		31,200			

Description	Qty	Unit Cost US$	Total Cost US$		
			F.O.B.	C.I.F.	CIF + Fees
B. REFRIGERATION SYSTEM					
1- Follow-up cost for field test, 50 units charged with HFC-134a		3,000			
2- Cost of refrigeration system evaluation		3,500			
Subtotal Refrigeration System		6,500			

Note: The following costs were not included in the budget:
i) Adaptation of the pre-heating ovens
ii) Civil works
iii) Costs from equipment movement
iv) Any action for parking the cyclopentane truck
v) In the costs of imported equipment, shipping costs were included only to the installation sites
vi) Service equipment for Helametal Catamarca S.A. or any of their Authorized Servicing Centers throughout the country.

SUMMARY

EQUIPMENT	Buenos Aires Plant	Catamarca Plant
1. FOAMS PLANT		
1.1 Pre-mix and feeding group	77,550	77,550
1.2 Injection machine for cabinets	187,600	187,600
1.3 Drum system for doors	12,000	12,000
1.4 Ventilation system for cabinets	99,150	99,150
1.5 Cabin for cabinet molding	43,680	43,680
1.6 Door ventilation system	33,500	33,500
1.7 Drum cabin for doors	21,380	21,380
1.8 Leak detection system	82,990	82,990
1.9 Installation of piping	28,500	28,500
1.10 Cyclopentane storage	10,090	10,090
1.11 Fire protection system	38,000	38,000
SUB - TOTAL	**633,400**	**633,400**

EQUIPMENT	Buenos Aires Plant	Catamarca Plant
2. REFRIGERATION SYSTEM		
2.1 HFC-134a charger	45,822	45,822
2.2 Over-pressure pump	7,565	7,565
2.3 Adjustment of vacuum pumps	5,400	5,400
2.4 Halogen detectors	26,228	26,228
2.5 Laboratory vacuum and charge unit	19,966	
2.6 Laboratory equipment	10,000	
SUB - TOTAL	**114,981**	**85,015**

EQUIPMENT	Buenos Aires Plant	Catamarca Plant
1- FOAMS 2- REFRIGERATION	633,400 114,981	633,400 85,015
SUB - TOTAL	**748,381**	**718,415**

TECHNICAL ASSISTANCE	Buenos Aires Plant	Catamarca Plant
1- FOAM 2- REFRIGERATION	73,000 30,000	73,000 30,000
SUB - TOTAL	**103,000**	**103,000**

TRAINING	Buenos Aires Plant	Catamarca Plant
1- FOAM 2- REFRIGERATION	17,000 20,650	17,000 7,800
SUB - TOTAL	**37,650**	**24,800**

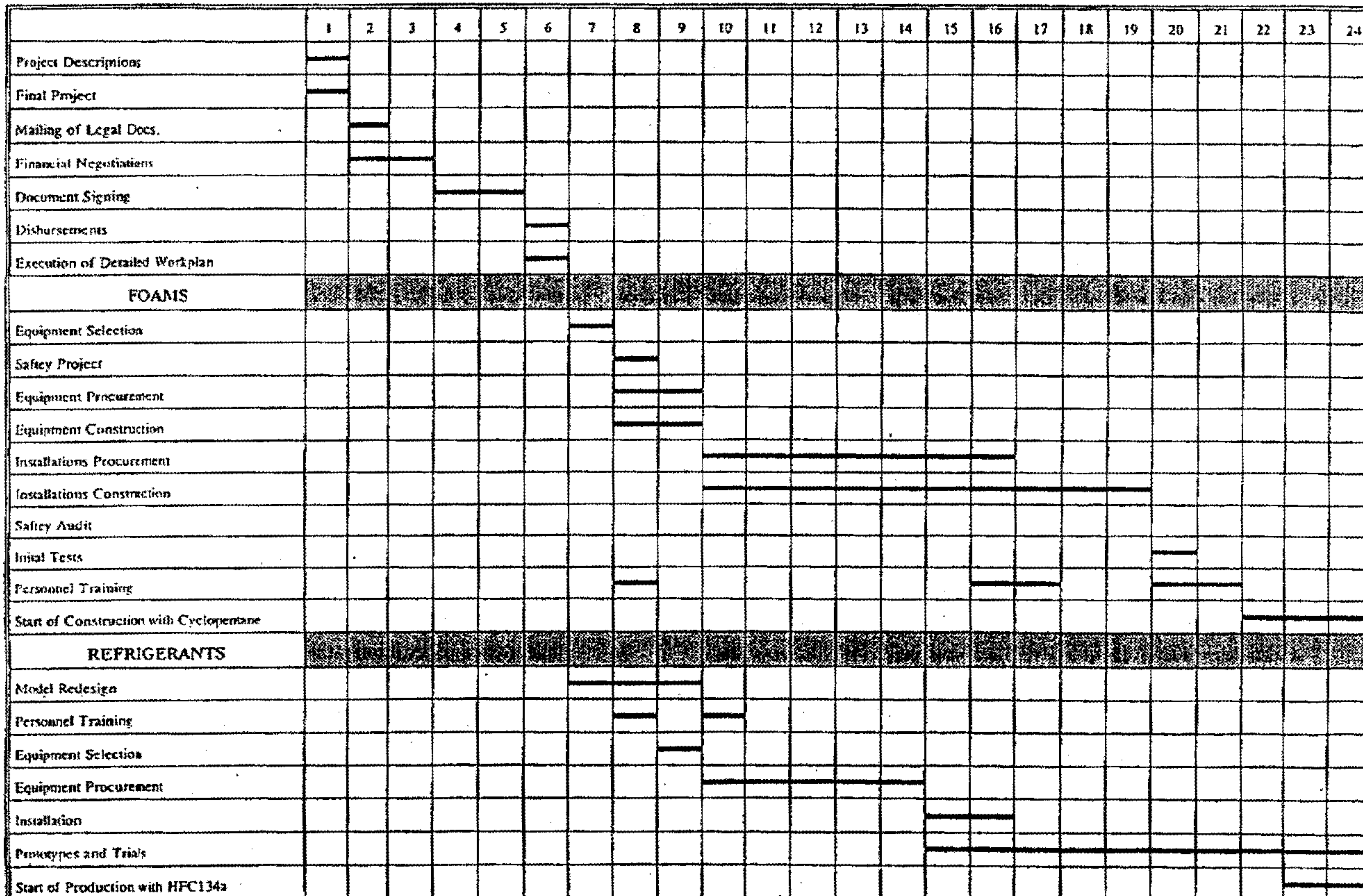
TESTING/DEVELOPMENT	Buenos Aires Plant	Catamarca Plant
1- FOAM 2- REFRIGERATION	31,200 6,500	- -
SUB - TOTAL	**37,700**	-

TOTAL PLANTS	Buenos Aires Plant	Catamarca Plant
1- SUBTOTALS	926,731	846,215
2- 15% CONTINGENCIES	139,010	126,932
SUB - TOTAL	**1,065,741**	**973,147**
TOTAL BOTH PLANTS	2,038,888	

ANNEX 2: CURRENT FOAMING PLANT CAPACITIES

HELAMETAL CABINET AND DOOR FOAM LINES - Buenos Aires and Catamarca
PRESENT PLANT - Cabinet Foaming
Maximum Capacity: 30 kg/min - one injection head
4 cabinet moulds generating production rate of 40 cabinets per hour
PRESENT PLANT - Door Foaming
Production: 40 pairs of door per hour

CHRONOLOGY (HELAMETAL)



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Country of origiARGENTINA

Project title: Elimination of CFC in two manufacturing plants of domestic refrigerators (Helametal S.A. and Helametal Catamarca S.A)

Sector/sub-sector Domestic refrigeration
Relationship to country pr(WorldBank)

Note This review addresses only the refrigerant conversion part does not address the part related to the foam blowing agent

Technology

- In this project HFC-134a is selected as the substitute refrigerant for CFC-12. In domestic refrigeration HFC-134a technology is a proven and acceptable (nontransitional) technology to reduce CFC-12 consumption.
- The company Helametal S.A. does not have a formal technology transfer partner. However, the company intends to develop the HFC-134a technology with assistance from compressor, refrigerant and equipment suppliers. Furthermore, provisions for external support are present. Due to these facts, a successful project implementation can be expected.
- Other technologies than HFC-134a were considered (hydrocarbons) but were not selected because of the lack of commercially available compressors and the development state. From the zero ODP technologies HFC-134a is one of the most cost effective solutions.

Environmental impact

HFC-134a has an ODP of zero and a GWP of 0.27. For domestic refrigeration a GWP of this magnitude is negligible.

Project costs

Incremental investments:

- The equipment requested is essential for the conversion process and costs are reasonable.
- Costs of training, testing and technical assistance are reasonable.

Incremental operational costs:

- Operational costs are claimed for one year.
- Operational costs are claimed for 72000 units which is the actual production
- The price of HFC-134a is high (16.0 USD) but is based on demonstrated quotations
- Charge reduction from CFC-12 to HFC-134a is not taken into account
- Heat exchangers cost increase of 1.1 USD might be too high (in principle no change in heat exchanger is required). This item must be re-evaluated after project implementation as is indicated in the project proposal.

The UAC value, calculated for the refrigeration part separately, amounts to 27.8 USD/kg/y which is reasonably high compared to other projects (it is also based on a somewhat optimistic CFC phaseout value).

Implementation timeframe Reasonable

Relevance and adequacy of information provided

Annex 1 contains a break down and a summary of the costs. Several inconsistencies between the two lists exist but the total costs reported are "reasonably equal". Besides this, some costs items are detailed in the project description. Altogether, quite a confusing picture. However, in general it can be concluded that, after some comments of the World Bank officers, sufficient information for a judgment was present.

Recommendations Approval as proposed

Janssen M.J.P.,OORG MM338, Eindhoven, The Netherlands, 4-November-1994

ARGENTINA - HELAMETAL (BUENOS AIRES & CATAMARCA)

TECHNOLOGY

The choice of cyclopentane was made after a consideration of other technologies. It is a well proven and has the best insulation efficiency of the zero ODP, long term, options now available. It is a technology which is still improving as the chemical suppliers continue development.

ENVIRONMENTAL ISSUES

Cyclopentane has zero ODP and a very low GWP and thus constitutes a long term solution.

The enterprise should consider how it will comply with any VOC regulations which apply.

The main issue relates to the safety handling of highly flammable cyclopentane. The enterprise will negotiate a technology partner agreement to cover safety issues.

PROJECT COSTS

The project cost effectiveness is poor because between the two factories four foam lines are proposed for conversion with the output of each (and hence CFC 11 replacement) being comparatively low. There is no production enhancement.

The basic equipment choice is sound. The existing low pressure injection equipment is not capable of conversion.

Full details of the operating cost calculation are given and these are accepted on the understanding that the actual costs after the first year of operation will be taken into account.

Despite the overall cost effectiveness being very poor there are no real cost saving measures practicable without production rationalisation.

TIMEFRAME

This is acceptable.

RECOMMENDATION

Approved.

GMFJ/kd/16/11/94

THE MONTREAL PROTOCOL ON SUBSTANCES THAT DEPLETE THE OZONE LAYER

PROJECT COVER SHEET

COUNTRY:	Argentina
PROJECT TITLE:	Elimination of ODS (Ozone depleting substances) in the production of domestic refrigerators in the FRIBE, S.A. plant located in Buenos Aires.
SECTORS COVERED:	Domestic Refrigeration
ODS CONSUMPTION IN AFFECTED SECTORS:	762 tons in 1992
PROJECT IMPACT:	Phaseout of the annual consumption of 10 tons of CFC-12 and 27 tons of CFC-11.
PROJECT DURATION:	2.5 years
PROJECT ECONOMIC LIFE:	10 years
TOTAL PROJECT COST:	Total capital cost: US$ 1,181,268 Incremental operating cost: US$ 606,042
INTERMEDIARY FEE:	US$ 35,440 (based on 3% of incremental capital cost)
PROPOSED ODS GRANT:	US$ 1,822,750 (incremental operating cost share to be considered in one year)
UNIT ABATEMENT COST:	Annualized capital cost: US$ 5.20/kg ODP Annualized total cost: US$ 21.58/kg ODP
IMPLEMENTING AGENCY:	The World Bank
COORDINATING NAT. AGENCIES:	Ozone Program Office and the National Institute of Industrial Technology
BENEFICIARY ENTERPRISE:	FRIBE S.A.

PROJECT SUMMARY:

1. The project will eliminate the use of CFCs in the manufacturing of domestic refrigerators in the FRIBE, S.A. plant, located in the vicinity of La Tablada, Buenos Aires, in the Republic of Argentina. The CFC-11 used as foaming agent in the production of insulating foams will be replaced with cyclopentane, and the CFC-12 used in the refrigeration circuit will be replaced with HFC-134a. It is estimated that 10 tons of CFC-12 and 27 tons of CFC-11 will be eliminated per year (37 tons of ODS). The funds required will be used to retrofit the production lines, by means of the new models, the training of personnel, and the incremental operating costs resulting from the conversion for a period of one year.

PROJECT OBJECTIVE:

2. The objective of this project is to eliminate the use of 37 tons annually of ozone depleting substances (ODS) including CFC-11 and CFC-12, in the production of domestic refrigerators manufactured by FRIBE, S.A.

SECTOR BACKGROUND:

3. In 1992, 1441 tons of CFC-12 and 333 tons of HCFC-22 were consumed in the refrigeration sector in Argentina, in refrigeration circuit applications. This sector is the largest consumer of ODS. In the refrigeration sector, 440 tons of CFC-12 were consumed in the domestic sector, of which 190 tons are used in new equipment and 250 tons are used for servicing operations. With respect to the commercial refrigeration sector, the consumption is 668 tons of CFC-12 (68 tons for new equipment and 600 tons for servicing operations) and 333 tons of HCFC-22. Refrigerated transport and fleets consume 333 tons of CFC-12.

4. With respect to the foams sector, in 1992 the sector consumed a total of 1275 tons of CFC-11 and 209 tons of CFC-12 (second largest consumer), of which 322 tons of CFC-11 were consumed in the production of insulating foams for domestic refrigerators, and 21 tons for commercial refrigerators. The production of domestic refrigerators in 1992, as indicated in the Country Program, totalled 761,000 units. This number grew by 7% in 1993, and there is an estimated growth rate of 6% for the present year.

5. The domestic sector, which produces refrigerators and freezers, is composed of more than 22 enterprises. 7 of which control approximately 72% of the market. Of these 7 enterprises, 2 are of foreign capital and the other 5 are 100% national capital. The principal industries have expressed the will to immediately replace the CFCs. Some of them already use the reduced-CFC foaming process.

6. Some of the CFCs are produced locally and some are imported. With respect to compressors, the local industry provides 30% of the market and the remaining 70% is imported mostly from Brazil. The establishment of MERCOSUR (common market of the southern cone countries) is leading to greater integration with Brazil, resulting in the import of some components from Brazil.

7. An unrestricted demand of CFCs in the domestic refrigeration sector would result in estimated consumption of 1170 tons by the year 2000. The strategy of the Argentinian government for the phase-out of ODS consumption is clearly set forth in the Country Program, which considers the domestic refrigeration sector to be a priority. The program for reduction and elimination of consumption in the domestic refrigeration sector establishes the schedule for the

reduction in consumption of CFCs to begin after 1995 for foam applications, after 1996 for refrigeration circuit applications, and reaching total elimination of consumption in the production of new units in the year 2000. The approval of this project by the Multilateral Fund will undoubtedly contribute to the implementation of the planned strategy and the achievement of the objectives of ODS elimination.

ENTERPRISE BACKGROUND

8. FRIBE, S.A., is one of the 7 enterprises that lead the sector. Its present operation utilizes the reduced CFC-11 technology for foaming applications and CFC-12 for circuit refrigerant. FRIBE S.A. is 100% Argentinian, and FRIBE Buenos Aires and FRIBE La Rioja are independent of one another. FRIBE Buenos Aires has a capacity of 90,000 units per year. It owns 80% of FRIBE La Rioja, a facility with a similar operation, with a capacity of 72,000 units per year. The two companies command approximately 10% of the market, targetting the local market as well as the countries in part of MERCOSUR. It should be noted that the FRIBE La Rioja's operation serves national industrial policy objectives and any rationalization of the two operations is not possible within the Argentine context. FRIBE uses technology developed locally, with the technical support of suppliers of raw materials and companies that manufacture the equipment used in the facility. These are Bayer (Germany), Dow Chemical (USA), Canon-Crios (Italy), Perros (Italy), Krauss Maffei (Germany), and Galileo (Italy).

DESCRIPTION OF THE PROJECT

9. The project consists of converting the existing production lines, which use reduced CFC-11 and CFC-12 technology for foaming agent and refrigeration respectively, to permit production with cyclopentane as foaming agent and HFC-134a as refrigerant, without increasing capacity.

10. Presently, the refrigeration circuit plant is equipped with a cabinet preassembly line with leak controls for CFC-12 and two final assembly lines with CFC-12 charging lines (Galileo B 150 F 1 and Leybold), with leak controls for CFC-12 in low- and high-pressure refrigerant, by means of Leybold leak detectors. There is no equipment for the recovery and recycling of CFC-12. CFC-12 will be replaced with HFC-134a in all applications of domestic refrigerators and freezers. The necessary modifications in the product will include changes in the capillary, drying filter, and compressor suitable for HFC-134a with polyol-ester oil. The change-over will be introduced gradually in the production process, with 20% of the line after approval of the field tests, which will last one year, to complete 100% after the third quarter of approval of the field tests (see the annexed calendar). The engineering technology of the product is FRIBE's own, and the compressors would be imported primarily from Brazil (Sicom Ltd, Lic. Tecumseh). FRIBE does not have a formal technology transfer agreement with any industrialized country domestic refrigerator manufacturer. However, the proposed project includes the services of an international expert to guide the company in the HFC-134a conversion process (Refer to Annex 1).

11. The project scope includes: i) procurement of new machinery and equipment; ii) modifying the presently used equipment, such as pumps; iii) redesign of assembly lines; iv) redesign of refrigerator and freezer doors and cabinets; and v) installation, supervision, and training for foam injection systems.

12. The change in equipment in the refrigeration circuit will include (i) the adaptation (possible acquisition) of charging equipment for HFC-134a, (ii) the acquisition of 4 leak detectors for HFC-134a (Yokogawa or Leybold), and (iii) the adaptation of existing vacuum pumps. Once the project is approved, testing will start on the refrigerant and the existing foaming process (50% CFC-11) which yields appropriate comparator material due to the similar conductivity of the proposed foaming

technology. The insulation foams system presently has an installation for cabinet foaming which consists of (i) one low-pressure foaming machine, Viking brand, with a maximum capacity of 60 kg/min, 1:1 ratio, (ii) and a carousel with 9 molds rotating at 9 min/turn, resulting in a production capacity of 7800 cabinets/month, considering a shift of 8.5 hours, and a yield of 0.77, 20 work days/month. The foaming system for doors, which are assembled without screws and with an open-mold "sandwich" foaming, has a production capacity of 486 freezers/shift, and is designed for a curing time of 4.5 minutes, and 15 fixed positions in the installation. The low-pressure foaming machine is a Canon Model B 30 RF2, with a maximum capacity of 30 kg/min, 1:1 ratio.

13. The implementation of the cyclopentane technology will involve the modification of several parts of equipment. Included in the project are ventilation devices for each line (cabinets and doors) recommended by independent experts under contract with the World Bank who considered such modifications important in the interest of safety concerns with cyclopentane technology in the Fribe facilities. Also recommended by these experts was mold heating through warm water rather than an electric source.

a) First, a high-pressure injection machine suitable for the cabinet foaming system. This will eliminate the use of chlorinated cleaning solvents used in low-pressure machines for cleaning the injection heads after every shot of components. The maximum capacity of delivery is 80 kg/min, and 1:1 ratio.

b) A system for cabinet foaming designed for cyclopentane will also be necessary. The system will include: (i) preheating ovens, (ii) loading and unloading machine, and (iii) injection. Contemplated production characteristics are: 270 seconds of polymerization time, 50 seconds for servicing, 320 seconds for cycle, and 405 parts from the effective production of the installation in 8 hours, and 90% efficiency.

c) The procurement of a high-pressure PU injection machine is required with one injection head, to serve the door foaming plant. The maximum capacity of delivery is 40 kg/min, and 1:1 ratio.

d) Another modification involves the installation of the door foaming system designed to work with cyclopentane, capable of injecting sandwich doors. Contemplated production characteristics include: 270 seconds for polymerization, 50 seconds for servicing, 320 seconds for the cycle, and 485 sets from effective production of the installation in 8 hours with a 90% efficiency.

e) The ventilation and extraction system for the installation of cabinet foaming will require cabins for closing the molds, tubes, and heads, and 2 ventilators, one for normal function and another on reserve/for emergencies, 20 ren/hr during normal function and 40 ren/hr for emergencies, for each cabin.

f) The ventilation and extraction system for the installation of doors requires cabins for the door foaming system, tubes, and injection head, and two ventilators, one for normal functioning and another for emergencies, 20 ren/hr during normal function and 40 ren/hr for emergencies.

g) Adequate sensors and safeties for the cabinet and door foaming installations will also be required.

h) A feeding and pre-mix of raw materials group will be necessary, and it should include: (i) one complete Easy-Froth Multi Unit of closing box and extraction, (ii) one deposit for pure polyol with heat exchanger, (iii) two discharge pumps, (iv) one pressurizing group with nitrogen for the cyclopentane tanks, and (v) one group of two ventilators and tubing for 20/40 spare parts for the Easy-froth cabin (20 spare parts with normal function and 40 in emergency, 10% LEL).

i) Finally, assistance for the installation and start-up will include assistance in assembly and start-up, a training manual, supervision and control of the installation during the start-up by a security expert technician, and a technician for the supervision of the safeties (period estimated at one week).

PROJECT IMPLEMENTATION

14. Project implementation, including product line redesign and testing, rearrangement of assembly lines, installation of equipment for foam injection and refrigerant circuit installation, and technology transfer, will take place over a period of 30 months. The project implementation schedule is included in Annex 3.

JUSTIFICATION FOR SELECTION OF ALTERNATIVE TECHNOLOGY

15. The two options for replacement of CFC-12 as a refrigerant are HFC-134a and hydrocarbons. HFC-134a has been selected for replacement of the CFC-12 refrigerant in domestic refrigerators because it is presently accepted worldwide, and its technology has been thoroughly developed and introduced commercially in many developed countries. There are numerous suppliers of gas, oils, and components of the circuit, and it appears to be a vialbe solution in other subsectors such as commercial refrigeration and the automotive industry. There are certain doubts concerning its GWP, but there are no nearby dates for its limitation. The option of using hydrocarbons as refrigerants has been developed in Germany and units are being manufactured for isobutane. It may appear to be a promising technology, but FRIBE believes its development has not been completed, and obtaining the adequate components for its operation is not easy.

16. In the case of foaming technologies, there are presently three replacements for insulation in domestic refrigerators: i) water/HCFC-141b; ii) water/HCFC-22 and -142b blend or HFC-134a and -152a blend; and iii) cyclopentane. The first solution is an aqueous solution whose technology is similar to the one used now, but it is a transitional substance because HCFC-141b is a transition substance, and as such is controlled by the Montreal Protocol, and the government policy is to support projects with definite solutions that are feasible. The second solution uses blends of foaming gases, requires totally new equipment, and its start-up is difficult and troublesome. The third solution, the one proposed in this project, is cyclopentane technology, which has been successfully introduced in European countries, especially in Germany. The installation of cyclopentane requires special considerations for safety problems due to its flammability, but there is considerable experience in Argentina in the handling and storage of hydrocarbons, since Argentina has a considerable production of hydrocarbons, used as fuel, including automobiles.

17. Cyclopentane is available in the market at a cost approximately 50% of HCFC-141b. In addition, there is experience in the country in operating high-pressure machines for foaming. The supplier of the high-pressure equipment will guarantee the proper technology transfer of cyclopentane to FRIBE, S.A. (offering an "Operational Safety Statement"), as well as the global guarantee on the safety of installation by sending safety experts who will audit the installation. The safety aspects and the involved risks will be analyzed per the recommendations of the World Bank in its implementation of the proposed installations. Cyclopentane technology, with a ODP = 0, is the most efficient in relation to its function as an environmentally neutral agent and in relation to the operating costs, although it presents a challenge in terms of economic, technical, and health and

safety efforts, it is compatible with the HIPS.

