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Executive Committee of
the Multilateral Fund for the
Implementation of the Montreal Protocol

Fifteenth Meeting
Montreal, 13-16 December 1994

PROJECT PROPOSALS: URUGUAY

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-11 as blowing agent in rigid polyurethane foams used as insulation in thermal tanks at TEM S.A. IBRD
- Elimination of the use of CFC-11 as a blowing agent in rigid polyurethane foam used as insulation in thermal tanks at Etchepare-Gil S.A. IBRD

Refrigeration

- Elimination of the use of CFC-11 as blowing agent in rigid polyurethane foams used as insulation in cold storage and substitution of CFC-12 used as refrigerant with HFC-134a at Colder S.R.L. IBRD
- Elimination of the use of CFC-11 as a blowing agent in rigid polyurethane foams used as insulation for refrigerators and substitution of CFC-12 used as refrigerant at Indurnor S.A. IBRD

PROJECT EVALUATION SHEET

COUNTRY OR REGION: Uruguay

PROJECT TITLE: Investment Project for Phasing Out ODS at:

1. Etchepare Gil S.A.
2. TEM S.A.
3. Colder S.R.L.
4. Indunor S.A.

TOTAL BUDGET: US \$ 1,228,560 (See attached Table)

INCREMENTAL COSTS:

1. US \$235,050
2. US \$220,300
3. US \$325,070
4. US \$448,140

ODS PHASE-OUT:

1. 3.43 tonnes CFC-11
2. 5.26 tonnes CFC-11
3. 7.57 tonnes CFC-11
3.2 tonnes CFC-12
4. 10.1 tonnes CFC-11
7.8 tonnes CFC-12

COST EFFECTIVENESS:

1. US \$21.96 per Kg. ODP saved
2. US \$11.00 per Kg. ODP saved
3. US \$10.22 per Kg. ODP saved
4. US \$19.05 per Kg. ODP saved

PROJECT DURATION: 8 months
6 months for refrigerant component

IMPLEMENTING AGENCY: World Bank

NATIONAL COORDINATING AGENCY : Comisión Técnica Gubernamental de Ozono,
Ministerio de Vivienda, Ordenamiento y Medio
Ambiente

TECHNICAL REVIEW COMPLETED: YES X NO

Project Cost	Etchepare-Gil S.A.	TEM S.A.	Colder S.R.L.	Indunor S.A.
Capital Cost	175,000	175,000	237,000	292,180
Operating Cost	23,430	11,000	37,400	86,160
Sub-Total	198,430	186,000	274,400	378,340
15% Contingency	29,770	27,900	41,200	56,750
3% Financial Agent Fee	6,850	6,400	9,470	13,050
Total	235,050	220,300	325,070	448,140

SECRETARIAT'S COMMENTS

1. This project consists of four sub-projects for a total amount of US \$1,228,560 to phase out 37 tonnes of ODS in Uruguay.
2. Two of the projects (Etchepare-Gil and TEM) cover the phase out of CFC-11 in the production of rigid polyurethane foam for insulation in water heater tanks. One project is to eliminate the use of CFC-11 and CFC-12 in the manufacturing of domestic refrigerators at Indunor, said to be the largest producer of domestic refrigerators (75 per cent of the market) in Uruguay, while the other will phase out CFC-11 and CFC-12 in the production of cold storage chambers and glass cabinets.
3. For the production of insulation for thermal tanks and the cold storage chambers and glass cabinets, high pressure injection equipment will be used with HCFC-141b as the substitute for CFC-11. For the domestic refrigerator insulation foam, the company will retrofit its existing high pressure injection equipment for use with cyclopentane as blowing agent. HFC-134a will be the substitute refrigerant both for the domestic and commercial refrigeration.
4. The cost-effectiveness of the projects, particularly Etchepare-Gil and Indunor, are very low on account of the small scale of operation, and the high cost of high pressure HCFC-141b foaming machine to be supplied by Cannon (Italy), as well as the high cost of some of the chemicals in Uruguay. The World Bank will use the procurement process to ensure that more competitive prices are obtained for the equipment, where possible.
5. For the enterprises switching from low pressure to high pressure foaming technology where new high pressure equipment is to be procured the issue of the residual value of the old equipment was explored in order to take it into account in assessing the project costs. This residual value was considered to be insignificant on the basis of information provided by the enterprises and did not impact the cost of the project. However, the World Bank will have to ensure that the old equipment is destroyed in accordance with Executive Committee guidelines.

SECRETARIAT'S RECOMMENDATIONS

6. The Secretariat recommends approval of the project and funding as follows:

Etchepare-Gil S.A.:	US \$235,050
TEM S.A.:	US \$220,300
Colder S.R.L.:	US \$325,070
Indunor S.A.:	US \$448,140

7. The approval is subject to the comments in paragraphs 4 and 5 concerning the World Bank's role in the procurement of equipment and disposal of decommissioned equipment and the World Bank reflecting the outcomes as appropriate in its progress reports.