18. The proposed project therefore aims to implement a definite solution using a non-fluorocarbonated substance, and ensure the possibility of external competitiveness, taking into account that there are markets that only accept cyclopentane as technology.

PROJECT TOTAL CAPITAL AND INCREMENTAL COSTS

19. The total estimated project cost is US$ 1.79 million, of which incremental capital costs are US$ 1.18 million. Costs include equipment costs, technical assistance, training, field tests, and international experts. All costs specific to supply and installation of new technology, and which would otherwise not be incurred if the existing fabrication line could continue to be used, are considered incremental capital costs. The total capital cost was calculated based on current information, including OMS (Italy) foaming system. Additional costs may occur from a need to remodel the plant after determinations by safety experts (from the equipment supplier and the external consultant that will monitor the implementation of the project).

PROJECT COST SUMMARY	
REFRIGERATION SYSTEM	
Equipment	US$ 71,000
Tests and Prototypes	33,700
International Expert, Training and Technical Assistance	27,000
SUBTOTAL	131,700
FOAM SYSTEM	
Equipment	760,000
Tests and Prototypes	30,000
External Consultants	105,490
SUBTOTAL	895,490
REFRIGERATION AND FOAM	1,027,190
CONTINGENCY (15%)	154,078
TOTAL	1,181,268

NOTE: Includes Insurance and Freight

INCREMENTAL OPERATING COSTS

20. The units produced after the conversion will be more expensive (by approximately $12.5). The Incremental operating costs include the additional costs of raw materials, and the cost of the more expensive compressors necessary to handle the HFC-134a refrigerant. The calculation was made taking into consideration a production rate of 54,000 units.

INCREMENTAL OPERATING COST SUMMARY	
Cost Due to Changeover to HFC-134a Refrigerant	$5.5
Cost for Foam	6.97
Total Cost per Unit	12.47
TOTAL INCREMENTAL COST	$673,380
NPV (10% discounted)	$606,042

21. Annex 2 contains a complete breakdown of the incremental cost calculation. The incremental operating costs estimate is based on input prices which will be re-evaluated and additional quotations sought. The re-evaluation will also be subject to the results of the final product and protoype tests. The Government of Argentina has requested the project to be submitted with operating incremental cost as calculated, subject to re-evaluation once tests and protoypes are completed. It is noted that all approved incremental costs in Montreal Protocol projects funded through the World Bank implementation operations will be disbursed only against against actual expenditures and that these will have to be verifiable in strict accordance with World Bank disbursement policies.

PROPOSED OTF GRANT

22. The proposed OTF grant request of US$ 1,787,310 is based on 100% Argentinean ownership of FRIBE, S.A., covers the incremental capital costs for one year, and includes a 15% contingency over capital costs. Total project incremental capital and incremental operating costs for the Fribe S.A. project in Buenos Aires are $1,787,310.

23. The unit abatement cost calculation is shown below. The annualized capital cost is US$5.20/kg ODP. The annualized total cost is US$ 21.58/kg ODP.

A) CAPITAL COST: US$ 1,181,268

B) RECURRENT INCREMENTAL COSTS: US$ 606,042

C) CAPITAL RECOVERY FACTOR: 0.16275

D) ODS CONSUMPTION: 37,000 Kg

UNIT ABATMENT COST (UAC):
UAC - Capital Costs (A x C)/D = (US$/kg. ODP/year) = $5.29
UAC - Total Costs (A x C + B)/D = (US$/kg. ODP/year) = $21.58

ANNEX 1: FRIBE, S.A. - PROJECT COST ESTIMATE

COST BREAKDOWN

Description	Qty.	Unit Cost US$	Total Cost US$
I. REFRIGERATION SYSTEM			
A. Equipment			
1- Galileo charge unit for HFC134a (see proforma COMP/EST 9870)			
Digifill B150F1	1	36,980	36,980
Display in Spanish	1	439	439
Refrigerant decant pump RPI	1	7,852	7,852
2- Shipping and insurance	1	3,000	3,000
3- Adaptation of existing Galileo vacuum pumps	8	300	2,400
4- Leak detectors (Yokogawa Model H25-C, proforma 10/8/94)	4	4,833	19,332
5- Shipping and insurance	1	1,000	1,000
Subtotal			71,000
B. Research and Development			
6- Thermodynamic tests at INTI Laboratories, according to annexed budget			
2 simultaneous equipment tests ($2,900) and 5 refrigerator models tests	10	145	14,500
7- Field test costs, manufacturing of prototypes	50	300	15,000
8- Samples to SICOM (Brazil) per test	10	300	3,000
9- Shipping	1	1,200	1,200
Subtotal			33,700
C. International Expert, Training & Technical Assistance			
12- International Expert to assist in HFC-134a Conversion from implementation to start-up.	1	15,000	15,000

Description	Qty.	Unit Cost US$	Total Cost US$
13- Training of Fribe personnel during implementation and start-up.		7,000	7,000
13- Start-up of Galileo and A'Gramkow equipment (estimates including lodging, food, and trip expenses)			
Galileo technician for 1 week	1	5,000	5,000
Subtotal			27,000
Subtotal Refrigeration (A,B, and C)			131,700
II. POLYURETHANE FOAMING SYSTEM			
A. Polyurethane Foaming System			
1- Cyclopentane supply system (from barrels)			
2- Intermediate tank			
3- Premixing system			
4- Cabinet foaming machine with mixing head			
5- Door foaming machine with mixing head			
Subtotal			383,000
6- Preheating oven	2	20,000	40,000
7- Rebuilding foam fixtures for cabinets	9	3,000	27,000
8- Rebuilding fixtures for doors	15	2,000	30,000
9- Rebuilding foam plugs	9	1,000	9,000
10- Ventilation and extraction system for installation of cabinet foaming	1	65,000	65,000
11- Ventilation and extraction system for installation and door foaming	1	20,000	20,000
12- Set of sensors and safeties for installations of cabinet and door foaming equipment	1	90,000	90,000
13- Assistance for installation and start-up	1	60,000	60,000
14- Shipping and Insurance (5%)			36,000
Subtotal			377,000

Description	Qty.	Unit Cost US$	Total Cost US$
B. Research and Development			
1- Tests for foam injection PU - 15 prototypes of each of the 5 models	75	100	7,500
2- Shipping costs	1	8,000	8,000
3- Thermodynamic tests at INTI Laboratories (according to annexed budget)			
2 simultaneous equipment tests ($2900) and 5 refrigerator models	10	145	14,500
4- Personnel training - Will be provided by technicians from the equipment supplier		0	0
Subtotal			30,000
C. External Consultants			
5- Engineering study - setting lay-out, area classification, set-up of safety systems, municipal approval, modifications to the plant, supervision and control of work, according to budget			105,490
Subtotal Foams (A,B, and C)			895,490
TOTAL COST OF THE PROJECT			1,027,190
CONTINGENCIES (15%)			154,078
TOTAL CAPITAL COST			1,181,269

Note: The total cost was estimated based on current information, and it does not include the additional costs that could occur after determinations from the safety experts, from the equipment supplier as well as the external consultants that will monitor the progress of the project.

NOTES TO ANNEX 1

1. CHARGE UNITS

The proposals of the companies listed below are available in the comprehensive World Bank project files:

A'Gramkow (Denmark)
Galileo (Italy)
CEMA (Argentina)

CEMA has provided documentation certificates that justify the renovation of one of the Leybold Herseus chargers that presently exist in the plant (Also available in the World Bank Fribe project file).

Considering the confidence that Fribe has in Galileo equipment, and that presently there is Galileo equipment that needs to be adapted to R-134a, Fribe has tentatively accepted the Galileo proposal.

NOTE: FRIBE is continuing discussions of the quotes in an effort to negotiate better prices.

2. LEAK DETECTORS FOR R-134a

The proposals from the companies offering their equipment is available in the World Bank Fribe project file.

Yokogawa (Japan, imported from the USA)
Leybold-Inficon (Germany)

The Yokogawa equipment has been selected, due to its reliability and lower price.

3. EVACUATION EQUIPMENT AND HELIUM CHARGING

The approval of this item is in the control of the experts from the funding authority. However, the criteria to propose the approval is to extend the recovery of helium gases during the control operation. The proposal from A'Gramkow is in the World Bank Fribe project files.

4. INTERNATIONAL EXPERT AND TRAINING

The cost of the international refrigeration expert has been reduced by $5000 on the assumption of reduced international travel expenses due to implementation of the two Fribe projects simultaneously. Training will be done in conjunction with technicians of Galileo, CEMA, SICOM-TECUMSEH and other parts suppliers.

5. LABORATORY THERMODYNAMIC TESTS

The INTI proposal is available in the World Bank FRIBE project file.

6. POLYURETHANE FOAMS EQUIPMENT

Proposals from the main equipment vendors are available at the World Bank in the Bank's project files. The complete proposals are available for:

Canon-Crios (Italy)
Hennecke (Bayer Germany)
OMS (Italy)

The company Perros (Italy) did not complete the modifications requested by the safety experts from the World Bank during their visit in August to Argentina, by the due date for presentation of this project.

FRIBE S.A. Buenos Aires will probably choose the offer from Hennecke (Germany) because it appears that the company can provide the best technical assistance in the country after the entry to production, through the group Bayer, who is a major supplier of polyurethane components.

Capital cost estimates provided are based on the data provided by OMS.

7. EXTERNAL CONSULTANTS

Proposals from the following firms are available in the World Bank's project files:

Espacios Verdes y Labranzas, S.A.
Dow Chemical

The quote offered by Dow Chemical has been used for calculating the capital costs of the project, and was the lowest cost option offered to FRIBE S.A. Buenos Aires S.A. The reliability of the company is prized at FRIBE S.A. Buenos Aires and will faciliate the execution of the project. Dow, in effect, will be contracted as an external partner for transfer of technology.

ANNEX 2: BREAKDOWN OF RECURRING INCREMENTAL COSTS

INCREMENTAL COST CALCULATION FOR FOAM-TYPE REFRIGERATOR

Price of formulation of PV system based on CFC-11-50% reduced.

PRODUCT	WEIGHTED PART	US$/KG
Polyol	100	2.20
CFC-11	17	2.45
Isocyanate	150	2.20

Price per kg of foam: US$2.20/kg

*Part: According to system use documents.
**Prices: Polyol-Isoc-CFC-11 according to purchase orderes enclosed.

<u>OBSERVATION</u>

Actual molded density: 34Kg/m^3
Kgs. per refrigerator: 7 Kg. (cabinet + door)
Price of formulation for PU system based on cyclopentane: US$2.88 (see Attachment A, DOW Chemical offer).

<u>INCREMENTAL COST (AC)</u>

CFC 50% reduced refrigerator = 7 Kg.
Cyclopentane refrigerator = 7.77 Kg. (molded density 38Kg/m^3 for dimensional stability)

AC = 7.77 x 2.88 - 7.70 x 2.20 = US$ 6.97

TOTAL INCREMENTAL COST

AC = AC1 + AC2 + AC3 = US$ 5.5 per freezer

INCREMENTAL COST CALCULATION (AC) FOR REFRIGERANT-TYPE FREEZER

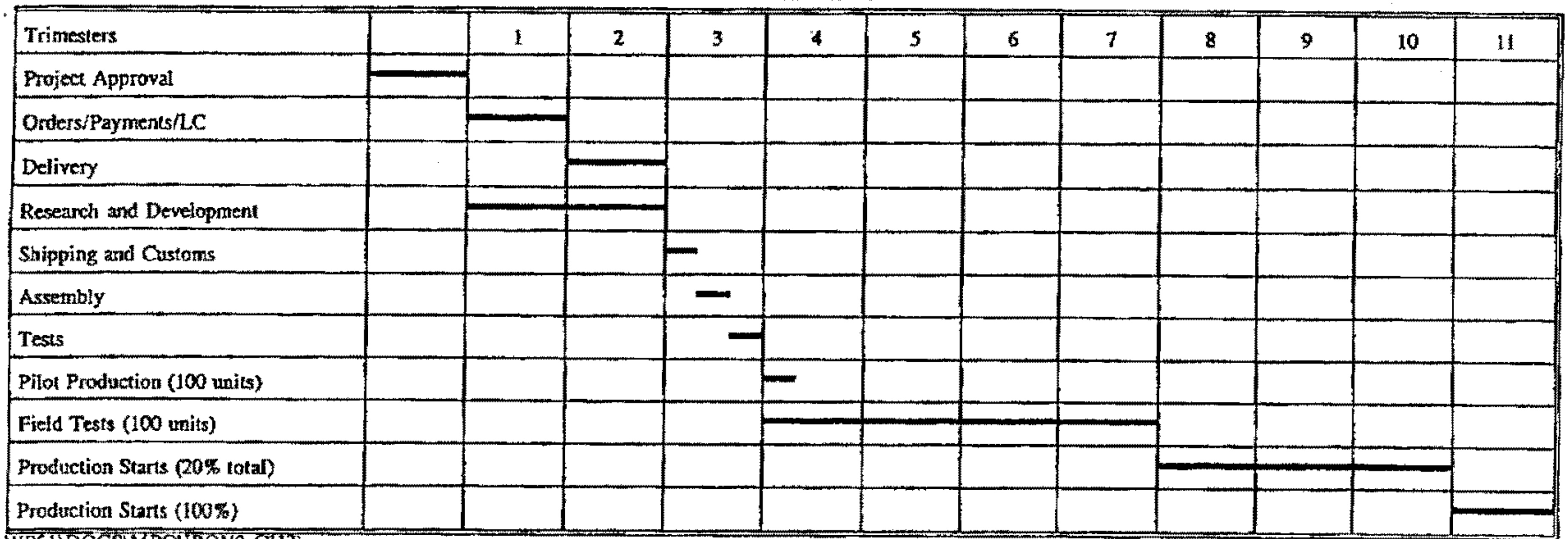
Compressor for R-134a refrigerant (see Sicom offer in Attachment C)
AC1 = 30.47 - 34.08 = US$ 2.39

Refrigerant gas R-134a (see DuPont offer in Attachment B)
Charge in refrigerator = 180 gm
AC2 = 0.180 Kg x US$15.60/Kg - 0.180 x US$3.60/Kg = US$ 2.16

Changes to capillary and molecular filter
AC3 = US$ 1 (estimate which will be reviewed). This cost per unit takes into account the capillary, the filter, and some small heat exchanger changes - evaporator and condenser. The need for the latter will be re-evaluated with the review of the estimate.

IMPLEMENTATION CHRONOLOGY (FRIBE)

REFRIGERANTS



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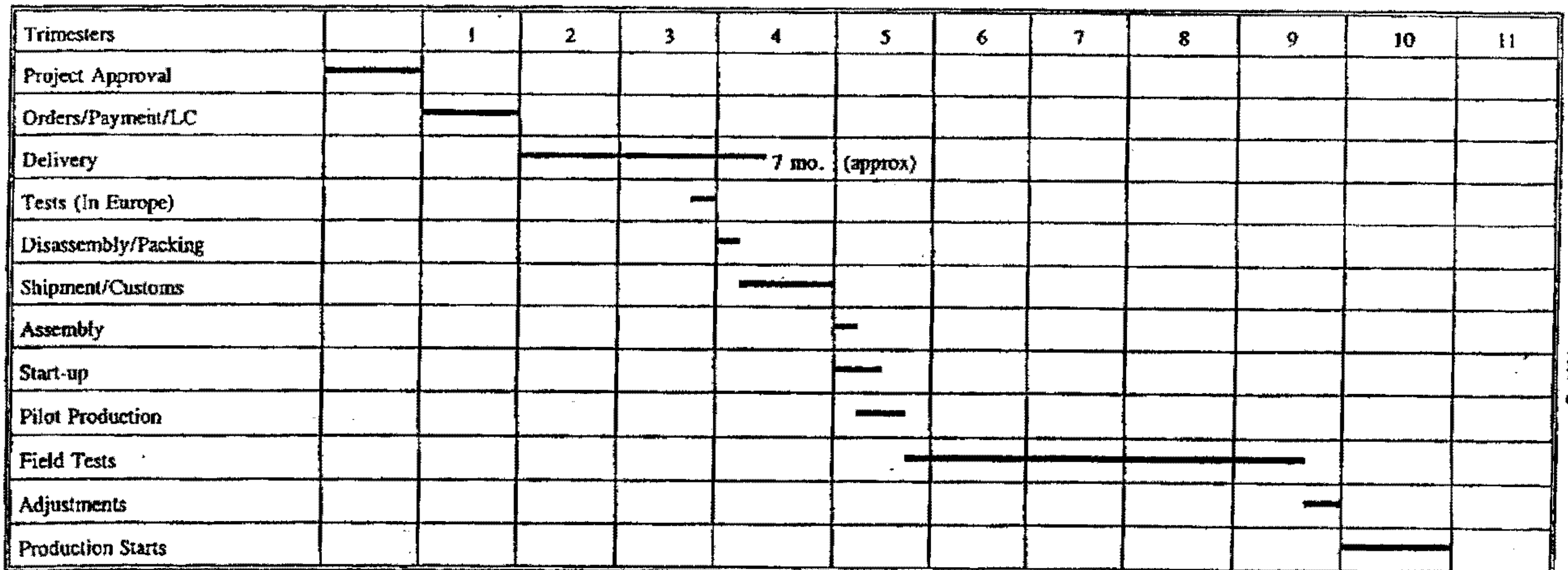
POLYURETHANE FOAMS



Annex 3

ARGENTINA - FRIBE (BUENOS AIRES)

TECHNOLOGY

The choice of cyclopentane was made after a consideration of other technologies. It is a well proven and has the best insulation efficiency of the zero ODP, long term, options now available. It is a technology which is still improving as the chemical suppliers continue development.

ENVIRONMENTAL ISSUES

Cyclopentane has zero ODP and a very low GWP and thus constitutes a long term solution.

The enterprise should consider how it will comply with any VOC regulations which apply.

The main issue relates to the safety handling of highly flammable cyclopentane. The enterprise has received a specification / quotation from an experienced supplier of suitable equipment who will also give a signed undertaking - operational safety statement - and safety training to staff.

PROJECT COSTS

The purchase of new injection equipment is justified since the current low pressure machines would not be suitable for modification. The other items including ventilation devices are also necessary.

The operating cost calculation is basically sound and any reservation which I have will be removed when actual costs are taken into account.

The cost effectiveness is comparatively poor - high capital and operating costs spread over a low CFC replacement tonnage.

TIMEFRAME

The timeframe is reasonable.

RECOMMENDATION

Approved.

GMFJ/kd/16/11/94

Country of origiARGENTINA

Project title: Elimination of ODS in the production of domestic refrigerators in the FRIBE, S.A. plant located in Buenos Aires

Sector/sub-sector Domestic refrigeration
Relationship to country pr(World Bank)

Note This review addresses only the refrigerant conversion part does not address the part related to the foam blowing agent

Technology

- In this project HFC-134a is selected as the substitute refrigerant for CFC-12. In domestic refrigeration HFC-134a technology is a proven and acceptable (nontransitional) technology to reduce CFC-12 consumption.
- The company FRIBE S.A. does not have a formal technology transfer partner. However, the company intends to develop the HFC-134a technology with assistance from compressor, refrigerant and equipment suppliers. Furthermore, provisions for external support are present. Due to these facts, a successful project implementation can be expected.
- Other technologies than HFC-134a were considered (hydrocarbons) but were not selected because of the lack of commercially available compressors and the development state. From the zero ODP technologies HFC-134a is one of the most cost effective solutions.

Environmental impact
HFC-134a has an ODP of zero and a GWP of 0.27. For domestic refrigeration a GWP of this magnitude is negligible.

Project costs
Incremental investments:

- The helium evacuation and charge system is not a necessity and must be eliminated (only the helium leak detectors were eliminated after the first review)
- The rest of the equipment requested is essential for the conversion process and costs are reasonable.
- Costs of training, testing and external support are reasonable.

Incremental operational costs:

- Operational costs are claimed for one year.
- Operational costs are claimed for 54000 units which is the actual production.
- The price of HFC-134a is high (15.6 USD) but is based on demonstrated quotations.
- Charge reduction from CFC-12 to HFC-134a is not taken into account.
- USD 1 estimate for capillary / filter / heat exchanger modifications might be too high. This item must be re-evaluated after project implementation as is indicated in the project proposal.

The UAC value, calculated for the refrigeration part separately, amounts to 33 USD/kg/y which is reasonably high compared to other projects.

Implementation timeframe Reasonable

Relevance and adequacy of information provided
The project description, together with comments of the World Bank officers, provided sufficient information for a judgment.

Recommendations Approval provided the helium equipment is eliminated.

Janssen M.J.P.,OORG MM338, Eindhoven, The Netherlands, 4-November-1994

ATTACHMENT A

Dow Plásticos

Buenos Aires, 08 de Agosto de 1994

Sres.,
Eribe S.A.
Av. Chiclana y Cerrito
(1766) Tablada

Ate.: Ing. A. Tavarozzi CC: Ing R. Peralta

Ref.: Precio Formulación sistema PU basado en ciclo pentano

A continuación le detallamos los precios de una formulación de ciclo pentano según datos obtenidos por diferentes organismos:

PRODUCTO	PARTES*	US/KG**
Poliol	100	2.90
C. Pentano	12	2.72
Isocianato	144	2.90

Precio por Kg espuma = 2.88 US/kg

*Partes: según hoja de uso de nuestro sistema DSD 172.01 (adjunta)
**Precios: - Poliol e Isocianato según estimación dada por la Compañía.
- Ciclo Pentano: pág. 10 Protocolo de Montreal Jun'94 (adjunto)
(2.25 US/kg Fob + 0.15 US/kg fleto + 13% nacionalización)

OBSERVACION:

Debemos considerar que por razones de estabilidad dimensional, la densidad moldeada actual de 34 Kg/m3 se incrementa a 38 Kg/m3. Por lo tanto la cantidad de Kgs por heladera se incrementa en un 11%.

Eje.: heladera CFC 50 % = 5 kg
heladera C. Pentano = 5.6 kg

Precio total: 5.6 kg/heladera x 2.88 US/kg = 16.12 US

En relación al HCFC 141b, el precio que hemos recibido de Elf Atochem es de 3.25 US/kg costo y flete a lo que hay que sumarle el recargo arancelario de 7.5 % y la estadística del 10%.
La posición NADI es = 2' 03 40 510

Nota: es importante recalcar que el precio del sistema mencionado anteriormente es un precio estimado ya que como Ud. comprenderá, la ley de oferta y demanda será la que finalmente determine el precio.

Atentamente,

Gabriel Bunaim

THE MONTREAL PROTOCOL
ON SUBSTANCES THAT DEPLETE THE OZONE LAYER

PROJECT COVER SHEET

COUNTRY:	Argentina
PROJECT NAME:	Elimination of CFC in the domestic refrigerator manufacturing plant of McLEAN in Argentina.
SECTORS COVERED:	Domestic refrigeration
ODS CONSUMPTION IN AFFECTED SECTORS:	762 tons (1992)
PROJECT IMPACT:	Phase out of 74 tons of ODS.
PROJECT DURATION:	2 years
PROJECT ECONOMIC LIFE:	10 years
TOTAL PROJECT COST:	Total capital cost: US$ 1,116,090 Incremental operating costs: US$ 1,291,000
INTERMEDIARY FEE:	US$ 33,480 (based on 3% incremental capital cost)
PROPOSED ODS GRANT:	US$ 2,440,570 (incremental operating cost share to be considered in one year)
UNIT ABATEMENT COST:	Annualized capital cost: US$ 2.5/kg ODP Annual incremental cost: US$ 19.9/kg ODP
IMPLEMENTING AGENCY:	World Bank
COORDINATING NAT. AGENCIES:	Ozone Program Office / National Institute of Industrial Technology
BENEFICIARY ENTERPRISE:	McLEAN, S.A.I.C.I.A.

PROJECT SUMMARY

1. This program will eliminate the use of CFCs in the manufacturing of domestic refrigerators at the McLEAN S.A.I.C.I.A. plant, located in Haedo, Buenos Aires, Republic of Argentina. The CFC-11 used as foaming agent in the production of insulating foams will be replaced with cyclopentane, and the CFC-12 used in the refrigeration circuit will be replaced with HFC-134a. It is anticipated that 20 tons of CFC-12 and 54 tons of CFC-11 will be eliminated per year (74 tons of ODS). The funds required will be used to retrofit the production lines, the start-up and tests of the new models, the training of personnel, and the incremental operating costs resulting from the retrofit for a period of 1 year.

GENERAL BACKGROUND

2. The Country Program of the Republic of Argentina for the protection of the ozone layer was presented and approved during the XII meeting of the Executive Committee of the Multilateral Fund of the Montreal Protocol. This Country Program reflects the objectives of the Government and Industry to reduce the consumption of substances that deplete the ozone layer. The Program foresees the total elimination of ODS for the year 2006, before the date established by the Montreal Protocol and its amendments. The reasons for this policy are the environmental impact of this decision and the restrictions that the global agreement will impose on the industrial product that contains ODS in its production. Argentina has consumed in 1992, the base year for the Country Program, 1,338 tons of CFC-11 and 2,408 tons of CFC-12. Due to the growth in the sectors, we estimate that consumption has increased by 7% during 1993, and will increase an additional 6% during 1994. Both substances are produced domestically (660 tons of CFC-11 and 772 of CFC-12), and are also imported (1,048 tons of CFC-11 and 1,990 of CFC-12).

PROJECT OBJECTIVE

3. The objective of the project is the fast and complete elimination of the use of chlorofluorocarbonated compounds in the manufacturing of domestic refrigerators in the McLEAN S.A.I.C.I.A. plant, located in the Buenos Aires Province of the Republic of Argentina. CFC-11 used as a foaming agent in the production of polyurethane foams used in thermal insulation will be replaced by cyclopentane, and CFC-12 used as a refrigerant will be replaced by HFC-134a in the domestic refrigerators.

SECTOR BACKGROUND

4. In 1992, 1441 tons of CFC-12 and 333 tons of HCFC-22 were consumed in the refrigeration sector in Argentina, in refrigeration circuit applications. This sector is the largest consumer of ODS. In the refrigeration sector, 440 tons of CFC-12 were consumed in the domestic sector, of which 190 tons are used in new equipment and 250 tons are used for servicing operations. With respect to the commercial refrigeration sector, the consumption is 668 tons of CFC-12 (68 tons for new equipment and 600 tons for servicing operations) and 333 tons of HCFC-22. Refrigerated transport and fleets consume 333 tons of CFC-12.

5. With respect to the foams sector, in 1992 the sector consumed a total of 1275 tons of CFC-11 and 209 tons of CFC-12 (second largest consumer), of which 322 tons of CFC-11 were consumed in the production of insulating foams for domestic refrigerators, and 21 tons for commercial refrigerators. The production of domestic refrigerators in 1992, as indicated in the Country Program, totalled 761,000 units. This number grew by 7% in 1993, and there is an estimated growth rate of 6% for the present year.

6. The domestic sector, which produces refrigerators and freezers, is composed of more than 22 enterprises. 7 of which control approximately 72% of the market. Of these 7 enterprises, 2 are of foreign capital and the other 5 are 100% national capital. The principal industries have expressed the will to immediately replace the CFCs. Some of them already use the reduced-CFC foaming process.

7. Some of the CFCs are produced locally and some are imported. With respect to compressors, the local industry provides 30% of the market and the remaining 70% is imported mostly from Brazil. The establishment of MERCOSUR (common market of the southern cone countries) is leading to greater integration with Brazil, resulting in the import of some components from Brazil.

8. An unrestricted demand of CFCs in the domestic refrigeration sector would result in estimated consumption of 1170 tons by the year 2000. The strategy of the Argentinian government for the phase-out of ODS consumption is clearly set forth in the Country Program, which considers the domestic refrigeration sector to be a priority. The program for reduction and elimination of consumption in the domestic refrigeration sector establishes the schedule for the reduction in consumption of CFCs to begin after 1995 for foam applications, after 1996 for refrigeration circuit applications, and reaching total elimination of consumption in the production of new units in the year 2000. The approval of this project by the Multilateral Fund will undoubtedly contribute to the implementation of the planned strategy and the achievement of the objectives of ODS elimination.

ENTERPRISE BACKGROUND

9. Mac Lean S.A.I.C.I.A. is one of the 7 enterprises mentioned in para. 6 that play a significant role in the refrigeration sector. The company has recently installed a completely automated plant with the latest technology, adapted by its own engineering department. The enterprise also produces other domestic products, such as washing machines and dish washers. The present company situation is as follows:

Annual ODS consumption:	74 tons
Installed capacity:	250,000 units
Actual production:	110,000 units
Sector participation:	13%
Product market:	Local and foreign: Bolivia, Paraguay and Uruguay
Origin of technology:	Part of the technology was developed locally and adapted to the plant. The imported technology is from Rigo (Italy), Crios Cannon (Italy), Olma (Switzerland), Gema (Switzerland), and Durr (Germany).
Enterprise ownership:	100% Argentinean

PROJECT DESCRIPTION

10. This project is designed to convert the existing CFC-11 technology with cyclopentane for foaming applications, to convert the CFC-12 refrigeration circuit to HFC-134a, and to eliminate methylene chloride as a cleaning agent. The development of these technologies and the personnel training necessary to operate the new technologies has been programmed over a 24 month period of time. The enterprise has already initiated the procurement and installation of equipment for the foams section, taking into account the need for conversion.

11. The utilization of HFC-134a requires the redesign of all products to accommodate the frigorific circuits according to the thermodynamic conditions of the new refrigerant, and keeping the same energy efficiency as with the CFC-12 system. It is also necessary to modify systems for dehydration, charging, and refrigerant leak detection, to renovate any other equipment affected by this process, and address associated issues related to training of personnel. An HFC-134a recovery installation is also part of the design of the project. The leak detectors must be replaced because the present ones are sensitive to chlorine molecules. Included also is a conversion of the vacuum pumps. The refrigeration circuit has to be optimized to use HFC-134a through testing of new compressors, dehydrating filters, and new capillaries due to the lower flow of refrigerant at a low temperature. The increased tendency for leakage with HFC-134a requires the incorporation of helium detectors to serve an initial leak detection function previous to the realization of a vacuum in the units. All the refrigerator models must be tested according to the IRAM 2120, Parts 1 to 4, national standards.

12. Included in this project are: i) machinery for charging operations; ii) adjustment and redesign of the refrigeration circuit; iii) personnel training in the new technologies; iv) trials and tests; v) laboratory equipment adequate for the new refrigerators. Annex 1, Section II details the refrigeration system equipment included for incremental cost funding.

13. The replacement of CFC-11 with cyclopentane requires the change in low-pressure polyurethane injection systems for high-pressure systems, and includes storage and mixing facilities that are adapted to the explosive conditions of cyclopentane as detailed below: i) a tank for the bulk reception of cyclopentane that complies with the safety requirements corresponding to combustible liquids; ii) a cyclopentane detection installation with sufficient sensors that are located in storage areas as well as work areas; iii) pre-mix equipment for cyclopentane with polyol adapted for the use of flammable and explosive substances; iv) change of the low-pressure injectors for high-pressure injectors able to handle cyclopentane, and which eliminate the need for methylene chloride; v) injection head with a nitrogen sweeping valve which will be housed inside a chamber installed with appropriate ventilation for normal operation as well as an emergency ventilation system; vi) all machinery and installations shall be explosion proof and grounded; vii) safety technicians will study the requirements for the installations before execution of the project and will audit the construction and the start-up; viii) training courses for all personnel involved; ix) the beneficiary will negotiate a comprehensive technology partnering agreement in order to ensure appropriate technology transfer and assign responsibility for the overall safety of the installation. Annex 1, Section I details the foaming eqipment indluced for incremental cost funding.

JUSTIFICATION FOR SELECTION OF ALTERNATIVE TECHNOLOGY

14. In the case of foaming technologies, there are presently three replacements for insulation in domestic refrigerators: i) water/HCFC-141b; ii) water/HCFC-22 and -142b blend or HFC-134a and -152a blend; and iii) cyclopentane. The first solution is an aqueous solution whose technology is similar to the one used now, but it is a transitional substance because HCFC-141b is a transition substance, and as such is controlled by the Montreal Protocol, and the government policy is to

support projects with definite solutions that are feasible. The second solution uses blends of foaming gases, requires totally new equipment, and its start-up is difficult and troublesome. The third solution, the one proposed in this project, is cyclopentane technology, which has been successfully introduced in European countries, especially in Germany. The installation of cyclopentane requires special considerations for safety problems due to its flammability, but there is considerable experience in Argentina in the handling and storage of hydrocarbons, since Argentina has a considerable production of hydrocarbons, used as fuel, including automobiles. This substance is available in the market at a cost approximately 50% of HCFC-141b. In addition, there is experience in the country in operating high-pressure machines for foaming. The supplier of the high-pressure equipment will guarantee the proper technology transfer of cyclopentane to McLean (offering an "Operational Safety Statement"), as well as the global guarantee on the safety of installation by sending safety experts who will audit the installation. The safety aspects and the involved risks will be analyzed by the World Bank experts.

15. The company's choice of cyclopentane technology provider was based on quotes received from Hennecke, OMS, Elastogran, Perros, and Cannon. Copies of complete quotes are available in the World Bank's project files. The "foams plant" equipment cost breakdown is summarized in the first page of Annex 1 which details project costs.

16. There are two options for replacement of CFC-12 as a refrigerant: HFC-134a and hydrocarbons. HFC-134a has been selected for replacement of the CFC-12 refrigerant in domestic refrigerators because it is presently accepted worldwide, and its technology has been developed thoroughly and has been introduced commercially in many developed countries. There are numerous suppliers of gas, oils, and components of the circuit, and it appears to be a unique solution in other subsectors such as commercial refrigeration and the automotive industry. There are certain doubts concerning its GWP, but there are no nearby dates for its limitation. The option of using hydrocarbons as refrigerants have been developed by Germany and units are being manufactured for isobutane. It may appear to be a promising technology, but its development has not been completed, and obtaining the adequate components for its operation is not easy. McLEAN does not have a formal technology transfer agreement with any industrialized country domestic refrigeration company. However, the proposed project includes the services of an international expert to guide the company in the HFC-134a conversion process (Refer to Annex 1).

PROJECT TOTAL CAPITAL AND INCREMENTAL COSTS

17. The total investment necessary to cover the procurement of the new equipment, installations, development and training costs, is detailed in Annex 1. Imported equipment prices have been quoted FOB, and then the insurance cost, the shipping fee from the port of origin - Buenos Aires, and the internal shipping fee to the installation site have been included. The foams system is of greater capacity than the currently functioning system. Therefore, the funding requested for for this equipment have been adjusted in proportion to the installed capacity of the plant. These costs could change if safety experts reviewing the technical documentation believe further changes are necessary to meet acceptable standards. An amount equal to 15% of the total budget is included to cover contingencies that may arise due to the extensive and significant changes to be introduced.

EQUIPMENT	US$
1. Foaming	689,000
2. Refrigeration	112,100
3. International Expert & Technical Assistance	95,000
4. Training	21,000
5. Trials and tests	53,500
6. Contingencies 15%	145,590
TOTAL	1,116,090

INCREMENTAL OPERATING COSTS

18. The incremental operating costs estimate is based on input prices which, as noted in para. 20 below, are subject to re-evaluation. Heat exchanger modifications will also be subject to verification. The re-evaluation will also take into consideration results of final product and prototype tests. The Government of Argentina has also requested the project to be submitted with operating costs as calculated, but subject to re-evaluation on the basis of input price changes and final tests and prototypes. It is also noted that all approved incremental costs in projects funded through World Bank Montreal Protocol implemenation operations will be disbursed only against actual expenditures and these will have to be verifiable in strict accordance with World Bank disbursement guidelines. Attachment B is a quotation verifying the price quoted for HFC-134a by Frio Industries Argentinas S.A.

19. The elimination of CFC-11 as a foaming agent in polyurethane foams results in the following changes in operating costs:

Actual Foam Composition:
Weight x Unit: 5.578 Kg.

Isocyanate	67% 3.73 kg.	US$ 2.11	US$ 7.885
Polyol	21% 1.17 kg.	US$ 2.11	US$ 2.473
CFC-11	12% 0.669 kg.	US$ 2.845	US$ 1.904
		Total	US$ 12.262

Composition replacing CFC-11 for cyclopentane:
Weight x Unit: 6.7 Kg.

Isocyanate	56.25% 3.77 kg.	US$ 2.90	US$ 10.93
Polyol	39% 2.62 kg.	US$ 2.90	US$ 7.598
Cyclopentane	4.68% 0.669 kg.	US$ 3.35	US$ 1.038
		Total	US$ 19.569

20. The cost of isocyanate is quoted by DOW chemical and can be verified in Attachment A. Before project implementation, new quotations will be requested and, in the case of isocyanate, tests will be conducted to apply the currently used isocyanate formulation in the new foaming operation. It is acknowledged that the foam density increase with the new technology in the order of 20.5% is not in line with other domestic refrigeration projects submitted by the Government of Argentina.

Total elimination of CFC-11: 19.569 - 12.262 = US$ 7.307

21. The elimination of CFC-12 involves the following changes in operating costs:

Replacement of CFC-12 compressor for HFC-134a compressor:
Difference: US$3

Replacement of CFC-12 for HFC-134a:
Actual average charge: 170 grams
CFC-12 0.170 kg x US$ 3.50/kg = US$ 0.595
HFC-134a 0.153 kg x US$ 16/kg = US$ 2.45
Difference: US$ 1.855

Modification molecular filter:
Difference: US$ 0.05

Capillary modification:
Difference: US$ 0.15

Modification of heat exchangers:
Difference: US$ 1.10

Total elimination CFC-12: US$ 5.605

Total per unit: US$ 12.912

Total per year (base 1994): 12.912 x 110,000 = US$ 1,420,100

NPV at 10%: US$ 1,291,000

TOTAL COST OF THE PROJECT

22. The total capital costs plus the total operational costs (discounted) equal:

1,116,090 + 1,291,000 = US$ 2,407,090

23. The unit abatement cost of the project is equal to US$ 19.9/kg. The detailed costs are:

a) Capital costs: US$ 1,116,090
b) Capital recovery factor, 10% per year, 10 year investment: US$ 0.16275
c) Recurrent incremental costs, 10% discount rate, 1 year: US$ 1,291,000
d) ODS reduction: 74 tons

U.A.C. for capital costs: (AxB)/D = US$ 2.45 kg/year
U.A.C. for total costs: (AxB+C)/D = US$ 19.90 kg/year

PROJECT FINANCING

24. McLEAN requires a grant from the Multilateral Fund of the Montreal Protocol equal to: US$ 2,407,075.

EXECUTION OF THE PROJECT

25. The World Bank, jointly with the National Institute of Industrial Technology will supervise the implementation of the project.

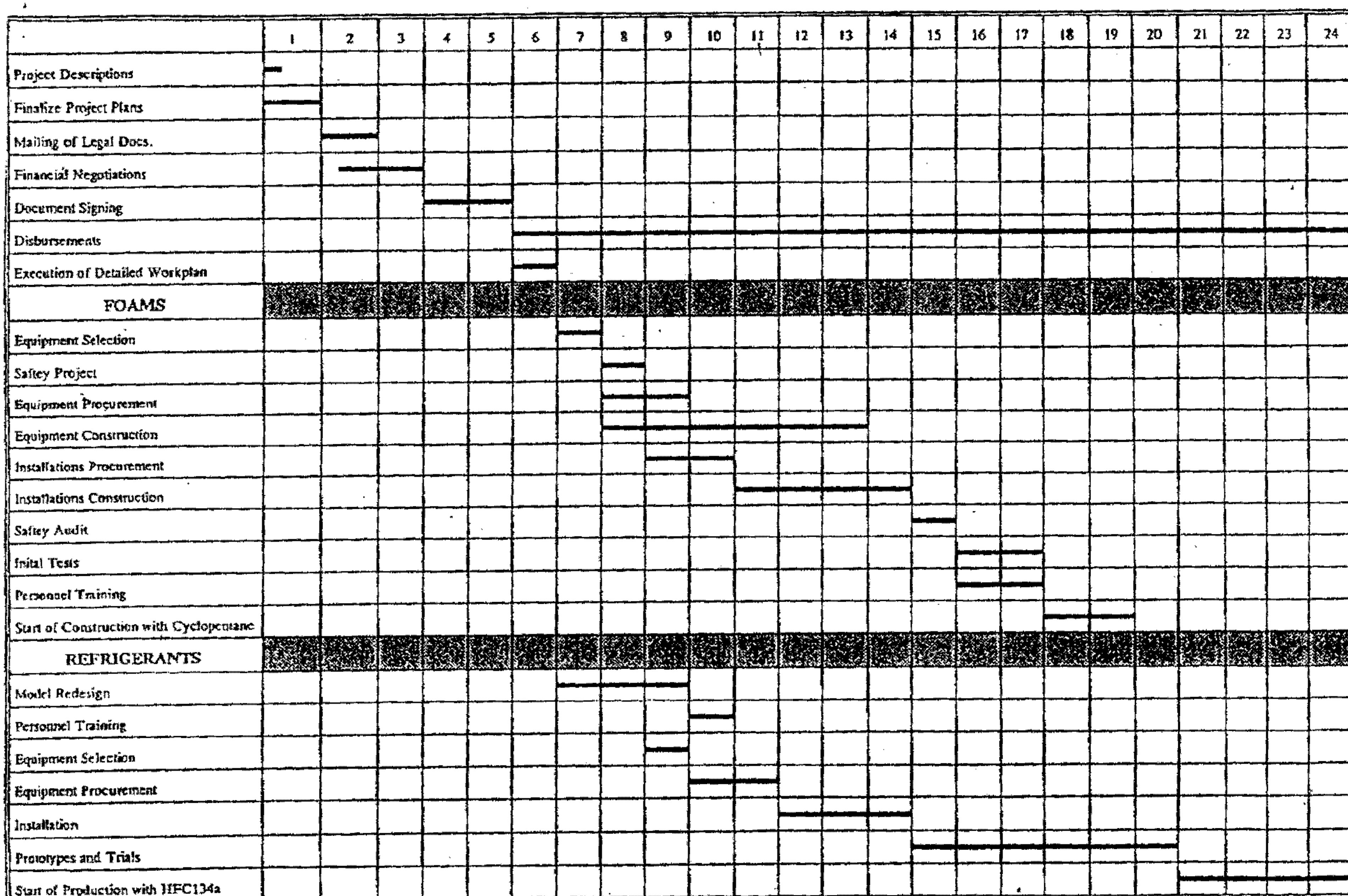
IMPLEMENTATION TIMETABLE

See next page

PROJECT IMPACT

26. This project will eliminate the use of 74 tons of CFCs in the first year of its implementation.

TIMETABLE MACLEAN



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IMPLEMENTATION

ANNEX 1: CAPITAL COST BREAKDOWN

DESCRIPTION	TOTAL COST
I. CYCLOPENTANE SYSTEM 1. Impianti OMS Polyurethane Foaming System, including: Cyclopentane tank Intermediate tank Premixing system Cabinet foaming machine with mixing head Door foaming machine with mixing head	425,000
2. Preheating oven (2)	40,000
3. Rebuilding foam fixtures for cabinets (9)	27,000
4. Rebuilding foam fixtures for doors (15)	30,000
5. Rebuilding foam plugs (9)	9,000
6. Ventilation and exhaust system for cabinet foaming installation	55,000
7. Ventilation and exhaust system for door foaming installation	20,000
8. Sensor and safety set for cabinet and door foaming installation	80,000
9. Antistatic floor	3,000
SUBTOTAL	689,000

Note: Taking into account that the machine being purchased has a capacity of 1000 units each 8.5 hours and the current capacity is 270 units every 8 hours, the capital to request from the Fund was calculated using the following formula:

I2/I1 = (Q2/Q1)exp0,6

where I = investment and Q = capacity, resulting in

I2 = 2.19 I1

The formula employed in this calculation is widely used in the engineering community to estimate unknown investment costs on the generally accepted assumption that investments are not directly proportional to capacities.

DESCRIPTION	TOTAL COST
II. REFRIGERATION SYSTEM	
HFC-134a charger	43,000
Over-pressure pump	7,500
Adjustment of vacuum pumps (6 total)	1,800
Halogen detector (4 total)	5,700
Vacuum and charge unit for laboratory	17,000
Laboratory instruments	10,000
Insurance, transportation, shipping fee	10,000
SUBTOTAL REFRIGERATION SYSTEM	

ANNEX 2: TRAINING COST BREAKDOWN

DESCRIPTION	COST
1. FOAMS PLANT	
Testing and training on safety system (1 technician from supplier, 2 weeks)	5,500
Testing and training on injection machines, pre-mixing unit, and door drum (2 technicians from supplier, 2 weeks)	9,500
Safety course for plant personnel	2,000
SUBTOTAL FOAMS PLANT	17,000
2. REFRIGERATION SYSTEM	
Testing and training on charger and recovery machine (1 technician, 1 week)	4,000
SUBTOTAL REFRIGERATION SYSTEM	4,000

TECHNICAL ASSISTANCE:
COST BREAKDOWN

DESCRIPTION	COSTS
1. FOAMS PLANT	
1.1 Previous safety study	25,000
1.2 Assistance in assembly and start-up in plant (2 technicians, 2 weeks). Supervision and control of installation during start-up by safety expert (1 technician, 1 week).	50,000
2. REFRIGERATION SYSTEM	
2.1 International Expert to assist with HFC-134a conversion.	20,000
SUBTOTAL	95,000

TRIALS AND TESTS:
COST BREAKDOWN

DESCRIPTION	COSTS
1. FOAMS PLANT Foam testing in 180 cabinets (22 models)	18,000
2. REFRIGERATION SYSTEM Costs of follow-up of Field Test for 60 units charged with HFC-134a	3,600
3. TRIALS ACCORDING TO IRAM STANDARD INTI Laboratories, 1 trial per model, 22 trials	31,900
SUBTOTAL	53,500

SUMMARY

DESCRIPTION	US$
EQUIPMENT	
1- FOAMS 2- REFRIGERATION	689,000 112,100
SUBTOTAL	801,100
INTERNATIONAL EXPERT & TECH. ASSISTANCE	95,000
TRAINING	
1- FOAMS 2- REFRIGERATION	17,000 4,000
SUBTOTAL	21,000
TRIALS AND TESTS	53,500
TOTAL	970,600
CONTINGENCIES (15%)	145,590
T O T A L	1,116,190

Country of origiARGENTINA

Project title: Elimination of CFC in the domestic refrigerator manufacturing plant of McLEAN

Sector/sub-sector Domestic refrigeration
Relationship to country pr(WorldBank)

Note This review addresses only the refrigerant conversion part does not address the part related to the foam blowing agent

Technology

- In this project HFC-134a is selected as the substitute refrigerant for CFC-12. In domestic refrigeration HFC-134a technology is a proven and acceptable (nontransitional) technology to reduce CFC-12 consumption.
- The company McLEAN does not have a formal technology transfer partner. However, the company intends to develop the HFC-134a technology with assistance from compressor, refrigerant and equipment suppliers. Furthermore, provisions for external support are present. Due to these facts, a successful project implementation can be expected.
- Other technologies than HFC-134a were considered (hydrocarbons) but were not selected because of the lack of commercially available compressors and the development state. From the zero ODP technologies HFC-134a is one of the most cost effective solutions.

Environmental impact

HFC-134a has an ODP of zero and a GWP of 0.27. For domestic refrigeration a GWP of this magnitude is negligible.

Project costs

Incremental investments:

- The cost of the charging unit in the technical service is too high.
- The rest of the equipment requested is essential for the conversion process and costs are reasonable.
- Costs of training, testing and external support are reasonable.

Incremental operational costs:

- Operational costs are claimed for one year.
- Operational costs are claimed for 110,000 units which is the actual production.
- The price of HFC-134a is high (16.0 USD) but is based on demonstrated quotations.
- Charge reduction from CFC-12 to HFC-134a is not taken into account.
- Heat exchangers cost increase of 1.1 USD might be too high (in principle no change in heat exchanger is required). This item must be re-evaluated after project implementation as is indicated in the project proposal.

The UAC value calculated for the refrigerant part separately amounts to app. 37 USD which is high compared to similar projects.

Implementation timeframe Reasonable

Relevance and adequacy of information provided

The project description, together with comments of the World Bank officers, provided sufficient information for a judgment.