TEM

PROJECT COVER SHEET

Country: Uruguay.

Project Title: Elimination of the use of CFC-11 as blowing agent in rigid polyurethane foams used as insulation in water heater tanks. HCFC-141b as blowing agent will be adopted.

Covered Sector: Insulation of water heater tanks.

Use of ODPs in the Sector: 12.5 MT of CFC-11 annually.

Project Impact: Eliminate consumption of 5.26 MT per year

Duration of the Project: Eight months.

Project Economic Life: Ten years.

Total Cost of Project:

Investments	US\$ 175,000
Incremental operating costs (6 mos.)	US\$ 11,000
Subtotal	US\$ 186,000
Total Cost w/Contingencies ¹	US\$ 213,900
Financial/Administrative expenses ²	US\$ 6,400

Proposed OTF Financing: US\$ 220,300

Unit Abatement Cost: 11.00 US\$/kg

Beneficiary Company: TEM S.A.

Coordinating National Authority: Comisión Técnica Gubernamental de Ozono, Ministerio de Vivienda, Ordenamiento Territorial y Medio Ambiente.

Executing Agency: World Bank.

¹ Includes 15% for contingencies.

² Three percent.

NOVEMBER 18, 1994

1. Project Summary:

This Project will eliminate the annual consumption of CFC-11 used in the production of rigid polyurethane foams as insulation for thermal tanks by TEM S.A. HCFC-141b is the proposed alternative given the domestic availability of chemical products and equipment that will allow the adoption of this technology. Cyclopentane is not an option for this company because its urban location and the associated municipal regulation rule out the use of flammable gases. *Future alternatives to replace HCFC-141b could be the liquid HFCs under development.*

The Company is aware that this is only a temporary solution and that eventually it must convert to a definite technology. The adoption of high-pressure injection equipment proposed here prepares the company for that final transition.

2. Project Objectives:

Substitute the use of CFC-11 as blowing agent in the production of rigid polyurethane foams used as insulation for thermal tanks. To achieve this, the adoption of HCFC-141b is recommended.

3. Sector Information:

The Sector has two large companies, one of them using the traditional CFC-11 technology and in ETCHEPARE-GIL S.A. reduction of its use by 50%.

4. Company Information:

TEM S.A. is a company that began operations in 1950, manufacturing household appliances. Currently, the Company uses CFC-11 in thermal insulation of thermal tanks, using its own manufactured manual injection equipment. In 1993, TEM S.A. consumed 3.5 MT of CFC-11 and produced 20,000 thermal tanks, 16,000 stoves and 35,000 heaters. The Company exported 24.2% of the units produced to MERCOSUR countries.

Its maximum annual production capacity is 60,000 thermal tanks, 50,000 heaters, and 60,000 stoves, working on a single shift. The Company's share of the domestic market is estimated at 30%.

TEM S.A. does not receive foreign technical assistance.

TEM S.A. is 100% owned by domestic capitals.

5. Project Description:

TEM S.A. currently uses CFC-11 for the manufacture of rigid foams. The company wishes to use HCFC-141b as blowing agent, for which the use of other chemical products and equipment must be adopted. Suppliers of chemical products will provide the necessary technical assistance to implement adjustments to the new process.

The low pressure injection machine currently being used is manual, was manufactured by TEM, and is causing significant material waste. It has no salvage value due to its poor condition. High pressure equipment would be adopted in this project to eliminate waste and to prepare the company to a definitive no-ODP alternative.

Modification of molds is necessary, if not replacement, because the old ones (which were used with the 100% CFC-11 technology) need to be separately heated to prevent foam adherence problems.

6. Justification of Selected Technology:

This alternative was studied along with a potential cyclopentane option; however, the latter was dismissed on the basis that municipal regulations would not permit the use of flammable materials in TEM's site. The characteristics of the foams obtained with HCFC-141b are similar to those currently produced, and there is ample experience on its use at the international level. The necessary chemical products and equipment would be available in the domestic market, and supplier companies may provide the necessary technical assistance.

The company's current facilities are capable of safely handling chemical materials with slight flammability, such as HCFC-141b. In addition, the company is committed to adopt any special precautionary measures that may be specified by equipment and HCFC-141b suppliers for safely handling HCFC-141b. The project costs included in this proposal include resources for staff training which includes addressing the slight flammability of HCFC-141b.

HCFC-141b is only a temporary solution entailing the need for future reconversion. Such final conversion will be less costly as the necessary injection equipment proposed in this project would accommodate the definitive blowing agent.

7. Project Cost:

Summary of Project Costs:

Capital Costs: US\$175,000 (see Annex 1).

Incremental Costs (six months): US\$ 11,000 (See Annex 2).

Share of Domestic Capital in the Company: 100%.