Recommendations Approval provided the cost of the charging unit is reconsidered

Janssen M.J.P.,OORG MM338, Eindhoven, The Netherlands, 4-November-1994

ARGENTINA - MCLEAN

TECHNOLOGY

The technology chosen by the enterprise for the manufacture of foam for refrigerators is based on cyclopentane as a replacement for CFC 11. This is now a well proven technology in use in many countries. The enterprise also considered HCFC 141b but did not pursue this option because it is a transitional substance and is more expensive (per kg) than cyclopentane.

The technology change will necessitate replacement of the current low pressure dispensing units by high pressure machines.

ENVIRONMENTAL ISSUES

Cyclopentane has zero ODP and very low GWP and hence constitutes a long term replacement.

The enterprise should confirm with relevant national / local authorities that any relevant regulations on VOC emissions are complied with.

The main issue regards safe operation with highly flammable cyclopentane. The enterprise has already received information from Cannon, a highly experienced supplier of pentane-compatible refrigerator production equipment and will seek the necessary letter of assurance on safety-related issues from them. In addition, a training package is being proposed (Annex 2).

PROJECT COSTS

Annex 1 clearly indicates that the equipment it proposes to obtain from Cannon will enhance production capacity. This is taken into account and corrected for as explained in Annex 1.

Training and technical assistance costs are acceptable.

The incremental cost calculation (attachment C) should be adjusted to a new figure of 6.3 (not 8.3) kg/unit.

The reviewer does not agree that a new higher priced isocyanate is required but finds acceptable that trials be conducted with the existing isocyanate and that the outcome be included in the operating costs actually paid after the first year of operation.

TIMEFRAME

If the time intervals are months, then this is acceptable.

RECOMMENDATION

Approved.

GMFJ/kd/16/11/94

PROJECT COVER SHEET

Country:	**ARGENTINA**
Project Title:	**CINTER S.R.L. elimination of the use of CFC's in the manufacture of sandwich polyurethane panels.**
Sector Covered:	**Rigid Foams**
ODS used in Sector	**1585 tons CFCs (ODP - base year 1992)**
Project Impact:	**45,000 kg CFC-11/year (base 1993)**
Project Duration:	**One (1) year**
Project Economic Life:	**Ten (10) years**
Total Project Costs:	US$615,000 Incremental Capital Cost **US$ 110,000 Incremental Recurrent Cost**
Proposed MLF Grant:	US$725,000 (reflects 100% local ownership)
Cost Effectiveness:	US$3.64/kg/year (unit abatement cost)
National Coordinating Body:	**OPROZ - INTI**
Implementing Agency:	**UNDP**
Appraisal Date:	**September, 1994**

PROJECT SUMMARY

Under this project, CINTER S.R.L. will eliminate the use of CFCs in the manufacture of sandwich, polyurethane panels, through the introduction of formulations and procedures for foam injection based upon the use of cyclopentane as blowing agent. Additional fringe benefits include those derived from the elimination of solvents due to the use of high pressure injectors required for Cyclopentane. The project includes equipment modification, plant conversion, consulting, production trials, testing, and training and incremental operational costs for a period of two years.

Prepared by: **Cinter in cooperation with INTI (Maria Lucia Gomez)**
Reviewed by: **Bert Veenendaal**

PROJECT OF THE GOVERNMENT OF ARGENTINA

CINTER CONVERSION TO NON CFC TECHNOLOGY IN THE MANUFACTURE OF RIGID INSTULATING FOAM

1. GENERAL BACKGROUND

The country program of the Argentine Government fot the protection of the ozone layer was presented and aproved in the XIII Executive Committee Meeting of the Multilateral Fund of the Montreal Protocol.

This country program contains the intention of the Government and the industry to reduce and phase out the consumption of ozone deplecting substances (ODS). It calls for a total phase out of the ODS in year 2006, and reductions in advance to the scheduled data established for the Montreal Protocol and their admenmends. Reasons for such a policy are environmental impact and future international restrictions to the product that contains this susbstances.

The ODS consumption in Argentina during year 1992, base of the country program, was 1,338 ton of CFC11 and 2,408 ton of CFC12. Due to the growth of the sectors that use ODS, the consumption has increased aproximately 7% during 1993 and is expected to increase 6% during 1994.

2. OBJECTIVE

The objective of this project is to phase out the use of CFC-11 in the manufacture of sandwich polyurethane-foam panels at CINTER S.R.L., through the replacement of the CFC 11 by cyclopentane.

3. SECTOR BACKGROUND

The Argentine foam industry consumed in 1992, the base year of the country program, 1,484 tons of CFCs (1484 tons ODP). CFC 11 was the dominant subtance (1,275 tons) followed by CFC 12 (209 tons). The sector can be funcionally divided into:

* Non-insulating foams	- flexible foams (slabstock) - flexible and simirigid foams (molded) - extruded foams
* Insulation foams	- domestic refrigeration - commercial refrigeration

CFC use per category is indicated in the following table:

CATEGORY		CFC 11	CFC 12
PUF foams			
Rigid insulation	**-commercial & domestic refrigerators**	**343**	
Rigid insulation	**-pannels, vehicles**	**274**	
Flexible	**-slabstock**	**259**	
Flexible/semirigid -molded		**135**	
Others		**142**	
Extruded foams (XPS/PE foams)		**122**	**209**
TOTAL		**1,275**	**209**

Table 1: CFC-use per Foam Category in Argentina (tons; 1992)

The country progam calls for phaseout of CFCs in the non insulating foams in or before 1998. Insulating foams are scheduled to be phase out in or before year 2000.

Insulation foams for domestic and commercial refrigeration will be phase out jointly with the corresponding refrigerant.

Insulating foam manufacture for pannels is dominated by a few large manufacturers, which manage from 80 to 90% of the market and many small producers. The CFCs consumption in this sector was, in 1992, 141 tons. Insulating foam panels are widely used for modular and fixed cold stores, as such as for common warehouses and large buildings (roof and top). The strategy calls for a combination of individual (about five) projects and one or two group pojects. An early project (particularly in this case, with cyclopentane) will serve as demontration project, taking into account all the safety measurements required for an hydrocarbon project and will encourage other enterprises to come forward and to present their own projects.

PUR insulating rigid foams are also used in the construction of vehicles (trucks), refrigerated trucks and isohtermic box (containers) for transport. In this subsector there are also few large manufactures and some small producers.

In the flexible foam (slabstock) category are five (5) large manufacturers operating continuous production lines. In addition, there are many (about 25) smal l producers using "single block" production equipment. Products are aimed at the bedding industry, with smaller applications in furniture and miscellaneous industrial uses as packaging, household. The ODS phaseout strategy calls for individual projects for the large producers and a joint project for the small scale producers.

Molded foams are predominantly used in the automotive and furniture industry. Products include seat cushions, steering wheels, arm rests and chair legs. The strategy calls for the preparation of a few early phaseout projects to demonstrate the technical and economical feasibility of CFC replacement.

There are only a few enterprises producing extruded foams (polyethylene and polystyrene foam sheet). Products are used in the fast food industry and for packaging purposes. CFC phaseout will be addressed through individual projects.

4. ENTERPRISE BACKGROUND

CINTER S.R.L. provides, in general, industrialized ligth contructions, palletized storage systems and turn-key plants and storage warehouse, including of course refrigerated cold store.
In its plant in Sauce Viejo - Santa Fé sandwich polyurethane pannels (for roofs and walls), metallic structures and doors for cold stores are produced. The company is 100% Argentine owned.
During 1992 and 1993 100% of the production was consumed in the domestic market. The share of the market is in the order of 45%, with anual sales U$S 9.000.000. The company has 170 employees.
CFC11 is used in the production of pannels, being current CFC consumption the following:

TABLE 2: CFC-11 consumption in CINTER:

Year	Panels (*) (m^2/year)	CFC-11 content (kg/m^2)	CFC-11 consumption (kg/year**)
1990	100,000	0.30	30,000
1991	100,000	0.30	30,000
1992	125,000	0.30	37,500
1993	150,000	0.30	45,000

(*) polyurethane production is expressed in equivalent panels of 50 mm foam thickness.
(**) CFC-11 content/consumption calculations are based on CFC-11 weight contents of 15 % in the polyol-isocyanate-blowing agent mixture.

Plant Capacity:

a. Full production capacity: 150,000 m^2 of sandwich panel, 50 mm foam thickness, 40 kg/m^3 polyurethane density.
b. Current production: 150,000 m^2 of sandwich panel, 50 mm foam thickness, 40 kg/m^3 polyurethane density (100 % plant capacity utilization).

Production Technology:

Current injection technology is based on an imported, Italian made, low-pressure, computerized, polyurethane injection unit, **IMPIANTI OMS, model Serie 2001-C**. The injection system is completed with refrigerating units, two 500 lt. tanks for isocyanate and CFC 11-polyol, and the recirculation system for both components. The whole system is mounted on a cart to allow the movement of the PU dispenser to feed the molds. In the same carriage, a refrigeration system and two pre-loading tanks for isocyanate and the polyol/CFC-11 mixture are also installed. Polyol and isocyanate are fed to these tanks manually, from 200 lt barrels.

Sandwich panels currently under production are made with one or two sheets of either metallic (galvanized/cincalum steel, stainless steel, painted or not) or polymeric materials, with a Polyurethane core. Commercial panel dimensions go as high as 12,000 mm length x 1,200 mm width x 200 mm thickness.

Panels are currently produced in two multi-level presses with a single injection point located at the extreme of the panel length (short side of the rectangular projection of the panel area) using a static polymeric house placed in the mold, and thus finally integrated to the foam in the sandwich panel. A convenient arrangement of holes along the hose allows the reacting mixture to distribute homogeneously within the polymerizing mold volume when the injector head is connected to one end of the hose and PU reacting mixture flow begins.
Lateral, longitudinal guides for both the molds and the press (at the long sides of the rectangular projection of the panel area) are rigid, and designed to withstand the mold mounting system as structural parts, with no side entrances for neither single nor multiple point injection attainable through these longitudinal parts of the press-mold system.

4 TECHNOLOGY SELECTION CRITERIA AND IMPACT

4.1 Overview and Selection

Among the several options currently available in the developed markets to replace CFC-11 in the production of rigid polyurethane for sandwich panels, two of them were considered by CINTER in previously issued pre-projects:

a) the HCFC-141b intermediate option
b) the cyclopentane option

Alternative a) employs technology that is closely related to the existing process. HCFC-141b is not a zero ODP compound and, as such could only be regarded as an intermediate solution towards a complete replacement of CFC use.

Option b) has been introduced, mostly in Europe, as a final solution (zero ODP) alternative. Its flammable character requires safety conditions and limits its use to companies that face the challenge of retrofitting plant installations and retraining personnel. Cyclopentane is also regionally restricted, although this situation is changing at a fairly rapid pace. The foams produced using cyclopentane as the blowing agent present a higher thermal conductivity, and, thus, product modifications such as density changes and thickness increase must be considered when taking the cyclopentane option into account. Additionally, cyclopentane technology requires high pressure equipment to make up for lower solubilities in polyurethane reactants.

Cyclopentane, high-pressure technology is identified by CINTER S.R.L. as an alternative that is:

i) proven and widely accepted in demanding market and production environments such as those currently observed in Europe
ii) environmentally acceptable
iii) available from sources in Europe and USA via domestic representatives
iv) able to be handled with changes in both equipment and production procedures

4.2 Impact on Production Process

The use of cyclopentane (CP) will require substantial changes in the production and storage facilities based on the highly flammable/explosive character of the substance. The adherence to the strictest safety standards available, such as EN, NFPA or other internationally recognized standards is required for UNDP implemented projects. These standards classify explosive zones ("EX areas") generally in three categories:

Zone 0	**Where a constant amount of highly flammable/ explosive liquids or gases can be expected.** **Areas inside CP pipes and tanks are Zone 0 (level, pressure and temperature controls). Materials used have to be explosion proof (EX) and grounded.**
Zone 1	**Where from time to time highly flammable liquids or gases can be expected;** **Areas in and around molds and fixtures are Zone 1. Materials used have to be EX-e, -d or -ia and grounded. Zone-1 can generally be reclassified to Zone 2 by applying sufficient ventilation.**
Zone 2	**Where only by accident or scheduled maintenance highly flammable/explosive gases can be expected. Tank storage areas, premix stations and foam dispensers are generally Zone 2. Materials required are EX-n or with IP54 sealing. Grounding to avoid spark building triggered by differences in electrical potential, is required.**

Other requirements related to the use of CP are:

- **The installation of containment around CP storage tanks;**
- **Installation of premix equipment--CP cannot purchased pre-blended;**
- **Antistatic clothing and shoes in Zone 0/1 areas;**
- **Installation of CP gas sensors in all EX areas, connected to a central panel and an automatic recorder/ printer;**
- **A portable gas detector to monitor CP concentrations throughout the plant according to an approved monitoring plan;**
- **An approved preventive maintenance system and emergency response plan;**
- **Training for production and maintenance personnel in the safe handling of CP;**
- **Process Safety Audits (PSAs) by a UNDP appointed independent contractor prior, during and after implementation.**

In line with the above-mentioned modifications on equipment and safety requirements, process adjustment are required to cope with the lower insulation value, higher core temperatures and longer aging times related to the use of CP.

THE USE OF CYCLOPENTANE MUST CONFORM TO THE SAFETY REQUIREMENTS OF RELEVANT LOCAL AND STATE AUTHORITIES

5 DESCRIPTION OF THE PROPOSED DESIGN

The basic injection system proposed is described, schematically, as follows

1. **Cyclopentane Storage**: one double-walled (DIN 66082), stainless steel (all parts in contact with cyclopentane) tank mounted above ground, with breathing and overflow safety systems, with feed line and gas displacement connection, and with metering pump. Minimum expected distance between tank and any adjacent building: 15 meters.

2. **Reactant Storage**: two tanks, 500 liter each, for polyol and isocyanate, double-walled for temperature control with water, made of special steel, with 51 min^{-1}, 0.25 kW stirrers, each equipped with temperature control devices for hot and/or chilled water. One similar, additional tank for the polyol/cyclopentane mixture.

3. **Polyol Mixing Station**: including the mixing unit, static premixing, metering pumps, N_2 blanketing, leak and pressure detectors, complete piping, and all self-contained safety measures, of the type of the Hennecke PentaMat P-30 or similar.

4. **Injector**: one high pressure reaction casting machine with two hydraulically controlled recirculation injectors, with maximum output capacity of 5,000 cubic centimeter of mixture per second or 5,500 gr of mixture per second (1.1 gr/cc mixture density at I:P = 1:1). This arrangement is needed to fulfill the requirement of producing panels 12,000 mm x 1,200 mm of covered area, with 40 kg/m³ PU density and with 200 mm thickness. A multiple side point injection technique is mandatory, with more than one shots using the two heads per panel. Complete, with polyol and isocyanate metering pump-motor groups, hydraulic unit, filters, contact pressure gauges, safety valves, throttle valves, suction hoses, flexible lines, control cabinet, refrigerating unit for temperature control, and all auxiliary devices, mounted on a track carriage for displacement along the press length, of the type of the Hennecke HK 2500 P or simila

5. **Press**: one 2+2 press machine with two daylights and two extractable platforms for one 12000 mm x 1200 mm x 200 mm panel each. In the 2+2 press, two platens are held in the press during the foaming and polymerization cycle, while the other two are positioned in a platform outside the press for discharging and preparation. The system includes all the necessary arrangements to operate with the multiple point injection scheme demanded by the injector. In particular a motorized traverse unit for precise positioning of the heads is provided. Complete, with vacuum elevation system, manual system for opening and closing of molds, automatic temperature control, and auxiliary devices, of the type of the Simpianti 2+2 - 12000 or similar.

The system will be mounted in a specifically designed area, physically and electrically isolated from other plant facilities, and equipped with specific ventilation units. Prevention devices, mostly leak and gas detectors, as well as alarm and fire systems will be designed in detail and installed with the assistance of experts. All electrically equipment in the injection and press area will be retrofitted in accordance with the regulations required for the safe handling of cyclopentane and the reacting mixtures containing it.

6 PROJECT COSTS

6.1 Capital Costs

Description	Subtotal US$	Total US$
Equipment		
High pressure, 2-head injector (5,500 gram/s)	215,000	
Transfer system for injector and mixing head	10,000	
Storage tank and piping for cyclopentane	45,000	
Cyclopentane premix unit, with supply pumps	62,000	
Ventilation unit for injector and press	20,000	
Gas and leak detectors	60,000	412,000
Building conditioning - Modifications		
Building-wall addition (isolation of injection area)	35,000	
Building-roof modification (for ventilation system)	18,000	
Electrical Modifications	25,000	
Fire protection modifications	21,000	
Production trials	10,000	109,000
Other Costs		
International consultant assistance (Safety)	10,000	
Technology transfer	20,000	
Process/safety training	10,000	
Contingency/rounding	54,000	94,000
INCREMENTAL CAPITAL COST		615,000

6.2 Operating Costs

The company will experience higher costs for the sandwich panel production due to higher amount of polyurethane system needed to attain commercially required heat insulation values. The net present value of these incremental cost over a period of two years at 10% discount rate amounts to:

INCREMENTAL OPERATING COST OVER 2 YEARS **(net present value at 10 % discount rate)**	**US$** **110,000**

More details are provided in Appendix A.

6.3 Unit Abatement Cost

	Item	Units	Value
a)	ODS Reduction Project Cost	US$	1,080,000
b)	Annual Incremental Costs (after project)	US$	63,600
c)	Project Useful Life	years	10
d)	ODS Reduction/year	kg	45,000
f)	Capital Recovery factor (10 % discount rate)		0.16275

Unit Abatement Cost {[a(f) + b]/d}	US$/kg/year	5.32

7 PROJECT FINANCING

CINTER request the donation of 100% of the project costs, reflecting the 100 % local ownership, calculated on:

USD725,000
==========

8 PROJECT EXECUTION

8.1 Responsibilities

CINTER S.R.L. will coordinate with <u>OPROZ</u> the terms for all required responsibility agreements, including a description of CINTER accountability, and explicit arrangements to receive technical or managerial assistance from both federal institutions (as INTI) and/or private, domestic or foreign parties, from either international organizations (as UNDP) or from the private sector, mainly in association with equipment/raw-material suppliers.

UNDP and INTI will oversee the successfull implementation of the project. UNDP will audit at the very beginnings all the aspecto related with safety.

8.2 Project Timetable

a) Phase 1: Project Presentation

Day	Event
0	Pre-project presentation (this document)
30	Suggestions and Recommendations for modifications received. Coordination for items to be filled together with UNDP, OPROZ and INTI completed.
60	**Final Project** presentation

b) Phase 2: Project Execution (after project approval)

Day	Event
0	Signing of the Reconversion Agreement and associated documents Placing Purchase Order for equipment.
120	Equipment Reception
150	Equipment installation completed, trials start
180	Production begins.
210	Name plate production begins.

8.3 Financial Agreement and Document Signing

CINTER S.R.L. will coordinate with OPROZ all required agreements concerning project financing, including document signing arrangements.

8.4 Flow of project funding

CINTER S.R.L. will coordinate with <u>UNDP</u> and <u>OPROZ</u> the matters related to this topic at a later stage.

8.5 Project Management, Procurement and Auditing

CINTER S.R.L. will coordinate with INTI the matters related to this topic at a later stage.
It is suggested that UNDP oversees the implementation of the project and furnish technical and procedural assistance, once an agreement with the local application authorities is reached.

9 REGULATORY ACTION

This project will not require regulatory actions.

10 PROJECT IMPACT

This project will eliminate the use of, at least, 45 tons of CFC-11 in the first year of implementation. The projects employ commercially and environmentally acceptable technology and will thus be instrumen in the subsequent elimination of the use of CFCs in similar plants in Argentina.

11. ANNEXES

ANNEX-1: Incremental recurrent Costs

ANNEX-2: Technical Review

ANNEX- I: INCREMENTAL RECURRENT COSTS

The use of cyclopentane blown foam changes the product cost related yo the use of different chemicals, different formulations and higher required densities.

ASSUMPTIONS

1. PU foam production (base: 1993)
   150,000 m2/year x 50 mm = 7,500 m/3 x 40 kg/m3 = 300,000 kg PU foam
2. Required density increase: 10%
3. For materials not yet available on a regular base in Argentina, international prices plus reosanable transportation costs are assumed. This is the case for CP-compatible polyol blends and for CP itself.

4. Formulation with CFC-11 (base: 1993)

Component	U.Price, US$/kg	Parts, kg	Parts, %	Cost, US$/kg PU
Polyol	2.08	100	0.35	0.72
Isocyanate	2.08	144	0.50	1.04
CFC-11	3.10	43	0.15	0.46
PU foam				**2.23**

5. Formulation with Cyclopentane (base: 1993)

Component	U.Price, US$/kg	Parts, kg	Parts, %	Cost, US$/kg PU
Polyol	2.40	100	0.36	0.86
Isocyanate	2.60	160	0.57	1.49
Cyclopentane	2.40	20	0.07	0.17
PU foam				**2.51**

CALCULATION

	Before (CFC-11)	**After (cyclopentane)**
Price of Foam (USD/kg)	2.23	2.22
Average Foam Density (kg/m3)	40	44
Production 19 93	7,500	7,500
Cost of Foam per year (USD)	669,000	732,600
Difference After/Before (USD)	63,600	
Net present Value (2 years; 10% interest)	110,028	
Rounded (USD)	**110,000**	

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TECHNICAL ASSESSMENT

PROJECT TITLE:	CINTER S.R.L. elimination of the use of CFCs in the manufacture of sandwich polyurethane panels
(SUB)SECTOR	Rigid Foams
CP RELATIONSHIP:	Mentioned in the sector strategy
TECHNOLOGY:	The use of (Cyclo)pentane technology is acceptable, provided that safety is adequately addressed in project design and in proposed operational procedures. The technology is non-transitional. The company intends to use cyclopentane (CP). Similar products are produced in Europe using n-pentane, which is less costly but also less energy efficient. A formalized technology transfer agreement is not needed. UNDP has recognized cyclopentane specialists on its roster that can assist in the implementation. Also, chemical manufacturers offer such support to their customers where needed. The company considered, according to the document, at one time HCFC-141b but decided for a non-transitional solution. HCFC=141b would have triggered less investments, but higher incremental recurrent cost. In addition, a non-transitional cost-effective drop-in for 141b is not yet assured.
ENVIRONMENTAL IMPACT:	Cyclopentane has no ODP and a very low GWP. The substance is photochemically active and can cause smog. This is a localized phenomena and of no concern in the area where CINTER produces. Safety concerns are considerable. INTI is working with future users of cyclopentane in Argentina to come to a common approach to address this issue, related to the flammability of CP. UNDP implementation procedures include the performance of 2-3 Process Safety Audits (PSA) before (review of design), during (review of installation

during dry/wet testing) and after (commissioning) implementation of projects that include the use of highly flammable/explosive substances. Such a procedure--albeit not cheap--is considered a pre-condition for the endorsement of such projects.

PROJECT COSTS:	EQUIPMENT: All cost elements are related to the replacement of CFCs. The costs are relatively high because of the inclusion of a new press, replacing two old ones. This has been recommended by the equipment supplier as more cost-effective than retrofit of the old ones. There will not be an increase of capacity. The old machine will be scrapped. UNDP has the serial numbers of the equipment on file to avois redeployment. Training and related costs are mentioned in the budget, but not expanded upon. UNDP/INTI will have to assure the quality of the training. The original operating costs are modified upon suggestion of the reviewer. The local prices for CP-compatible polyol as well as the price for CP itself were too high and reflected the absence of current business. Also, one supplier had included an increase for MDI, which cannot be related to the use of CP. The new calculation is endorsed.
IMPLEMENTATION:	The time frame, counted from time of approval, is realistic.
RECOMMENDATIONS:	Approval as proposed.
COMMENTS:	It is understood--and endorsed--that INTI will work with prospective CP users in the sourcing of reasonable priced import as well as in triggering interest in local production.
REFERENCES:	Similar projects utilizing pentane in Egypt and Turkey.
REVIEWER:	Bert Veenendaal
DATE:	October 22, 1994

PROJECT COVER SHEET

COUNTRY:	Argentina
PROJECT TITLE:	Conversion to non-CFC technology in the production of heat exchangers for mobile air conditioning.
SECTOR COVERED:	Mobile Air Conditioning
ODS USED IN SECTOR:	627 tons CFCs (ODP)
PROJECT IMPACT:	180 tons CFC-12/year (jointly with Mirgor and Cachan Project)
PROJECT DURATION:	One (1) year
PROJECT ECONOMIC LIFE:	Ten (10) years
TOTAL PROJECT COSTS:	Incremental Capital Cost US$ 1,925,661
INTERMEDIARY FEE:	US$ 57,769
PROPOSED ODS GRANT:	US$ 1,983,430 (reflects 100 % local ownership)
UNIT ABATEMENT COST:	US$ 3.57 / kg / year (indirect unit abatement cost, for capital cost)
IMPLEMENTING AGENCY:	WORLD BANK
COORDINATING NATIONAL AGENCIES:	OPROZ - INTI
BENEFICIARY ENTERPRISE:	INTERCLIMA, S.A.

PROJECT SUMMARY

Under this project, INTERCLIMA S.A. will convert the present production of CFC-12 heat exchangers for mobile air conditioning (MAC) to HFC-134a compatible technologies. This project includes the redesign and retooling of production lines, training, and technical assistance. To assure the reduction of CFC consumption, this project has been integrated with the CACHAN project (condensers) and the MIRGOR project (unit assembly and hoses), in order to cover all system components.

PROJECT OF THE GOVERNMENT OF ARGENTINA

INTERCLIMA S.A. CONVERSION TO NON CFCs TECHNOLOGIES IN THE MANUFACTURE OF HEAT EXCHANGERS

1. GENERAL BACKGROUND

The Country Program of the Government of Argentina for the protection of the ozone layer was presented and approved in the XIII Meeting of the Executive Committee of the Multilateral Fund of the Montreal Protocol. This Country Program contains the intentions of the Government and industry to reduce and phase out the consumption of ozone depleting substances (ODS).

The Country Program calls for a total phase out of the ODS by the year 2006, and reductions in advance to the scheduled data established by the Montreal Protocol and their amendments. Reasons for such a policy are environmental impact and future international restrictions on products that contain these substances.

ODS consumption in Argentina during 1992, the base year of the Country Program, was 1,338 tons of CFC-11 and 2,408 tons of CFC-12. Due to the growth of the sectors that use ODS, the consumption has increased approximately 7% during 1993 and will increase 6% during 1994.

A strategy is being designed to address the issues associated with service, containment, and reduction of CFCs in the older vehicles. The Government of Argentina will present the project at a later date.

2. OBJECTIVE

The objective of this project is to convert the present INTERCLIMA production of CFC-12 heat exchangers (evaporators and condensers), for mobile air conditioning (MAC) units to HFC-134a compatible exchangers. Redesigning and retooling the present production lines is required. The project also includes the elimination of the use of the chlorinated solvents currently needed for cleaning and which will be controlled in the future by the Montreal Protocol.

3. SECTOR BACKGROUND

In 1993, the Argentinian automobile industry produced 300,000 vehicles. This production has increased greatly during the present year. Taking into account the production programs of the domestic auto manufacturers CIADEA (Renault), SEVEL (Fiat, Peugeot)

and Autolatina Argentina (Ford and Volkswagen), 1994 automobile production will reach 400,000 units.

Approximately 45% to 50% of new vehicles have air conditioning units. In addition, there is strong demand in the after market for MAC units, since around 10% of the cars less than one year old install an air conditioning unit after entering circulation.

Taking into account these figures, and considering that the average charge is 1 kg per unit, present CFC-12 consumption is around 200 tons per year for new units.

Approximately 1,700,000 vehicles in Argentina have air conditioning. Assuming that every 3 to 4 years the units are recharged and that each service consumes 0.8 kg, 427 ton per year are consumed in servicing activities.

The production structure of this sector is based on 4 companies, according to the following:

INTERCLIMA:
Produces condensers and evaporators for MIRGOR S.A and for VALEO Brazil.

CACHAN:
Produces radiators and condensers. Major part of its condenser production is for MIRGOR S.A.

MIRGOR:
Provides complete systems to the domestic auto manufacturers. Produces hose assemblys for the systems, assembles condensers and evaporators provided by CACHAN and INTERCLIMA respectively and imports the compressors. Its customers are CIADEA (Renault) and SEVEL (Fiat y Peugeot). Units provided represent around 75% of the domestic market.

SISTEMAIRE:
Provides complete systems to the domestic auto manufacturer AUTOLATINA Argentina, produces condensers, evaporators, and hoses assemblys. It shares 25% of the complete MAC units market.

The Country Program calls for the phaseout of CFCs in the MAC sector on or before the year 2000 for new equipment, and phaseout of CFCs consumption in servicing activities on or before the year 2004.

The strategy for the sector is as follows:

a) Define and present the three integrated projects simultaneously: MIRGOR, INTERCLIMA, and CACHAN. Such an approach serves to take into account that in

the domestic market, INTERCLIMA and CACHAN are important suppliers to MIRGOR. An advantage is that the issue of double counting can be avoided.

b) One project to convert the heat exchanger and hoses production and the assembly line by SISTEMAIRE.

c) One project for recovery and recycling of CFC-12 and training for service activities.

4. ENTERPRISE BACKGROUND

INTERCLIMA produces heat exchangers, evaporators and condensers for MACs systems. Annual sales of US$ 8,617,072 were reported for 1993. Additional company data are as follows:

No. of Employees:	64
Capacity Production:	25,000 units per month
Present Production:	20,000 units per month
Annual CFC consumption:	183 Tons (indirect, jointly with MIRGOR y CACHAN)
Market share:	75% for evaporators, domestic market; 45% for condensers, domestic market
Other markets:	Brazil
Ownership:	100% Argentinean
Technology sources:	Evaporators: Valeo France and own design Condenser: own design

5. TECHNOLOGY : Overview and Selection

Currently, the only commercially viable alternative available to replace CFC-12 is HFC-134a. This refrigerant is being widely introduced in MACs in Europe, Japan and the United States.

Because of different performance and working temperatures of HFC-134a, changes in heat exchanger and hoses of the MAC systems are required.

INTERCLIMA presently produces tube and fin (T&F) condensers for MAC systems. The current tube and fin design will not meet the 20% to 35% increase in performance required for HFC-134a MAC system applications. A change in design technology to either serpentine or parallel flow (PF) is required.

T&F technology was preferred by European auto manufacturers. Therefore, Argentinian auto manufacturers, who are associated with European companies, demand INTERCLIMA to choose the PF technology.

For evaporators, it is not necessary to change the actual T&F design. But because of probable related chemical problems between HFC-134a, related oils and copper, auto manufacturers demand aluminum tubes instead of the old copper ones.

Description of the evaporator and condenser lines are included in Annexes VI and VII.

6. DESCRIPTION OF THE PROPOSED CONVERSION

The change of technologies for the production of heat exchangers (evaporators and condensers) by INTERCLIMA, demands the retooling of the production lines as follows:

Condenser: Change to parallel flow will demand:

1) Seco/Warwick Al Brazing System
Flux application system
Drying Oven
Brazing Furnace
2) Curl cut off and tube straightener
3) Final wash paint process
4) Degreasing system
5) Mass spectrometer leak text
6) Gear and mechanization of tanks

Evaporator: Items 1) , 4) and 5) are also applicable for evaporators.

Detailed tooling and the equipment required are provided in Annexes III and V, and models to be converted appear in Annex II.

7. PROJECT COSTS

7.1 Capital Costs

Capital incremental costs include tooling and shipping expenses, technical assistance, and training. A detailed cost breakdown is given in Annexes I and III. The capital costs amount to US$ 1,674,488.

7.2 Operational Costs

As operational costs would remain basically the same, this project does not include incremental costs.

7.3 Unit Abatement Cost

The CFC consumers in the mobile air conditioning sector are auto manufacturers, not the MAC system producers. In order to estimate the unit abatement cost, and taking into account that this project is part of an integral one, that also includes the CACHAN project and the MIRGOR project, an indirect CFC consumption was assumed, based on the total units that MIRGOR provides for the domestic market and some servicing consumption to units for one year, the capital cost of the three projects considered are:

US$ 1,674,488 - INTERCLIMA
US$ 30,080 - MIRGOR
US$ 2,311,707 - CACHAN

	Item	Units	Value
a)	Capital costs	US$	**4,016,275**
b)	Project Useful Life	years	10
d)	ODS Reduction/year	kg	183,000
e)	Capital Recovery factor (10 % discount rate)		0.16275
	Unit Abatement Cost [a(e) /d] - Capital Costs.	**US$/kg/year**	**3.57**

8. PROJECT FINANCING

INTERCLIMA requests the grant of 100% of the project costs, reflecting the 100% local ownership of the company. The total grant requested is thus US$ 1,983,430.

9. PROJECT EXECUTION

9.1 Responsibilities

INTERCLIMA S.A will coordinate with OPROZ the terms for all required responsibility agreements, including a description of accountability, and explicit arrangements to receive technical or managerial assistance from both federal institutions (as INTI) and/or private, domestic or foreign parties, from either international organizations (as World Bank) or from the private sector, mainly in association with equipment/raw-material suppliers.

OPROZ and INTI will oversee the successful implementation of the project. As part of their supervisory role, they will ensure the proper disposition of the CFC-12 equipment. If it is possible to retool for another industry, that will be the preferred approach. Equipment which cannot be retooled will be destroyed.

9.2 Project Timetable

The new assembly line will be ready within the 15 month of beginning the project. The development of components to start production in estimated around the 4th month (including testing approval by customers). The implementation schedule is given in annex V.

10. REGULATORY ACTION

This project will not require regulatory actions.

11. PROJECT IMPACT

This project, jointly with the MIRGOR and the CACHAN projects, will contribute to eliminate the use of, at least, 183 tons of CFC-12 in the first year of implementation. The projects employs commercially and environmentally acceptable technologies, and will thus be instrumental in the subsequent elimination of the use of CFCs in similar plants in Argentina.

ANNEX I

INTERCLIMA, S.A.
PROJECT ESTIMATE COST

			INCREMENTAL
EQUIPMENT (Annex II)			1,438,415
SHIPPING	Cost to port to entry BS.AS		51,450
(Annex II)	Cost to port BS.AS - Rio Grande		54,773
TRAINING	(Ams. Burr-Oak, Kinsburg, Livernois)		129,850
IMPORT TAX			0
		Sub-Total	1,674,488
Contingency 15%			251,173
		TOTAL	1,925,661

ANNEX II

TABLE I

TYPE DESIGNS SUITABLE FOR HFC-134a
(AC) AIR CONDITIONING SYSTEM
AND THEIR APPLICATION FOR INTERCLIMA'S CUSTOMERS

AC COMPONENT	DESIGN CHARACTERISTIC			HFC 134A APPLICATION
	TUBE WIDTH	CENTER HEIGT		
PARALELL FLOW	18.7	9.83		A
	Depht	Long	Higth	
TUBE AND FIN	79	180	166	B
	79	220	203	C
	79	270	203	D
	79	285	203	E
	79	245	152	F
	79	321	178	G
	79	263	229	H

		DESIGN APPLICATION	
CUSTOMER VEHICLE	MODEL	PARALELL FLOW Condenser	TUBE AND FI Evaporato
MIRGOR SACIFIA	DUNA	A	C
	UNO	A	B
	REGATTA	A	-,-
	504	A	C
	505	-,-	D
	405	A	E
	9	-,-	F
	19	-,-	G
	21	-,-	H
VALEO CLIMATIZACAO L	SANTANA	-,-	H

ANNEX II
TABLE II
INTERCLIMA CUSTOMER DESIGN CHANGES BY VEHICLE MODEL
AND DESIGN CHANGE TYPE

CUSTOMER	MODEL(s)	CHANGE TYPE 1	2	3	ESTIMATED YEARL VOLUME EVAPORATO	CONDENSER
MIRGOR SACIFIA	DUNA	X			11,040	11,040
	UNO	X			15,400	15,400
	REGATTA	X			0	2,480
	504	X			13,572	8,112
	505	X			4,480	
	405	X			8,000	8,000
	9	X			17,280	
	11	X			6,000	
	19	X			34,800	
	21	X			5,200	
VALEO CLIMATIZACAO	SANTANA	X			34,848	
		Subtotal			150,620	45,032
MIRGOR SACIFIA	DUNA VVM		X		3,500	
	504		X		1,000	
	CLIO		X		5,000	
	178		X		5,000	
	306		X		4,000	
		Subtotal			18,500	0
MIRGOR SACIFIA	DUNA			X	800	11,040
	UNO			X	0	15,400
	9			X	0	17,280
	19			X	0	34,800
	21			X	0	5,200
	GOL			X	1,500	1,500
	ORION			X	1,500	1,500
VALEO CLIMATIZACAO	ESCORT			X	1,500	1,500
MIRGOR SACIFIA	MERCEDES BENZ			X	300	300
	SCANIA			X	300	300
		Subtotal			5,100	77,780
		TOTAL			174,220	122,812

1 - For ACC units on present production that require to be redesign for HFC-134a.
2 - For ACC units in proyect design process HFC-134a required to start production during 1994/95/96.
3 - For ACC units under factibility studies. HFC-134a requiered.

ANNEX III
EQUIPMENT COST BREAKDOWN

DESCRIPTION	IMPORT OR LOCAL	EQUIPMENT COST A	TOTAL COST B	TOTAL COST C=A+B	SHIPPING		TOTAL US DOLLAR F=C+D+E
					TO BA D	TO RG E	
01- Multivoid single flat tube cutoff unit	I	31,895		31,895	383	829	33,107
01- Hitch feed assembly: 3-foot tandem (2 axis)	I	31,760		31,760	381	826	32,967
01- End sizing station programmable	I	38,535		38,535	462	1,002	39,999
01- End sizing clamp jaws	I	995		995	12	26	1,033
01- Powdered tube loading unit	I	5,895		5,895	71	153	6,119
01- Two plane tube straightener: w/ sizing (special)	I	25,975		25,975	312	675	26,962
01- Single station scoring, cutoff and pull-apart	I	28,230		28,230	339	734	29,303
01- Coil stand w/ power assist (modification)	I	5,700		5,700	0	300	6,000
01- Air brake	I	570		570	7	15	592
01- Plywood cardboard reel supports	I	680		680	8	18	706
01- Tooling (basic, one dimension, ceramic rolls)	I	26,195		26,195	314	681	27,190
01- Tooling: edge roller shaft mounted ceramic per dimension	I	8,160		8,160	98	212	8,470
01- Stacker shuttle - 2 position with scrap collector	I	15,610		15,610	187	406	16,203
01- Adjustable stacker guide tube	I	2,955		2,955	35	77	3,067
02- Corrugated fin	I	187,650		187,650	2,252	4,879	194,781
04- Straight and fit header pipe	I	132,500		132,500	1,590	3,445	137,535
04- Placement baffle	I	63,200		63,200	758	1,643	65,601
06- Degreaser	I	270,000		270,000	3,240	7,020	280,260
07- Die and press pole for end cap, baffle and side support	I	32,000		32,000	0	832	32,832
08- Core builder	L	25,000		25,000	0	5,000	30,000

DESCRIPTION	IMPORT OR LOCAL	EQUIPMENT COST A	TOTAL COST B	TOTAL COST C=A+B	SHIPPING		TOTAL US DOLLAR F=C+D+E
					TO BA D	TO RG E	
09- Seco/Warwick Fluxer as herein specified	I	86,250		86,250	2,965	1,700	90,915
09- Seco/Warwick Dry-off oven as herein specified	I	90,970		90,970	3,230	1,852	96,052
09- Seco/Warwick Aluminum brazing furnace	I	935,700		935,700	33,240	19,055	987,995
10- Helium mass spectrometer turbo test MD-180T	I	21,000		21,000	252	546	21,798
11- Perforator of header pipe	I	109,500		109,500	1,314	2,847	113,661
TOTALS		2,176,925		2,176,925	51,450	54,773	2,283,148

Note: Eligible incremental costs are calculated on basis of 50% of Degreaser, Seco-Warwick, and mass spectrometer (06, 09, 10).

ANNEX IV
TOOL AND EQUIPMENT LIST

EQUIPMENT/TOOLS	REFERENCE NUMBER
SECO/WARWICK Fluxer	1
SECO/WARWICK Dry-off oven	2
SECO/WARWICK Aluminum brazing furnace	3
Degreaser	4
Multivoid single flat tube custoff unit	5
Hitch feed assembly	6
End sizing station programmable	7
Core builder	8
End sizing clam jaws	9
Powered tube loading unit	10
Two plane tube straightener	11
Single station scoring, cutoff and pull-apart	12
Coil stand modification	13
Air brake	14
Plywood cardboard reel supports	15
Tooling basic ceramics rolls	16
Tooling edge rollers shaft	17
Stacker, shuttle	18
Adjustable stacker guide tube	19
Straightener and fit header pipe	20
Perforator of header pipe	21
Placement baffle	22
Corrugated fin	23
Die and press pole for end cap and baffle	24

ANNEX IV

EQUIPMENT / TOOLS REFERENCE NUMBERS / APPLICATION TO CUSTOMER MODELS

CUSTOMER	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
CARRY OVER MODELS																									APPLICATIONS TOTAL
MIRGOR SACIFIA	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	24
DUNA	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	24
UNO	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	24
REGATTA	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	24
504	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	24
505	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	24
405	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	24
9	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	24
19	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	24
21	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	24
VALEO CLIMATIZACAO																									
SANTANA	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	24

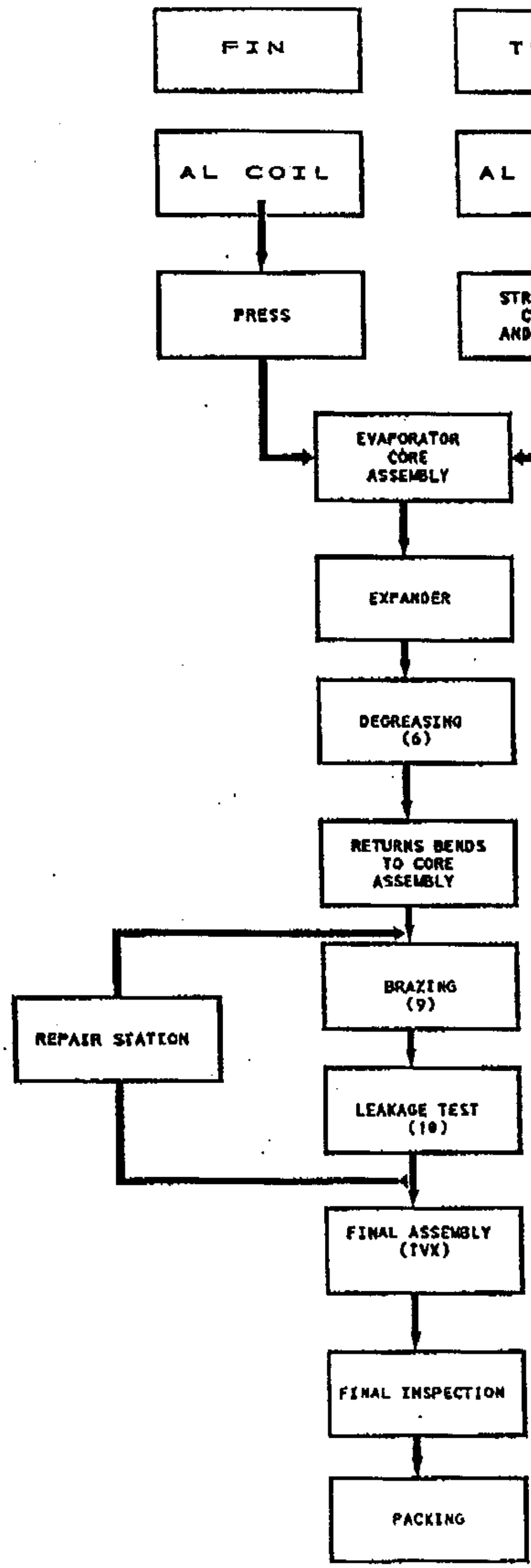
ANNEX V

IMPLEMENTATION SCHEDULE FOR PARALELL FLOW CONDENSER AND ALL ALUMINUN EVAPORATOR

NUMBER	STEP	PHASE	TIME
1	TECHNOLOGY SELECTIO	-Technology Exchange at SECO WARWICK with INTERCLI -Train INTERCLIMA Personnel on Paralell Flow Manuf Process	1/8 mont 1/8 mont
2	PRODUCT DESIGN	-Design to achive Customers Spec's	3 month 4 month
3	PURCHASE ORDER OF EQUIPMENT	-Purchase Orders to Various Suppliers -Build to Specifications	1/2 mont 12 month
4	ARRANGEMENT	-Site Preparation -Certification and Functional Check of Equipment (	1 month 1/2 mont
5	TRANSPORTATION	-Packing and Dispatch -Overseas to Buenos Aires, Argentine -Transport to INTERCLIMA	1/2 mont 1 month 1/2 mont
6	INSTALLATION	-Complete Equipment Installation -Complete Site Preparation	1 month 1 month
7	PROCESS CAPABILITY CHECK	-Train INTERCLIMA Personnel on Proper Equipment Op Equipment Manufacturer's Personnel/Consulting Eng -Train Run and Debug Problems	2 month 1 month
8	TEST	- Prototypes Manufacturing - Perfomance, Funcionability and Durability Testin	1 month 2 month
9	PRODUCTION	-Start full production.	19 month

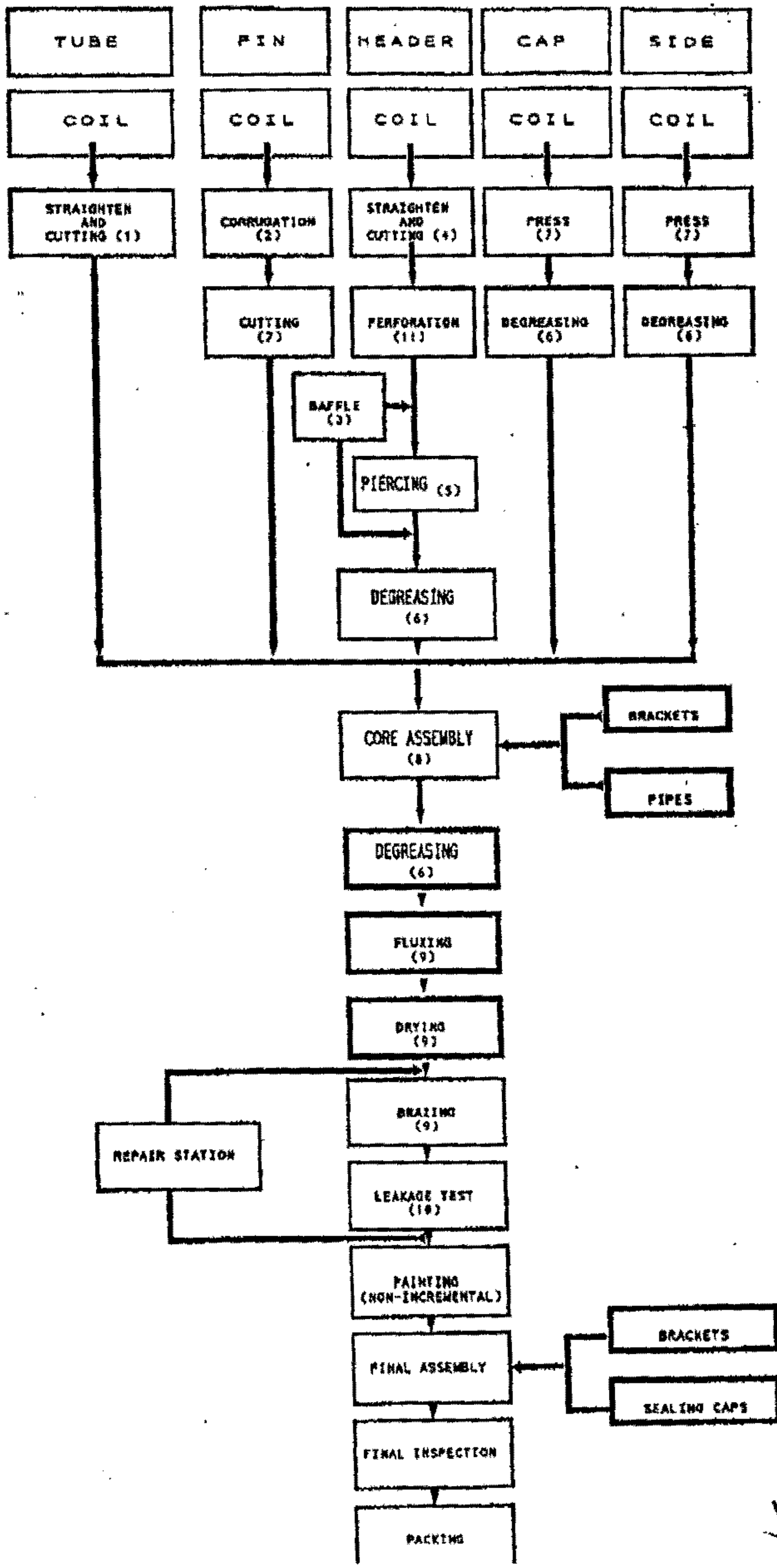
ANNEX VI

" EVAPORATOR ASSEMBLY LINE "



ANNEX VII

"CONDENSER ASSEMBLY LINE"



OZONE OPERATIONS RESOURCE GROUP REVIEW

ANNEX VIII

COUNTRY:	REPUBLIC OF ARGENTINA	Pg. 1
PROJECT TITLE:	CONVERSION TO NON-TECHNOLOGY IN THE PRODUCTION OF HEAT EXCHANGERS FOR MOBILE AIR CONDITIONERS.	
PROJECT ENTERPRISES:	MIRGOR, INTERCLIMA AND SIMON CACHAN	
SECTOR/SUB-SECTOR:	MOBILE AIR CONDITIONING (MAC)	
REFERENCE:	Meeting at World Bank Offices 11/24/94, and two Preliminary Reviews	

RELATIONSHIP TO COUNTRY PROGRAM:

The project preparers have noted that a strategy is needed and is being developed to treat issues related to the fleet of older cars, CFC-12 availability for service, retrofit options and sector policies (including possible government tax interventions). It is suggested that a training component for the service industry in containment and contaminant reduction in CFC-12 systems, and cleanliness control in HFC-134a systems be considered within the sector strategy. The program should also consider the positive effects of improved manufacturing and service prior to conversion of the manufacturing facilities.

TECHNICAL SOUNDNESS:

These proposals identify the technical support sources and their anticipated costs. The sources identified for technology acquisition are believed to be competent.

It is expected that the government in its sector strategy will include provisioning for good penetration into the application and service field outside the primary objective of CFC containment in MACs.

RELEVANCE AND ADEQUACY OF INFORMATION PROVIDED:

The information, along with the proposals of each firm with regard to machinery and equipment appears to define the project and the anticipated expenses adequately. There is some uncertainty that the request for incremental operational costs can be justified given that this is an integrated conversion project affecting 80 percent of the producers. Thus, the price changes would be expected to be virtually sector-wide and Government intervention and public education could provide a simultaneous impact.

It is recognized that this is a portion of the total program for MACs and the rest of the program is currently undefined.

ENVIRONMENTAL IMPACT:

The inclusion of mass spectrometer leak testing infers a product with less leaks and therefore less service requirements. This is desirable and will contribute to reduction of the emissions of HFC-134a (a greenhouse gas). It is anticipated that the aforementioned sector strategy will incorporate the need for reduction of leakage of CFC-12 (an ODS) in the service sector. The reduction of leakage of CFC-12 in current production and service is not addressed.

SAFETY ISSUES:

To the knowledge of this reviewer, there are not any unique safety practices required for the handling of HFC-134a or HFC-134a products. There are however, safety practices associated with interchangeability of parts for mechanical and functional reliability that service personnel must be aware of. It is expected that adequate training and control of intrerchangeability of parts through design control will cover all unique safety considerations.

PROJECT COSTS:

The unit abatement cost (UAC) is reported as $6.64/kg/yr. Any review should be considered by those with more understanding of the consequences and alternatives and with more time allocated in the review program.

The inclusion of mass spectrometery leak detection in the manufacturing program for CFC-12 systems, instead of waiting for the conversion to HFC-134a systems should be considered.

In the case of SIMON CACHAN, painting and packaging systems are listed in the description of the proposed conversion as well as a "box price" (paragraph 7.1-1) and safety equipment (annex III, last two items on the first page). Justification for these expenses should be reviewed.

IMPLEMENTATION TIMEFRAME(S):

CACHAN The 10 quarter implementation time (2.5 yrs.) should be adequate in the case of SIMON CACHAN.

INTERCLIMA The 19 month implementation time is extremely optimistic but feasible.

MIRGOR No timeframe is specified, but it is suspected to correspond to the introduction of new models. If this is the case, the portion of tooling associated with model change should be separated from the portion of the costs associated with recovering the loss in performance due to the use of HFC-134a.

RECOMMENDATIONS:

CACHAN It is opinion of this reviewer that the proposed project is within the scope of our objectives and should be approved.

INTERCLIMA It is the opinion of this reviewer that the proposed project is within the scope of fundable projects.

MIRGOR It is opinion of this reviewer that the proposed project is within the scope of fundable projects.

OORG REVIEW________________________Robert H. Proctor

DATE OF REVIEW________________________12 November, 1994

PROJECT COVER SHEET

COUNTRY:	Argentina
PROJECT TITLE:	Conversion to non-CFC technology in the production of condensers for mobile air conditioning.
SECTOR COVERED:	Mobile Air Conditioning
ODS USED IN SECTOR:	627 tons CFCs (ODP)
PROJECT IMPACT:	180 tons CFC-12/year (jointly with Mirgor and Interclima Project)
PROJECT DURATION:	One (1) year
PROJECT ECONOMIC LIFE:	Ten (10) years
TOTAL PROJECT COSTS:	US$ 2,658,463 Incremental Capital Cost
INTERMEDIARY FEE:	US$ 79,750
PROPOSED ODS GRANT:	US$ 2,738,217 (reflects 100 % local ownership)
UNIT ABATEMENT COST:	US$ 3.57/kg/year (indirect unit abatement cost, for capital cost)
IMPLEMENTING AGENCY:	WORLD BANK
COORDINATING NATIONAL AGENCIES:	OPROZ - INTI
BENEFICIARY ENTERPRISE:	SIMON CACHAN, S.A.

PROJECT SUMMARY

Under this project, CACHAN S.A. will convert the present production of CFC-12 condensers for mobile air conditioning (MAC) to HFC-134a compatible technologies. This project includes the redesign and retooling of production lines, training, and technical assistance. To assure the reduction of CFC consumption, this project has been integrated with the INTERCLIMA project (condensers and evaporators) and the MIRGOR project (unit assembly and hoses), in order to cover all system components.

PROJECT OF THE GOVERNMENT OF ARGENTINA

SIMON CACHAN S.A. CONVERSION TO NON CFCs TECHNOLOGIES IN THE MANUFACTURE OF CONDENSERS FOR MOBILE AIR CONDITIONING HEAT EXCHANGERS

1. GENERAL BACKGROUND

The Country Program of the Government of Argentina for the protection of the ozone layer was presented and approved in the XIII Meeting of the Executive Committee of the Multilateral Fund of the Montreal Protocol. This Country Program contains the intentions of the Government and industry to reduce and phase out the consumption of ozone depleting substances (ODS).

The Country Program calls for a total phase out of the ODS by the year 2006, and reductions in advance to the scheduled data established by the Montreal Protocol and their amendments. Reasons for such a policy are environmental impact and future international restrictions on products that contain these substances.

ODS consumption in Argentina during 1992, the base year of the Country Program, was 1,338 tons of CFC-11 and 2,408 tons of CFC-12. Due to the growth of the sectors that use ODS, the consumption has increased approximately 7% during 1993 and will increase 6% during 1994.

A strategy is being designed to address the issues associated with service, containment, and reduction of CFCs in the older vehicles. The Government of Argentina will present the project at a later date.

2. OBJECTIVE

The objective of this project is to convert the present CACHAN production of CFC-12 condensers for the mobile air conditioning units to HFC-134a compatible condensers. Redesigning and retooling the present production lines are required. The project also included the elimination of the use of the chlorinated solvents needed for cleaning, which will be restricted in the future by the Montreal Protocol.

3. SECTOR BACKGROUND

In 1993, the Argentinian automobile industry produced 300,000 vehicles. This production has increased greatly during the present year. Taking into account the production programs of the domestic auto manufacturers CIADEA (Renault), SEVEL (Fiat, Peugeot)

and Autolatina Argentina (Ford and Volkswagen), 1994 automobile production will reach 400,000 units.

Approximately 45% to 50% of new vehicles have air conditioning units. In addition, there is strong demand in the after market for MAC units, since around 10% of the cars less than one year old install an air conditioning unit after entering circulation.

Taking into account these figures, and considering that the average charge is 1 kg per unit, present CFC-12 consumption is around 200 tons per year for new units.

Approximately 1,700,000 vehicles in Argentina have air conditioning. Assuming that every 3 to 4 years the units are recharged and that each service consumes 0.8 kg, 427 ton per year are consumed in servicing activities.

The production structure of this sector is based on 4 companies, according to the following:

INTERCLIMA:
Produces condensers and evaporators for MIRGOR S.A and for VALEO Brazil.

CACHAN:
Produces radiators and condensers. Major part of its condenser production is for MIRGOR S.A.

MIRGOR:
Provides complete systems to the domestic auto manufacturers. Produces hose assemblys for the systems, assembles condensers and evaporators provided by CACHAN and INTERCLIMA respectively and imports the compressors. Its customers are CIADEA (Renault) and SEVEL (Fiat y Peugeot). Units provided represent around 75% of the domestic market.

SISTEMAIRE:
Provides complete systems to the domestic auto manufacturer AUTOLATINA Argentina, produces condensers, evaporators, and hoses assemblys. It shares 25% of the complete MAC units market.

The Country Program calls for the phaseout of CFCs in the MAC sector on or before the year 2000 for new equipment, and phaseout of CFCs consumption in servicing activities on or before the year 2004.

The strategy for the sector is as follows:

a) Define and present the three integrated projects simultaneously: MIRGOR, INTERCLIMA, and CACHAN. Such an approach serves to take into account that in

the domestic market, INTERCLIMA and CACHAN are important suppliers to MIRGOR. An advantage is that the issue of double counting can be avoided.

b) One project to convert the heat exchanger and hoses production and the assembly line by SISTEMAIRE.

c) One project for recovery and recycling of CFC-12 and training for service activities.

4. ENTERPRISE BACKGROUND

SIMON CACHAN is a 100% Argentinian company founded in 1907. The company manufactures in two plants (one in Buenos Aires and one in San Luis). In addition to MAC condensers, CACHAN's products include automobile radiators, and oil and air coolers. Reported annual sales are US$ 10,994,130. Additional company data are as follows:

No. of Employees:	187
Capacity Production:	176,000 units per month
Present Production:	143,000 units per month
Annual CFC consumption:	183 Tons (indirect, jointly with MIRGOR and INTERCLIMA)
Market share:	80% for MAC, domestic market
Other markets:	Brazil
Ownership:	100% Argentinian
Technology sources:	Condenser: own design

Simon Cachan is the only manufacturer of all aluminum serpentines. It has developed an own technology based on an aluminum multichannel tube, bent into a serpentine shape and surrounded by aluminum fins. It has adopted a brazing technology, ALFUSE, licensed by MODINE, Mfg. Co. (Racine - USA).

5. TECHNOLOGY : Overview and Selection

Currently, the only commercially viable alternative available to replace CFC-12 is HFC-134a. This refrigerant is being widely introduced in MACs in Europe, Japan and the United States.

Because of different performance and working temperatures of HFC-134a, changes in heat exchanger and hose assemblys of the MAC systems are required.

CACHAN presently produces serpentine condensers for MAC systems. The basic serpentine design would meet the 20 to 35% increase in performance required for HFC-134a MAC systems after a redesign in order to provide additional condensation surface. This change implies a major volume and weight alteration, which will not be accepted by CACHAN customers. CACHAN's end customers are associated with European auto manufacturers, who have optimized the engine space to provide greater comfort for the occupants, and they do not agree with the requirement of additional space for a larger condensing unit. Therefore, a change in the design for the parallel flow technology is required.

6. DESCRIPTION OF THE PROPOSED CONVERSION

The Parallel Flow (PF) condenser design involves the following parts and processes:

a) Manufacture of the multichannel tube where the refrigerant condenses.
b) Manufacture of the clad aluminum fins.
c) Manufacture of the clad aluminum tanks and heads. Accessories to ensure impermeability and refrigerant flow in these parts (caps, dividers, connectors, brackets, etc.) also have to be provided.
d) Manufacture of clad aluminum sides (necessary to protect the fins and fix the condenser to the car.
e) Components degreasing, washing, and drying.
f) Assembly of the above components.
g) Fluxing and drying of the set in a nitrogen atmosphere.
h) Preheating, furnace brazing, and cooling in nitrogen atmosphere.
i) Pressurization and leakage test.
j) Painting.
k) Packaging.

To effect the changeover, this manufacturing process requires the following new tools and equipment:

1) Aluminum brazing system which includes:
   Flux application system
   Drying oven
   Brazing Furnace
2) Fin machines
3) Microextruded tube straightener and cutter
4) Assembly machine
5) Washing, drying, fluxing, predrying, preheating, brazing, and cooling equipments
6) Mass spectrometer leak test machine
7) Painting and packaging systems
8) Devices and gauges quality control equipment

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f) Assembly of the above components.
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h) Preheating, furnace brazing, and cooling in nitrogen atmosphere.
i) Pressurization and leakage test.
j) Painting.
k) Packaging.

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   Flux application system
   Drying oven
   Brazing Furnace
2) Microextruded tube straightener and cutter
3) Assembly machine
4) Washing, drying, fluxing, predrying, preheating, brazing, and cooling equipments
5) Mass spectrometer leak test machine
6) Painting and packaging systems
8) Fin machine and gauges modification

Detailed tooling and the equipment required are provided in Annex II. Implementation schedules appear in Annex III. Annex V is a 50 page compilation of quotations requested by the company and is in the WORLD BANK SIMON CACHAN project file.

7. PROJECT COSTS

7.1 Capital Costs

Incremental Capital costs include tooling and shipping expenses, technical assistance and training. A detailed cost breakdown is given in Annex II. The capital costs amount to US$ 2,311,707 not including 15% continency.

7.2 Cachan Project Total Costs

US$ 2,658,463 with contingency.

7.3 Unit Abatement Cost

The CFC consumers in the MAC sector are auto manufacturers, not the MAC system producers. In order to estimate the unit abatement cost, and taking into account that this project is part of an integrated one, that also includes the INTERCLIMA project and the MIRGOR project, an indirect CFC consumption was assumed, based on the total units that MIRGOR provides for the domestic market and some servicing consumption to units for one year. The capital cost of the three projects considered are:

US$ 1,674,488 - INTERCLIMA
US$ 30,080 - MIRGOR
US$ 2,311,707 - CACHAN

Item		Units	Value
a)	Capital costs	US$	**4,016,275**
b)	Project Useful Life	years	10
d)	ODS Reduction/year	kg	183,000
e)	Capital Recovery factor (10 % discount rate)		0.16275
	Unit Abatement Cost [a(e) /d] - Capital Costs.	**US$/kg/year**	**3.57**

8. PROJECT FINANCING

CACHAN requests the grant of 100% of the project costs, reflecting the 100% local ownership, based on US$ 2,738,217. This includes 3% intermediary fee of US$ 79,750.

9. PROJECT EXECUTION

9.1 Responsibilities

CACHAN will coordinate with OPROZ the terms for all required responsibility agreements, including a description of accountability, and explicit arrangements to receive technical or managerial assistance from both federal institutions (as INTI) and/or private, domestic or foreign parties, from either international organizations (as World Bank) or from the private sector, mainly in association with equipment/raw-material suppliers.

OPROZ and INTI will oversee the successful implementation of the project. As part of their supervisory role, they will ensure the proper disposition of the CFC-12 equipment. If it is possible to retool for another industry, that will be the preferred approach. Equipment which cannot be retooled will be destroyed.

9.2 Project Timetable

The implementation schedule is given in Annex III.

10. REGULATORY ACTION

This project will not require regulatory actions.

11. PROJECT IMPACT

This project, jointly with the MIRGOR and the INTERCLIMA projects, will contribute to eliminate the use of, at least, 183 tons of CFC-12 in the first year of implementation. The project employs commercially and environmentally acceptable technologies, and will thus be instrumental in the subsequent elimination of the use of CFCs in similar plants in Argentina.

In the present production line, the components require vigorous washing which generate harmful pollutants that require neutralizing of this water and vapor products. As an additional benefit, the use of the new technology eliminates the production of contaminant vapors and water.

ANNEX I

ESTIMATE OF THE TOTAL PRODUCTION OF CONDENSERS

BY SIMON CACHAN FOR 1994.

a)	Market of automotive vehicle manufacturers.	
	Simón Cachan S.A.'s share of the market	85,072 units
b)	Export market	2,500 units
c)	Domestic aftermarket (12 months)	30,000 units
	Total estimated sales for 1994	117,572 units

PARTIAL MARKET

Estimate of the 1994 production of condensers by Simón Cachan S.A. for the original equipment manufacturers market (OEM).

Production intended for Sevel (Fiat and Peugeot), Ciadea (Renault) and Scania Argentina.

MODEL	TOTAL NUMBER OF VEHICLES EQUIPPED WITH AIR CONDIT.
504 SRD II	8,112
505 Carburetor	3,000
505 Injection	400
505 Diesel	1,080
405 C	8,000
Renault 9	17,280
Renault 11	6,000
Renault 19	34,800
Renault 21	5,200
Scania	1,200
TOTAL	85,072

% 11 months, 7,733 per month

TOTAL ARGENTINE MARKET

Estimate of Simón Cachan S.A.'s share of the original equipment manufacturers market (OEM) for 1994 = Condensers for vehicles equipped with air conditioners produced by Sevel, Autolatina, Ciadea and Scania.

Sevel	54,972 vehicles
Autolatina	33,958 vehicles
Ciadea	63,280 vehicles
Scania (trucks)	1,200 vehicles
	153,410 vehicles

equipped with air conditioners during 1994.

Vehicles equipped with condensers produced by Simón Cachan	85,072

Simón Cachan's share of the condenser market for air conditioners in the Argentine OEM market: 55.45%

ANNEX II

PROJECT COSTS

Capital Costs

ESTIMATED COST

DESCRIPTION	PURCHASE VALUE	TRANSPORT	INSURANCE	TOTAL
1. Technical assistance (S.A. DAY)	150,000			150,000
2. Microextruded tubes cutter and straightener (Bulad)	150,000	2,000	200	152,000
3. Tube trayers	80,000	2,000	200	82,200
4. Fin trayers (McKenica)	70,000			
5. Core assembly machine (McKenica)	417,800			
6. Motorized conveyor (McKenica)	20,000			
7. Semi automatic header machine (McKenica)	62,500			
8. Transport, insurance, and total cost for items 4 to 7		12,700	7,000	590,000
9. Washing and drying system (Seco Warwick)	157,500	6,017	1,450	164,967
10. Fluxing, drying, pre-heating, brazing and cooling line (Seco Warwick)	780,950	116,750	79,400	977,100
11. Flux concentrate station	20,000			20,000
12. Mass spectrometer	21,000			21,000
13. Connector soldering station (estimated)	40,000			40,000
14. Insert machine for end caps and header dividers	10,000			10,000
15. Fin machine tooling (McKenica)	80,420			80,420
16. Molds for fin trays	24,000			24,000
Subtotal				2,311,707
17. Contingency: 15% of subtotal				346,756
TOTAL				2,658,463

ASSEMBLY OF PFC CONDENSERS -- COUNSELING AGREEMENTS

Ref No	Description	Amount	Estimated cost	Imported	Local	Estimated transport cost		Total estimated cost
						Supplier to plant	Insurance	
2C	Technical counseling and support	1	150,000	X				150,000

ASSEMBLY OF PFC CONDENSERS -- EQUIPMENT

Ref No	Description	Amount	Estimated cost	Imported	Local	Estimated transport cost		Total estimated cost
						Supplier to plant	Insurance	
1E	Microextruded tubes cutter and straigthener	1	150,000		X	2,000	200	152,200
2E	Tube tray	1	80,000		X	2,000	200	82,200
3E	Fin tray	1	70,000		X			
4E	Core assembly machine	1	417,800	X				
5E	Motorized conveyor	1	20,000	X				
6E	Semi automatic header machine	1	62,500	X				
	Transport and total costs for 3E to 6E					12,700	7,000	590,000
7E	Washing and drying system	1	157,500	X		6,017	1,450	164,967
8E	Fluxing, drying, preheating, brazing, and cooling line	1	780,950	X		116,750	79,400	977,100
9E	Flux concentrate station	1	20,000		X			20,000
10E	Mass spectrometer	1	21,000		X			21,000
11E	Connector soldering station	1	40,000		X			40,000
12E	Insert machine for end caps and header dividers	1	10,000		X			10,000

ASSEMBLY OF PFC CONDENSERS -- TOOLING

Ref No	Description	Amount	Estimated cost	Imported	Local	Estimated transport cost		Total estimated cost
						Supplier to plant	Insurance	
1T	Fin machine tooling	1	80,420	X		Included in McKenica machine		80,420
2T	Molds for fin trays	1	24,000	X		Included in McKenica machine		24,000

ANNEX III

ACTIVITY	QUARTER									
	1st	2st	3rd	4th	5th	6th	7th	8th	9th	10th
Technical assistance			25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000
Fin machine				120,000		120,000		154,709		
Microextruded tubes straightener cutter and trayer				74,880	74,880	74,880	74,880	74,880		
Tooling				68,737	68,737	68,737	68,737	68,737	68,737	
Assembly machines				140,000		140,000		188,016		
Washing, drying, fluxing, and brazing line				365,000		365,000		482,067		
Leakage test				55,000		55,000		60,578		
Devices and gages					100,000	50,400				
Unforeseen costs				84,560	84,560	84,560	84,560	84,560	84,560	
TOTAL			25,000	933,177	253,177	945,677	365,677	1,201,447	190,797	25,000

ACTIVITY	QUARTER									
	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
PROJECT DESCRIPTION	XXX									
FINAL DRAFT	XXX									
FORWARDING OF LEGAL DOCUMENT	XXX									
FINANCIAL NEGOTIATIONS		XXX	XXX							
SIGNING OF DOCUMENTS				XXX						
PAYMENTS				XXX						
PURCHASE				XXX						
BUILDING					XXX	XXX	XXX	XXX		
INSTALLATION								XXX	XXX	
ADJUSTMENT									XXX	
START UP										XXX

Start up: 1/7 October'96

OZONE OPERATIONS RESOURCE GROUP REVIEW

ANNEX IV

COUNTRY: REPUBLIC OF ARGENTINA

PROJECT TITLE: CONVERSION TO NON-TECHNOLOGY IN THE PRODUCTION OF HEAT EXCHANGERS FOR MOBILE AIR CONDITIONERS.

PROJECT ENTERPRISES: MIRGOR, INTERCLIMA AND SIMON CACHAN

SECTOR/SUB-SECTOR: MOBILE AIR CONDITIONING (MAC)

REFERENCE: Meeting at World Bank Offices 11/24/94, and two Preliminary Reviews

RELATIONSHIP TO COUNTRY PROGRAM:

The project preparers have noted that a strategy is needed and is being developed to treat issues related to the fleet of older cars, CFC-12 availability for service, retrofit options and sector policies (including possible government tax interventions). It is suggested that a training component for the service industry in containment and contaminant reduction in CFC-12 systems, and cleanliness control in HFC-134a systems be considered within the sector strategy. The program should also consider the positive effects of improved manufacturing and service prior to conversion of the manufacturing facilities.

TECHNICAL SOUNDNESS:

These proposals identify the technical support sources and their anticipated costs. The sources identified for technology acquisition are believed to be competent.

It is expected that the government in its sector strategy will include provisioning for good penetration into the application and service field outside the primary objective of CFC containment in MACs.

RELEVANCE AND ADEQUACY OF INFORMATION PROVIDED:

The information, along with the proposals of each firm with regard to machinery and equipment appears to define the project and the anticipated expenses adequately. There is some uncertainty that the request for incremental operational costs can be justified given that this is an integrated conversion project affecting 80 percent of the producers. Thus, the price changes would be expected to be virtually sector-wide and Government intervention and public education could provide a simultaneous impact.

It is recognized that this is a portion of the total program for MACs and the rest of the program is currently undefined.

ENVIRONMENTAL IMPACT:

The inclusion of mass spectrometer leak testing infers a product with less leaks and therefore less service requirements. This is desirable and will contribute to reduction of the emissions of HFC-134a (a greenhouse gas). It is anticipated that the aforementioned sector strategy will incorporate the need for reduction of leakage of CFC-12 (an ODS) in the service sector. The reduction of leakage of CFC-12 in current production and service is not addressed.

SAFETY ISSUES:

To the knowledge of this reviewer, there are not any unique safety practices required for the handling of HFC-134a or HFC-134a products. There are however, safety practices associated with interchangeability of parts for mechanical and functional reliability that service personnel must be aware of. It is expected that adequate training and control of intrerchangeability of parts through design control will cover all unique safety considerations.

PROJECT COSTS:

The unit abatement cost (UAC) is reported as $6.64/kg/yr. Any review should be considered by those with more understanding of the consequences and alternatives and with more time allocated in the review program.

The inclusion of mass spectrometery leak detection in the manufacturing program for CFC-12 systems, instead of waiting for the conversion to HFC-134a systems should be considered.

In the case of SIMON CACHAN, painting and packaging systems are listed in the description of the proposed conversion as well as a "box price" (paragraph 7.1-1) and safety equipment (annex III, last two items on the first page). Justification for these expenses should be reviewed.

IMPLEMENTATION TIMEFRAME(S):

CACHAN The 10 quarter implementation time (2.5 yrs.) should be adequate in the case of SIMON CACHAN.

INTERCLIMA The 19 month implementation time is extremely optimistic but feasible.

MIRGOR No timeframe is specified, but it is suspected to correspond to the introduction of new models. If this is the case, the portion of tooling associated with model change should be separated from the portion of the costs associated with recovering the loss in performance due to the use of HFC-134a.

RECOMMENDATIONS:

CACHAN It is opinion of this reviewer that the proposed project is within the scope of our objectives and should be approved.

INTERCLIMA It is the opinion of this reviewer that the proposed project is within the scope of fundable projects.

MIRGOR It is opinion of this reviewer that the proposed project is within the scope of fundable projects.

OORG REVIEW________________________Robert H. Proctor

DATE OF REVIEW________________________12 November, 1994

PROJECT COVER SHEET

COUNTRY:	Argentina
PROJECT TITLE:	Conversion to non-CFC technology in the production of complete mobil air conditioning systems.
SECTOR COVERED:	Mobil Air Conditioning
ODS USED IN SECTOR:	627 tons CFCs (ODP)
PROJECT IMPACT:	180 tons CFC-12/year (jointly with Interclima and Cachan Project)
PROJECT DURATION:	One (1) year
PROJECT ECONOMIC LIFE:	Ten (10) years
TOTAL PROJECT COSTS:	Incremental Capital Cost US$ 34,592
INTERMEDIARY FEE:	US$ 1,040
PROPOSED MLF GRANT:	US$ 35,632 (reflects 100 % local ownership) Incremental Operational Cost US$ 1,882,187 (to be requested in one year)
COST EFFECTIVENESS:	US$ 3.57/kg/year (indirect unit abatement cost, for capital cost) US$ 10.3/kg/year (indirect unit abatement cost, for operational cost)
COORDINATING NATIONAL AGENCIES:	OPROZ - INTI
IMPLEMENTING AGENCY:	WORLD BANK
BENEFICIARY ENTERPRISE:	MIRGOR, S.A.

PROJECT SUMMARY

Under this project, MIRGOR will convert the present production of CFC-12 mobil air conditioning (MAC) units to HFC-134a compatible technologies. This project includes the redesign and retooling of production lines, training, technical assistance, and incremental operating costs for one year. To assure the reduction of CFC consumption, this project has been integrated with the CACHAN project (condensers) and the INTERCLIMA project (evaporators and condensers), in order to cover all system components.

PROJECT OF THE GOVERNMENT OF ARGENTINA

MIRGOR S.A. CONVERSION TO NON CFCs TECHNOLOGIES IN THE MANUFACTURE OF MOBIL AIR CONDITIONING UNITS

1. GENERAL BACKGROUND

The Country Program of the Government of Argentina for the protection of the ozone layer was presented and approved in the XIII Meeting of the Executive Committee of the Multilateral Fund of the Montreal Protocol. This Country Program contains the intentions of the Government and industry to reduce and phase out the consumption of ozone depleting substances (ODS).

The Country Program calls for a total phase out of the ODS by the year 2006, and reductions in advance to the scheduled data established by the Montreal Protocol and their amendments. Reasons for such a policy are environmental impact and future international restrictions on products that contain these substances.

ODS consumption in Argentina during 1992, the base year of the Country Program, was 1,338 tons of CFC-11 and 2,408 tons of CFC-12. Due to the growth of the sectors that use ODS, the consumption has increased approximately 7% during 1993 and will increase 6% during 1994.

A strategy is being designed to address the issues associated with service, containment, and reduction of CFCs in the older vehicles. The Government of Argentina will present the project at a later date.

2. OBJECTIVE

The objective of this project is to convert the present MIRGOR production of CFC-12 systems for mobile air conditioning to HFC-134a compatible systems. Redesign and retooling of the present assembly lines are required. Entire redesign of specific units that are not produced in Europe by the parent manufacturers will also be necessary.

3. SECTOR BACKGROUND

In 1993, the Argentinian automobile industry produced 300,000 vehicles. This production has increased greatly during the present year: Taking into account the production programs of the domestic auto manufacturers CIADEA (Renault), SEVEL (Fiat, Peugeot)

and Autolatina Argentina (Ford and Volkswagen), 1994 automobile production will reach 400,000 units.

Approximately 45% to 50% of new vehicles have air conditioning units. In addition, there is strong demand in the after market for MAC units, since around 10% of the cars less than one year old install an air conditioning unit after entering circulation.

Taking into account these figures, and considering that the average charge is 1 kg per unit, present CFC-12 consumption is around 200 tons per year for new units.

Approximately 1,700,000 vehicles in Argentina have air conditioning. Assuming that every 3 to 4 years the units are recharged and that each service consumes 0.8 kg, 427 ton per year are consumed in servicing activities.

The production structure of this sector is based on 4 companies, according to the following:

INTERCLIMA:
Produces condensers and evaporators for MIRGOR S.A and for VALEO Brazil.

CACHAN:
Produces radiators and condensers. Major part of its condenser production is for MIRGOR S.A.

MIRGOR:
Provides complete systems to the domestic auto manufacturers. Produces hose assemblys for the systems, assembles condensers and evaporators provided by CACHAN and INTERCLIMA respectively and imports the compressors. Its customers are CIADEA (Renault) and SEVEL (Fiat y Peugeot). Units provided represent around 75% of the domestic market.

SISTEMAIRE:
Provides complete systems to the domestic auto manufacturer AUTOLATINA Argentina, produces condensers, evaporators, and hoses assemblys. It shares 25% of the complete MAC units market.

The Country Program calls for the phaseout of CFCs in the MAC sector on or before the year 2000 for new equipment, and phaseout of CFCs consumption in servicing activities on or before the year 2004.

The strategy for the sector is as follows:

a) Define and present the three integrated projects simultaneously: MIRGOR, INTERCLIMA, and CACHAN. Such an approach serves to take into account that in

the domestic market, INTERCLIMA and CACHAN are important suppliers to MIRGOR. An advantage is that the issue of double counting can be avoided.

b) One project to convert the heat exchanger and hoses production and the assembly line by SISTEMAIRE.

c) One project for recovery and recycling of CFC-12 and training for service activities.

4. ENTERPRISE BACKGROUND

MIRGOR produces finished automobile air conditioning units. Annual sales of US$ 93,620,804 were reported during 1993. Facilities at the Mirgor Plant are one assembly line, one hose assembly line, and production text. Additional company data are as follows:

No. of Employees:	300
Capacity Production:	165,000 units per month
Present Production:	118,252 units per month
Annual CFC consumption:	183 Ton (indirect, jointly with INTERCLIMA and CACHAN)
Market share:	75% of domestic market
Other markets:	Brazil
Ownership:	100% Argentinian
Technology sources:	Evaporators: Valeo France and own design Condenser: own design
License agreements	VALEO TN France HARRISON Div Radiators (France - USA - Japan)

5. TECHNOLOGY : Overview and Selection

Currently, the only commercially viable alternative available to replace CFC-12 is HFC-134a. This refrigerant is being widely introduced in MACs in Europe, Japan and the United States.

Because of the different performance and working temperatures of HFC-134a, changes in heat exchangers and hoses of the MAC systems are required.

Conversion of evaporators and condensers are presented in the INTERCLIMA and CACHAN projects, but introduction of the newly designed components in the air conditioning system will require unit redesign. The same occurs with the compressor and expansion valves.

Different chemical processes associated with HFC-134a require the adoption of new hoses, dryers, and seals. Therefore, the hose assembly line has to be converted and it will be necessary to test the new components.

6. DESCRIPTION OF THE PROPOSED CONVERSION

The change of technology in the production of heat exchangers (evaporators and condenser) by INTERCLIMA demands the retooling of the production line as follows:

a) Redesign of Peugeot 505 and Regatta units.
b) Testing new units with the new components
c) Conversion of the hose production line.
d) Conversion of the assembly line.

Detailed technical specifications of required redesign are presented in Annex II.

7. PROJECT COSTS

7.1 Capital Costs

Capital incremental costs include:

1) Tooling for the hose line, procurement of equipment, and associated shipping costs (see Annex III).
Note: Each component was affected by a box price.

2) External engineering services, testing and materials for testing. (see Annex VI)

3) Training (see Annex I).

The capital costs amount to US$ 34,592.

7.2 Incremental Operational Costs

Incremental operational costs result from an increase in the prices of the compressor, expansion valve, and dehydrating tubes and hoses. The evaporators and condensers are not included in this project because they are included in the CACHAN and INTERCLIMA projects. Detailed incremental operational costs are given in Annex V. It is acknowledged that the incremental costs component of the project will require re-evaluation. However, the

Government of Argentina has requested their inclusion in the project, subject to re-evaluation of the input prices. It should also be noted that approved incremental costs in Montreal Protocol projects funded through World Bank implementation operations will be disbursed only against actual expenditures and that these will have to be verifiable in strict accordance with World Bank disbursement policies.

Operational incremental costs amount to US$ 2,091,319.

NPV (10% discount): US$ 1,882,187

7.3 Total Cost

34,592 + 1,882,187 = 1,917,819

7.4 Unit Abatement Cost

The CFC consumers in the mobile air conditioning sector are auto manufacturers, who are not the MAC system producers. Then, in order to estimate the unit abatement cost, taking into account that this project is part of an integral one, where the CACHAN project and INTERCLIMA project are involved, an indirect CFC consumption was assumed based on the total units that MIRGOR provides the domestic market and some servicing consumption for the first year of the units. The capital cost of the three projects considered are:

US$ 1,674,488 - INTERCLIMA
US$ 30,080 - MIRGOR
US$ 2,311,707 - CACHAN

Also, the incremental costs of this project were taken into account in this particular case:

	Item	Units	Value
a)	Capital costs	US$	**4,016,275**
b)	Project Useful Life	years	10
d)	ODS Reduction/year	kg	183,000
e)	Operational incremental costs	US$	1,882,187
f)	Capital Recovery factor (10 % discount rate)		0.16275
	Unit Abatement Cost [a(f) /d] - Capital Costs.	US$/kg/year	3.57
	Unit Abatement Cost [e/d] - Incremental Costs	US$/kg/year	10.30
	Total unit Abatement Costs	US$/kg/year	13.87

8. PROJECT FINANCING

MIRGOR requests the grant of 100% of the project costs, reflecting the 100% local ownership, based on US$ 35,632.

9. PROJECT EXECUTION

9.1 Responsibilities

MIRGOR SACIFIA will coordinate with OPROZ the terms for all required responsibility agreements, including a description of accountability, and explicit arrangements to receive technical or managerial assistance from both federal institutions (as INTI) and/or private, domestic or foreign parties, from either international organizations (as World Bank) or from the private sector, mainly in association with equipment/raw-material suppliers.

OPROZ and INTI will oversee the successful implementation of the project. As part of their supervisory role, they will ensure the proper disposition of the CFC-12 equipment. If it is possible to retool for another industry, that will be the preferred approach. Equipment which cannot be retooled will be destroyed.

9.2 Project Timetable

The new assembly line will be ready within 15 months from the start of project implementation. The development of components to start production is estimated to be 4 months (including testing and approval by customers). The implementation schedule is given in Annex V.

10. REGULATORY ACTION

This project will not require regulatory actions.

11. PROJECT IMPACT

This project, jointly with the CACHAN and the INTERCLIMA projects, will contribute to the elimination of consumption of, at least, 183 tons of CFC-12 in the first year of implementation. The projects utilizes commercially and environmentally acceptable technology and will thus be an efficient instrument in the subsequent elimination of the use of CFCs in similar plants in Argentina.

ANNEX I

MIRGOR SACIFIA - PROJECT ESTIMATE COST

		INCREMENTAL
TOOLING (Annex III)		23,284
SHIPPING	Cost to port to entry BS.AS	1,164
(Annex III)	Cost to port BS.AS - Rio Grande	1,632
LICENSE		0
TRAINING	Internal training courses	4,000
IMPORT TAX		0
	Sub-total	30,080
	15% contingencies	4,512
	TOTAL CAPITAL COSTS	34,592
INCREMENTAL COST RAW MATERIAL (Annex V)		2,091,319
	TOTAL	2,125,911

ANNEX II TABLE I
PARALELL FLOW TYPE DESIGNS SUITABLE FOR HFC-134
(AC) AIR CONDITIONING SYSTEM
AND THEIR APPLICATION FOR MIRGOR'S CUSTOME

AC COMPONENT	DESIGN CHARACTERISTIC			HFC 134A APPLICATION
	TUBE WIDTH	CENTER H		
PARALELL FLOW	18.7	9.83		A
	Depht	Long	Hihgt	
	79	180	166	B
	79	220	203	C
	79	270	203	D
TUBE AND FIN	79	285	203	E
	79	245	152	F
	79	321	178	G
	79	263	229	H

DESIGN APPLICATION			
CUSTOMER VEHICLE	MODEL	PARALELL FLOW CONDENSER	TUBE AND FI EVAPORATOR
FIAT (SEVEL)	DUNA	A	C
	UNO	A	B
	REGATTA	A	-,-
PEUGEOT (SEVEL)	504	A	C
	505	A	D
	405	A	E
CIADEA (RENAULT)	9	A	F
	19	A	G
	21	A	H

ANNEX II TABLE II
MIRGOR CUSTOMER DESIGN CHANGES BY VEHICLE
MODEL AND DESIGN CHANGE TYPE

CUSTOMER	MODEL(s)	CHANGE TYP 1	2	3	ESTIMATED YEARLY VOLUME
FIAT (SEVEL)	DUNA	X			11,040
	UNO	X			15,400
	REGATTA	X			2,480
PEUGEOT (SEVEL)	504	X			13,572
	505 CARB	X			2,240
	505 INY/DIES	X			2,240
	405	X			8,000
CIADEA (RENAULT)	9	X			17,280
	11	X			6,000
	19	X			34,800
	21	X			5,200
		Subtotal			118,252
PEUGEOT (SEVEL)	306		X		28,000
	504 HFC-134a		X		2,000
FIAT (SEVEL)	178		X		75,000
	DUNA VVM		X		33,000
CIADEA (RENAULT)	CLIO		X		25,000
VOLKSWAGEN	GOL (AV9)		X		20,000
		Subtotal			175,000
VOLKSWAGEN	POINTER			X	8,000
FORD	ORION			X	8,000
	ESCORT			X	10,000
MERCEDES BENZ	TIN			X	3,000
		Subtotal			29,000
		TOTAL			322,252

1 - ACC units on present production that require to be redesign for HFC-134a
2 - ACC units in proyect design process HFC-134a required to start production during 1994/95/96
3 - ACC units under factibility studies HFC-134a requiered.

MIRGOR

ANNEX III Table 1
EQUIPMENT COST BREAKDOWN

EQUIPMENT	IMPORT OR LOCAL	EQUIPMENT COST A	TOOLS COST B	TOTAL COST C=(A+B)	SHIPPING TO BS AS D	SHIPPING TO R.GDE E	TOTAL US DOLLAR F=C+D+E
DESIGN,DEVELOP.AND TRYOUT 5/16" RUBBER HOSE	I		661	661	33	46	740
DESIGN,DEVELOP.AND TRYOUT 13/32" RUBBER HOSE	I		661	661	33	46	740
DESIGN,DEVELOP.AND TRYOUT 1/2" RUBBER HOSE	I		661	661	33	46	740
DESIGN,DEVELOP.AND TRYOUT 5/8" RUBBER HOSE	I		661	661	33	46	740
MANCHESTER MOD. #60000 HYDRAULIC CRIMP PRESS FOR US MANCHESTER TOOL & DIE PATENTED 8-FINGER HOSE	I		22,636	22,636	1,132	1,585	25,352
REDESIG.BASE OF PRESS TO INCORPORATE HYDRAULIC POW INTO BASE OF MACHINE WITH STANDARD 15 GPM POWER UN	I		2,237	2,237	112	157	2,506
LABEL ALL ELECTRICAL COMPONENTS IN THE MAIN CABINE SPANISH TRANSLATIONS ON OPERATOR CONTROL STATION C	I		254	254	13	18	285
FOOT SWITCH & DUAL PALM BUTTON CONTROL CIRCUITS WI SELECTOR SWITCH TO CHOOSE MACHINE OPERATION BY EIT	I		392	392	20	27	439
SAFETY LIGHT CURTAIN INSTALLED TO PROTECT OPERATIO JAW OPENING	I		2,695	2,695	135	189	3,018
KEY LOCK RESET PARIS COUNTER IN PLACE OF STANDARD RESET COUNTER 6 DIGIT ELECTRIC, EAGLE	I		41	41	2	3	46

MINGOA

ANNEX III Table 1, continued

EQUIPMENT COST BREAKDOWN

EQUIPMENT	IMPORT OR LOCAL	EQUIPMENT COST A	TOOLS COST B	TOTAL COST C=(A+B)	SHIPPING TO BS AS D	SHIPPING TO R.GDE E	TOTAL US DOLLAR F=C+D+E
WIRING FOR 380/3/50 POWER	I		356	356	18	25	399
SINGLE CAVITY CRIMP DIE FOR 5/16" RUBBER HOSE	I		5,822	5,822	291	408	6,520
SPARE CRIMP FINGERS 8 PER SER 5/16" RUBBER HOSE	I		661	661	33	46	740
SINGLE CAVITY CRIMP DIE FOR 13/32" RUBBER HOSE	I		5,822	5,822	291	408	6,520
SPARE CRIMP FINGERS 8 PER SER 13/32" RUBBER HOSE	I		661	661	33	46	740
SINGLE CAVITY CRIMP DIE FOR 1/2" RUBBER HOSE	I		5,822	5,822	291	408	6,520
SPARE CRIMP FINGERS 8 PER SER 1/2" RUBBER HOSE	I		661	661	33	46	740
SINGLE CAVITY CRIMP DIE FOR 5/8" RUBBER HOSE	I		5,822	5,822	291	408	6,520
SPARE CRIMP FINGERS 8 PER SER 5/8" RUBBER HOSE	I		661	661	33	46	740
HELIUM'S CHAMBER	L	21,000		21,000	1,050	1,470	23,520
TOTALES		21,000	57,185	78,185	3,909	5,473	87,567

Price includes shipping charges until the country of origin port (USA)

ANNEX III
TABLE 2

EQUIPMENT INCREMENTAL COST BREAKDOWN

EQUIPMENT	IMPORT OR LOCAL	EQUIP. COST A	TOOLS COST B	TOTAL COST C=A+B	SHIPPING		TOTAL US DOLLAR F=C+D+E
					TO BS AS D	TO R.GDE E	
Single cavity crimp die for 5/16" rubber hose	I		5,822	5,822	291	408	6,520
Single cavity crimp die for 13/32" rubber hose	I		5,822	5,822	291	408	6,520
Single cavity crimp die for 1/2" rubber hose	I		5,822	5,822	291	408	6,520
Single cavity crimp die for 5/8" rubber hose	I		5,822	5,822	291	408	6,520
TOTALS			23,288	23,288	1,164	1,632	26,080

ANNEX IV

TOOL AND EQUIPMENT LIST

EQUIPMENT/TOOLS	REFERENCE NUMBER
DESIGN,DEVELOP.AND TRYOUT 5/16" RUBBER HOSE	1
DESIGN,DEVELOP.AND TRYOUT 13/32" RUBBER HOSE	2
DESIGN,DEVELOP.AND TRYOUT 1/2" RUBBER HOSE	3
DESIGN,DEVELOP.AND TRYOUT 5/8" RUBBER HOSE	4
MANCHESTER MOD.#60000 HYDRAULIC CRIMP PRESS	5
REDESIG.BASE OF PRESS TO INCORPORATE HYDRAULIC POWER UNI	6
LABEL ALL ELECTRICAL COMPONENTS IN THE MAIN CABINET	7
FOOT SWITCH & DUAL PALM BUTTOM CONTROL CIRCUITS	8
SAFETY LIGHT CURTAIN INSTALLED TO PROTECT OPERATION	9
KEY LOCK RESET PARIS COUNTER IN PLACE OF STANDARD THUMBW	10
WIRING FOR 380/3/50 POWER	11
SINGLE CAVITY CRIMP DIE FOR 5/16" RUBBER HOSE	12
SPARE CRIMP FINGERS 8 PER SER 5/16" RUBBER HOSE	13
SINGLE CAVITY CRIMP DIE FOR 13/32" RUBBER HOSE	14
SPARE CRIMP FINGERS 8 PER SER 13/32" RUBBER HOSE	15
SINGLE CAVITY CRIMP DIE FOR 1/2" RUBBER HOSE	16
SPARE CRIMP FINGERS 8 PER SER 1/2" RUBBER HOSE	17
SINGLE CAVITY CRIMP DIE FOR 5/8" RUBBER HOSE	18
SPARE CRIMP FINGERS 8 PER SER 5/8" RUBBER HOSE	19
HELIUM'S CHAMBER	20

ANNEX IV
EQUIPMENT/ TOOLS REFERENCE NUMBERS
APPLICATION TO CUSTOMER MODELS

CUSTOMER	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	APPLICATIONS TOTAL
CARRY OVER MODELS																					
FIAT (SEVEL)																					
DUNA	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	20
UNO	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	20
REGATTA	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	20
178	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	20
PEUGEOT (SEVEL)																					
504	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	20
505	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	20
405	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	20
504 hfc-134a	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	20
CIADEA (RENAULT)																					
9	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	20
19	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	20
21	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	20
CLIO	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	20

MIRGOR SACIFIA

ANNEX V

EQUIPMENTS		COMPONENTS: COMPRESSOR USD		CONDENS	EVAPORAT	EXPANSION VA (TXV) USD		DEHYDRATATOR TUBE USD		REFRIGERATOR TUBE: Number 6		Number 8		Number 10		Number
	PRICE HFC-134a		118.98	--o--	--o--		8.65		10.33		1.67		0.00		2.73	
	DIFERENCIAL CO	16.41	131,280			0.18	1,445	2.06	5,121	0.54	4,313	0.00	0	0.68	5,476	0.00
	QUANTITY		17,280	17,280	17,280		17,280		17,280		17,280		17,280		17,280	17
9	PRICE CFC-12		100.15	--o--	--o--		7.84		5.50		0.53		0.84		2.17	
	PRICE HFC-134a		116.17	--o--	--o--		8.01	1.23	6.75		0.79		1.12		2.90	
	DIFERENCIAL CO	16.02	276,826			0.17	2,899	1.25	21,600	0.26	4,447	0.28	4,822	0.73	12,555	0.00
	QUANTITY		15,660	15,660	15,660		15,660		15,660		15,660		15,660		15,660	15
19 RT	PRICE CFC-12		102.89	--o--	--o--		8.46		9.83		0.69		0.65		1.27	
	PRICE HFC-134a		119.35	--o--	--o--		8.65		11.08		1.02		0.86		1.69	
	DIFERENCIAL CO	16.46	257,764			0.18	2,829	1.25	19,575	0.33	5,189	0.21	3,354	0.42	6,644	0.00
	QUANTITY		10,440	10,440	10,440		10,440		10,440		10,440		10,440		10,440	10
19 AN	PRICE CFC-12		97.32	--o--	--o--		8.46		9.83		0.52		0.90		1.86	
	PRICE HFC-134a		112.89	--o--	--o--		8.65		11.08		0.77		1.20		2.49	
	DIFERENCIAL CO	15.57	162,551			0.18	1,886	1.25	13,050	0.25	2,613	0.30	3,106	0.62	6,513	0.00
	QUANTITY		8,700	8,700	8,700		8,700		8,700		8,700		8,700		8,700	8,
19	PRICE CFC-12		102.99	--o--	--o--		8.46		9.83		0.69		0.65		1.27	
DIESEL	PRICE HFC-134a		119.47	--o--	--o--		8.65		11.08		1.02		0.86		1.69	
	DIFERENCIAL CO	16.48	143,376			0.18	1,572	1.25	10,875	0.33	2,883	0.21	1,864	0.42	3,691	0.00
	QUANTITY		5,200	5,200	5,200		5,200		5,200		5,200		5,200		5,200	5,
21	PRICE CFC-12		102.02	--o--	--o--		8.26		5.50		0.88		0.77		1.65	
	PRICE HFC-134a		118.34	--o--	--o--		8.45		6.75		1.31		1.03		2.21	
	DIFERENCIAL CO	16.32	84,864			0.18	939	1.25	6,500	0.43	2,214	0.26	1,330	0.55	2,877	0.00
QUANTITY	TOTAL		83,912	83,912	83,912		83,912		80,220		83,912		83,912		83,912	83
TOTAL DI	$ 2,091,319		$ 1,795,089	$ 0	$ 0		$ 12,499		$ 137,832		$ 42,490		$ 39,519		$ 63,395	$

ANNEX 6.1
ENGINEERING DEVELOPMENT AND TESTING COST

Basic developments required		ACC Peugeot 405 HFC-134a			ACC Renault 19 HFC-134a			ACC Renault 21 HFC-134a	
Al/Al Evaporator coil and TXV		Valeo Design			Valeo Design			Valeo Design	
Condenser		Valeo Design			Valeo Design			Valeo Design	
Hoses		Peugeot Design			Renault Design			Mirgor Design	
Compressor		Peugeot-Sanden Design			Renault-Sanden Design			Mirgor-Sanden Design	
Parts		Mirgor Design			Mirgor Design			Mirgor Design	
Developments Time		200 days			200 days			200 days	
Human Resours (labor hrs)		Incremental	Non-Incremental		Incremental	Non-Incremental		Incremental	Non-Incremental
	hrs	Cost	Cost	hrs	Cost	Cost	hrs	Cost	Cost
Internal	400	-,-	8,800.00	500	-,-	11,000.00	500	-,-	11,000.00
External	500	15,000.00	-,-	250	7,500.00	-,-	600	18,000.00	-,-
Total	900	15,000.00	8,800.00	750	7,500.00	11,000.00	1,100	18,000.00	11,000.00
Materials		3,000.00			3,500.00			3,000.00	
Testing Device		2,000.00			2,000.00			2,000.00	
Vehicule Diferencial Cost		1,000.00			4,000.00			4,000.00	
	TOTAL	21,000.00	8,800.00		17,000.00	11,000.00		27,000.00	11,000.00

Testing Device: Especil materials consumption.
Vehicule Diferencial Cost: Purchase and Sale Price diference.

ANNEX 6.2
ENGINEERING DEVELOPMENT AND TESTING COST

Basic developments required	ACC Peugeot 505 HFC-134a			ACC Renault 11/9 HFC-134a			ACC Peugeot 504 HFC-134a		
Al/Al Evaporator coil and TXV	Mirgor Design			Mirgor Design			Mirgor Design		
Condenser	Mirgor Design			Mirgor Design			Mirgor Design		
Hoses	Mirgor Design			Mirgor Design			Mirgor Design		
Compressor	Mirgor-Sanden Design			Mirgor-Sanden Design			Mirgor-Sanden Design		
Parts	Mirgor Design			Mirgor Design			Mirgor Design		
Developments Time	300 days			280 days			280 days		
Human Resours (labor hrs)		Incremental	Non-Incremental		Incremental	Non-Incremental		Incremental	Non-Incremental
	hrs	Cost	Cost	hrs	Cost	Cost	hrs	Cost	Cost
Internal	500	-,-	11,000.00	500	-,-	11,000.00	500	-,-	11,000.00
External	600	18,000.00	-,-	600	18,000.00	-,-	600	18,000.00	-,-
Total	1,100	18,000.00	11,000.00	1,100	18,000.00	11,000.00	1,100	18,000.00	11,000.00
Materials		3,000.00			3,000.00			3,000.00	
Testing Device		2,000.00			2,000.00			2,000.00	
Vehicule Diferencial Cost		4,000.00			4,000.00			4,000.00	
		27,000.00	11,000.00		27,000.00	11,000.00		27,000.00	11,000.00

Testing Device: Especif materials consumption.
Vehicule Diferencial Cost: Purchase and Sale Price diference.

ANNEX 6.3

ENGINEERING DEVELOPMENT AND TESTING COST

Basic developments required	ACC Duna/Uno HFC-134a			ACC ACO HFC-134a			ACC Regatta HFC-134a		
Al/Al Evaporator coil and TXU	Mirgor Design			Mirgor Design			Plate Evaporator/Orifice HOO		
Condenser	Mirgor Design			Mirgor Design			Mirgor Design		
Hoses	Mirgor Design			Mirgor Design			Mirgor Design		
Compressor	Mirgor-Sanden Design			Hispacold Design			Mirgor-Sanden Design		
Parts	Mirgor Design			Mirgor Design			Mirgor Design		
Developments Time	280 days			280 days			280 days		
Human Resours (labor hrs)		Incremental	Non-Incremental		Incremental	Non-Incremental		Incremental	Non-Incremental
	hrs	Cost	Cost	hrs	Cost	Cost	hrs	Cost	Cost
Internal	500	-,-	11,000.00	500	-,-	11,000.00	500	-,-	11,000.00
External	600	18,000.00	-,-	700	21,000.00	-,-	600	18,000.00	-,-
Total	1,100	18,000.00	11,000.00	1,200	21,000.00	11,000.00	1,100	18,000.00	11,000.00
Materials		3,000.00			4,000.00			3,000.00	
Testing Device		2,000.00			2,000.00			2,000.00	
Vehicule Diferencial Cost		4,000.00			-,-			4,000.00	
		27,000.00	11,000.00		27,000.00	11,000.00		27,000.00	11,000.00

Testing Device: Especil materials consumption.

Vehicule Diferencial Cost: Purchase and Sale Price diference.

FROM: OMNIFAX

TO:

MANCHESTER TOOL & DIE, INC.
612 WEST 4th ST. • P.O. BOX 326
NORTH MANCHESTER, IN 46962
(219) 982-8524

INVOICE

PAGE 1

MIR001

SOLD TO	SHIP TO
MIRGOR, S.A. CHASCOMUS 5602 1440 -- BUENOS AIRES ARGENTINA	MIRGOR, S.A. CHASCOMUS 5602 1440 -- BUENOS AIRES ARGENTINA

INV. DATE	SHIP DATE	SHIP VIA	ORDER NUMBER	TERMS	INVOICE NO.
08/2?/9?	8/29/94	Arranged by Blue Star	IN-82?	NET 30 DAYS	00011003

ITEM NUMBER / DESCRIPTION		QUANTITY	UM	UNIT PRICE	AMOUNT
T00376	Ordered	1.0000			
SINGLE CAVITY CRIMP DIE FOR 5/16"	Shipped	1.0000	EA	$725.0000	$725.00
RUBBER HOSE					
T00377	Ordered	1.0000			
SPARE CRIMP FINGERS -- 8 PER SET	Shipped	1.0000	SET	650.0000	650.00
5/16" RUBBER HOSE					
T00399	Ordered	1.0000			
SINGLE CAVITY CRIMP DIE FOR 13/32"	Shipped	1.0000	EA	$725.0000	$725.00
RUBBER HOSE					
T00400	Ordered	1.0000			
SPARE CRIMP FINGERS -- 8 PER SET	Shipped	1.0000	SET	650.0000	650.00
13/32" RUBBER HOSE					
T00402	Ordered	1.0000			
SINGLE CAVITY CRIMP DIE FOR 1/2"	Shipped	1.0000	EA	$725.0000	$725.00
RUBBER HOSE					
T0040.	Ordered	1.0000			
SPARE CRIMP FINGERS -- 8 PER SET	Shipped	1.0000	SET	650.0000	650.00
1/2" RUBBER HOSE					
T00405	Ordered	1.0000			
SINGLE CAVITY CRIMP DIE FOR 5/8"	Shipped	1.0000	EA	$725.0000	$725.00
RUBBER HOSE					
T00406	Ordered	1.0000			
SPARE CRIMP FINGERS -- 8 PER SET	Shipped	1.0000	SET	650.0000	650.00
(continued on next page)					

NON-TAXABLE	TAXABLE	SALES TAX	FREIGHT	MISCELLANEOUS	TOTAL		

ORIGINAL INVOICE

MANCHESTER TOOL & DIE, INC.
612 WEST 4th ST. • P.O. BOX 326
NORTH MANCHESTER, IN 46962
(219) 982-8524

INVOICE

PAGE 1

MIRGOO1

SOLD TO:
MIRGOR, S.A.
CHASCOMUS 5602
1440 -- BUENOS AIRES
ARGENTINA

SHIP TO:
MIRGOR, S.A.
CHASCOMUS 5602
1440 -- BUENOS AIRES
ARGENTINA

INV. DATE	SHIP DATE	SHIP VIA	ORDER NUMBER	TERMS	INVOICE NO.
[illegible]	8/29/94	Arranged by Blue Star	[illegible]	NET 30 DAYS	00014004

DESCRIPTION		QUANTITY	UM	UNIT PRICE	AMOUNT
Y00399	Ordered	1.0000			
DESIGN, DEVELOPMENT AND TRYOUT 5/16" RUBBER HOSE	Shipped	1.0000	LOT	650.0000	650.00
Y00401	Ordered	1.0000			
DESIGN, DEVELOPMENT AND TRYOUT 13/32" RUBBER HOSE	Shipped	1.0000	LOT	650.0000	650.00
Y00404	Ordered	1.0000			
DESIGN, DEVELOPMENT AND TRYOUT 1/2" RUBBER HOSE	Shipped	1.0000	LOT	650.0000	650.00
Y00407	Ordered	1.0000			
DESIGN, DEVELOPMENT AND TRYOUT 5/8" RUBBER HOSE	Shipped	1.0000	LOT	650.0000	650.00

The following wire instructions need to be used for money being wired to accounts here.

Wire to: Norwest Bank Minnesota N.A.
ABA 0910 0001 9
BBK: Norwest Bank Fort Wayne
Credit: Indiana Lawrence Bank AC/135-9
Further Credit: Manchester Tool & Die, Inc.
Acct # 110-0163-5

pd. 9-1-94

NON-TAXABLE	TAXABLE	SALES TAX	FREIGHT	MISCELLANEOUS	TOTAL
2600.00	.00	.00	.00	.00	2600.00

ORIGINAL INVOICE

514 2820068 NOV 20, 1994 7:40PM #240 P.14

FROM: OMNIFAX
612 WEST 4th ST. • P.O. BOX 326
NORTH MANCHESTER, IN 46962
(219) 982-8524

TO:

INVOICE

PAGE 2

MIR001

SOLD TO

MIRGOR, S.A.
CHASCOMUS 5602
1440 -- BUENOS AIRES
ARGENTINA

SHIP TO

MIRGOR, S.A.
CHASCOMUS 5602
1440 -- BUENOS AIRES
ARGENTINA

INV. DATE	SHIP DATE	SHIP VIA	ORDER NUMBER	TERMS	INVOICE NO
08/21/94	8/29/94	Arranged by Blue Star	IN-024	NET 30 DAYS	00014003

DESCRIPTION	QUANTITY	UM	UNIT PRICE	AMOUNT
M00406 (continued) 5/8" RUBBER HOSE ...				

The following wire instructions need to be used for money being wired to accounts here.

Wire to: Norwest Bank Minnesota N.A.
ABA 0910 0001 9
BOK: Norwest Bank Fort Wayne
Credit: Indiana Lawrence Bank AC/155-9
Further Credit: Manchester Tool & Die, Inc.
Acct # 110-0163-5

pd. 9-1-94

NON-TAXABLE	TAXABLE	SALES TAX	FREIGHT	MISCELLANEOUS	TOTAL	
25500.00	.00	.00	.00	.00		25500.00

ORIGINAL INVOICE

FROM: OMNIFAX TO: 514 2820068 NOV 20, 1994 7:41PM #240 P.15

MANCHESTER TOOL & DIE, INC.
612 WEST 4th ST. • P.O. BOX 326
NORTH MANCHESTER, IN 46962
(219) 982-8524

INVOICE

PAGE 1

MIR001

SOLD TO:
MIRGOR, S.A.
CHASCOMUS 5602
1440 -- BUENOS AIRES
ARGENTINA

SHIP TO:
MIRGOR, S.A.
CHASCOMUS 5602
1440 -- BUENOS AIRES
ARGENTINA

INV. DATE	SHIP DATE	SHIP VIA	ORDER NUMBER	TERMS	INVOICE NO.
08/24/94	0/29/94	Arranged by Blue Star	IR-824	NET 30 DAYS	00014002

DESCRIPTION		QUANTITY	U/M	UNIT PRICE	AMOUNT
280148	Ordered	1.0000			
MANCHESTER MODEL #60000 HYDRAULIC CRIMP PRESS FOR USE WITH MANCHESTER TOOL & DIE PATENTED 8-FINGER HOSE CRIMP DIES. SERIAL # 814-02167 OPTIONS:	Shipped	1.0000	EA	22260.0000	22260.00
	Ordered	1.0000			
2. REDESIGNED BASE OF PRESS TO INCORPORATE HYDRAULIC POWER UNIT INTO BASE OF MACHINE, 1) WITH STANDARD 15 GPM POWER UNIT	Shipped	1.0000	EA	2200.0000	2200.00
	Ordered	1.0000			
3. LABEL ALL ELECTRICAL COMPONENTS IN THE MAIN CONTROL CABINET AND SPANISH TRANSLATIONS ON OPERATOR CONTROL STATION CONTROLS.	Shipped	1.0000	EA	250.0000	250.00
	Ordered	1.0000			
4. FOOT SWITCH AND DUAL PALM BUTTON CONTROL CIRCUITS WITH KEY LOCK SELECTOR SWITCH TO CHOOSE MACHINE OPERATION BY EITHER MODE. AVAILABLE ONLY IF ORDERED WITH OPTIONAL SAFETY LIGHT CURTAIN	Shipped	1.0000		365.0000	365.00

(continued on next page)

TAX	NON-TAXABLE	TAXABLE	SALES TAX	FREIGHT	MISCELLANEOUS	TOTAL

ORIGINAL INVOICE

ORIGINAL INVOICE

FROM: OMNIFAX TO: 514 2820068 NOV 20, 1994 7:41PM #240 P.16

[illegible] TOOL & DIE, INC.
812 WEST 4th ST. P.O. BOX 326
NORTH MANCHESTER, IN 46962
(219) 982-8524

INVOICE

MIR001

SOLD TO	SHIP TO
MIRGOR, S.A. CHASCOMUS 5602 1440 -- BUENOS AIRES ARGENTINA	MIRGOR, S.A. CHASCOMUS 5602 1440 -- BUENOS AIRES ARGENTINA

INV. DATE	SHIP DATE	SHIP VIA	ORDER NUMBER	TERMS	INVOICE NO
08/21/94	8/29/94	Arranged by Blue Star	IN-674	NET 30 DAYS	00014002

DESCRIPTION		QUANTITY	U/M	UNIT PRICE	AMOUNT
(continued) **NOTE** MANCHESTER TOOL & DIE, INC. RECOMMENDS ONLY THE STANDARD DUAL PALM BUTTON CONTROL CIRCUIT FOR OPERATOR SAFETY. IF MACHINE IS ORDERED WITH OPTION 11 (FOOT SWITCH), PURCHASE ORDER MUST STATE THAT MIRGOR, S.A. ASSUMES FULL RESPONSIBILITY FOR ORDERING AND USING MACHINE WITH A FOOT SWITCH AND WILL NOT HOLD MANCHESTER TOOL & DIE, INC. LIABLE.	Ordered Shipped	.0000 .0000		.0000	.00
4. SAFETY LIGHT CURTAIN-INSTALLED TO PR[illegible]T OPERATOR AT CRIMP JAW OPEN. 1) SCIENTIFIC TECHNOLOGIES, INC. (STI) 16" MINISAFE SAFETY LIGHT CURTAIN MODEL [illegible]	Ordered Shipped	1.0000 1.0000	EA	2650.0000	2650.00
5. KEY LOCK RESET PARTS COUNTER, IN PLACE OF STANDARD THUMBWHEEL RESET (continued on next page)	Ordered Shipped	1.0000 1.0000	EA	40.0000	40.00

NON-TAXABLE	TAXABLE	SALES TAX	FREIGHT	MISCELLANEOUS	TOTAL

ORIGINAL INVOICE

FROM:OMNIFAX TO: 514 2820068 NOV 20, 1994 7:42PM #240 P.17

MANCHESTER TOOL & DIE, INC.
612 WEST 4th ST. • P.O. BOX 326
NORTH MANCHESTER, IN 46962
(219) 982-8524

INVOICE

PAGE 3

MIR001

SOLD TO:
MIRGOR, S.A.
CHASCOMUS 5602
1440 -- BUENOS AIRES
ARGENTINA

SHIP TO:
MIRGOR, S.A.
CHASCOMUS 5602
1440 -- BUENOS AIRES
ARGENTINA

INV. DATE	SHIP DATE	SHIP VIA	ORDER NUMBER	TERMS	INVOICE NO
08/24/94	8/29/94	Arranged by Blue Star	IN-824	NET 30 DAYS	00014082

DESCRIPTION		QUANTITY	UM	UNIT PRICE	AMOUNT
(continued) COUNTER -- 6 DIGIT ELECTRIC, EAGLE SIGNAL #PCC-14					
	Ordered	1.0000			
16. WIRING FOR 380/3/50 POWER	Shipped	1.0000	EA	350.0000	350.00
	Ordered	1.0000			
17. FULL WOOD BOX CRATING OF MACHINE FOR SHIPMENT	Shipped	1.0000	EA	950.0000	950.00

Reporter

The following wire instructions need to be used for money being wired to accounts here:

Wire to: Norwest Bank Minnesota N.A.
ADA 0910 0001 9
BDK: Norwest Bank Fort Wayne
Credit: Indiana Lawrence Bank AC/155-9
Further Credit: Manchester Tool & Die, Inc.
Acct # 110-0163-5

SEE REVERSE SIDE FOR MACHINE SERVICE WARRANTY

pd. 9.1.94

NON-TAXABLE	TAXABLE	SALES TAX	FREIGHT	MISCELLANEOUS	TOTAL AMOUNT		
1 :5.00	.00	.00	.00	.00			21085.00

ORIGINAL INVOICE

VACUUM INSTRUMENT CORPORATION
2099 NINTH AVENUE, RONKONKOMA, NY 11779 (516) 737-0900

Helium Mass Spectrometer **CONSOLE MODELS**

MODEL	DESCRIPTION
TURBO-TEST MD-180T	- A fully automatic general purpose leak detector featuring stainless steel vacuum system, automatic spectrometer tube tuning, built-in helium calibrator, Ion-Quad thoria coated iridium filaments (4), and unique orifice sampling system providing direct reading of leak rates from 10-3 Atm-cc/sec to 5 x 10-11 Atm-cc/sec. Top and side test ports are standard. Includes direct drive 7.0 CFM roughing pump, 3.2 CFM forepump, and a high speed 60 l/s turbomolecular pump. Turbo Pump eliminates oil backstreaming problems associated with diffusion pump system, and provides rapid start-up and shutdown capabilities. P/N 961-104 $ 21,000.00

DESIGNERS AND MANUFACTURES
OF HIGH VACUUM AND LEAK DETECTION EQUIPMENT

OZONE OPERATIONS RESOURCE GROUP REVIEW

ANNEX IV

COUNTRY: REPUBLIC OF ARGENTINA Pg. 1

PROJECT TITLE: CONVERSION TO NON-TECHNOLOGY IN THE PRODUCTION OF HEAT EXCHANGERS FOR MOBILE AIR CONDITIONERS.

PROJECT ENTERPRISES: MIRGOR, INTERCLIMA AND SIMON CACHAN

SECTOR/SUB-SECTOR: MOBILE AIR CONDITIONING (MAC)

REFERENCE: Meating at World Bank Offices 11/24/94, and two Preliminary Reviews

RELATIONSHIP TO COUNTRY PROGRAM:

The project preparers have noted that a strategy is needed and is being developed to treat issues related to the fleet of older cars, CFC-12 availability for service, retrofit options and sector policies (including possible government tax interventions). It is suggested that a training component for the service industry in containment and contaminant reduction in CFC-12 systems, and cleanliness control in HFC-134a systems be considered within the sector strategy. The program should also consider the positive effects of improved manufacturing and service prior to conversion of the manufacturing facilities.

TECHNICAL SOUNDNESS:

These proposals identify the technical support sources and their anticipated costs. The sources identified for technology acquisition are believed to be competent.

It is expected that the government in its sector strategy will include provisioning for good penetration into the application and service field outside the primary objective of CFC containment in MACs.

RELEVANCE AND ADEQUACY OF INFORMATION PROVIDED:

The information, along with the proposals of each firm with regard to machinery and equipment appears to define the project and the anticipated expenses adequately. There is some uncertainty that the request for incremental operational costs can be justified given that this is an integrated conversion project affecting 80 percent of the producers. Thus, the price changes would be expected to be virtually sector-wide and Government intervention and public education could provide a simultaneous impact.

It is recognized that this is a portion of the total program for MACs and the rest of the program is currently undefined.

ENVIRONMENTAL IMPACT:

The inclusion of mass spectrometer leak testing infers a product with less leaks and therefore less service requirements. This is desirable and will contribute to reduction of the emissions of HFC-134a (a greenhouse gas). It is anticipated that the aforementioned sector strategy will incorporate the need for reduction of leakage of CFC-12 (an ODS) in the service sector. The reduction of leakage of CFC-12 in current production and service is not addressed.

SAFETY ISSUES:

To the knowledge of this reviewer, there are not any unique safety practices required for the handling of HFC-134a or HFC-134a products. There are however, safety practices associated with interchangeability of parts for mechanical and functional reliability that service personnel must be aware of. It is expected that adequate training and control of intrerchangeability of parts through design control will cover all unique safety considerations.

PROJECT COSTS:

The unit abatement cost (UAC) is reported as $6.64/kg/yr. Any review should be considered by those with more understanding of the consequences and alternatives and with more time allocated in the review program.

The inclusion of mass spectrometery leak detection in the manufacturing program for CFC-12 systems, instead of waiting for the conversion to HFC-134a systems should be considered.

In the case of SIMON CACHAN, painting and packaging systems are listed in the description of the proposed conversion as well as a "box price" (paragraph 7.1-1) and safety equipment (annex III, last two items on the first page). Justification for these expenses should be reviewed.

IMPLEMENTATION TIMEFRAME(S):

CACHAN The 10 quarter implementation time (2.5 yrs.) should be adequate in the case of SIMON CACHAN.

INTERCLIMA The 19 month implementation time is extremely optimistic but feasible.

MIRGOR No timeframe is specified, but it is suspected to correspond to the introduction of new models. If this is the case, the portion of tooling associated with model change should be separated from the portion of the costs associated with recovering the loss in performance due to the use of HFC-134a.

RECOMMENDATIONS:

CACHAN It is opinion of this reviewer that the proposed project is within the scope of our objectives and should be approved.

INTERCLIMA It is the opinion of this reviewer that the proposed project is within the scope of fundable projects.

MIRGOR It is opinion of this reviewer that the proposed project is within the scope of fundable projects.

OORG REVIEW ____________________ Robert H. Proctor

DATE OF REVIEW ____________________ 12 November, 1994