Contingencies: 15% plus 3% financial intermediation: US\$ 33,300

Total Costs: US\$ 220,300

Unit Abatement Cost (UAC): 11.00 US\$/kg (see Annex 3)

8. Project Implementation:

Estimated Timetable:

	M O N T H S							
Activity	1	2	3	4	5	6	7	8
Project Evaluation	*							
Purchase of Equipment		*	*	*	*			
Equipment Installation						*		
Staff Training							*	
Initial Tests							*	
Implementation								*

It is estimated that Project implementation could begin next year.

9. Results:

This project eliminates the consumption of 51.6 MT of CFC-11 in 10 years. Because HCFC-141b has an ODP of 0.11 the net reduction would be 4.59 MT per year.

Annex 1

Investment Breakdown

Substitution of CFC-11 by HCFC-141b.

High pressure equipment for
use with HCFC-141b and accessories*

US\$ 150,000*

Mold Modifications

US\$ 10,000

Tests

US\$ 5,000

Staff Training

US\$ 10,000

TOTAL US\$ 175,000

* Based on quote by Cannon (Italy) for a high-pressure machine model "A-System 40", standard version, ancillary equipment, and spare parts -- see Annex 4. As per the Secretariat's review more competitive equipment may exist in the marketplace; therefore, alternative quotes will be obtained as part of the procurement process.

Annex 2

Breakdown of Incremental Costs/Savings

Values expressed in US\$

Use of HCFC-141b as blowing agent

Base Costs			
Year	Unit Cost #	Units produced	Total Cost
1995	3.23	25,000	80,750
1996	3.28	28,000	91,840
1997	3.35	31,000	103,850
1998	3.42	34,000	116,280

Considering polyol, isocyanate and CFC-11.

CFC-11 Market Price: US\$ 2.84. Source: ORBEN (DUPONT)

Average CFC-11 use by assembled unit: 0.175 Kg CFC-11/unit.

Average CFC-11 use per assembled unit: 1.346 kg foam/unit.

An annual increase of 10% in the CFC-11 price has been estimated.

Polyol Market Price: US\$ 2.11/kg

Isocyanate Market Price: US\$ 2.49/kg

Composition of the mixture: polyol	100 parts
isocyanate	140 parts
CFC-11	40 parts

Source: BAYER

Density: 30 kg/m³

Cost of foam:

Year	Cost US\$/kg
1995	2.40
1996	2.44
1997	2.49
1998	2.54

Project Costs

Year	Unit Cost #	Units Produced	Total Cost
1995	4.11	25,000	102,750
1996	4.11	28,000	115,080
1997	4.11	31,000	127,410
1998	4.11	34,000	139,740

Considering isocyanate, polyol and HCFC-141b.

Estimated HCFC-141b Price: US\$ 5.00/kg. (BAYER - see Annex 4)

Composition of the mix:

HCFC-141b	30 parts
isocyanate	159 parts
polyol	100 parts

Density: 30 kg/m³

Source: BAYER.

Foam Cost: US\$ 2.62/kg.

Foam mass: 1.346 kg * 35/30 = 1.570 kg/unit.

Incremental Costs:

	\$US
Base Costs	80,750
Project Costs	102,750
Incremental Cost	22,000 (one year)
	11,000 (six months)

Annex 3

Unit Abatement Cost Calculation

Use of HCFC-141b as blowing agent

1. Average yearly CFC-11 consumption
(average consumption estimated for
the first four years) 5.16 MT
Average use of HCFC-141b 5.16 MT
ODP of HCFC-141b 0.11
Weighted use per ODP/year 0.57 MT
Weighted savings per ODP/Year 4.59 MT

2. Annual Capital Costs

Total Investment US\$ 175,000
Project Economic Life 10 years
Discount Rate 10%
Annual Capital Incremental Costs US\$ 28,480

3. Operational Costs

Incremental costs (one year) US\$ 22,000

4. Unit Abatement Cost (US\$/kg of eliminated CFC-11)

$$\frac{28480 + 22,000}{4590} = 11.00$$

Annex 4

HCFC-141b and Injection Machine Supplier Quotes



Bayer Uruguay Limitada

Señores
Comisión medio ambiente

Ing. Jorge Castro

Presente

Paysandú 1283
Casilla de Correo 304
11000 - Montevideo
Teléfono 92 00 13
Telax 032 22228 Bayer UY
Fax (00598-2) 92 11 25
Cables: Uniquim

Su referencia:

Su carta:

Nuestra referencia:

Montevideo,

E. Rauhut/grc

10.8.1994

GAS R 141 B DE ATOCHEM / FRANCIA

Estimado Ing. Castro:

Según lo conversado esta mañana confirmamos a Uds. que es altamente probable, aunque dependiente de una confirmación final del proveedor (ATD), que Bayer Uruguay Ltda. sea designada distribuidor en Uruguay para el gas de la referencia, sustituto del Freon R 11.

De confirmarse lo antedicho, o bien importaríamos el material en contenedores desde Francia o alternativamente seríamos provistos a través del distribuidor brasileño.

Para el caso de la primera opción, hemos calculado un precio orientativo de venta al usuario de US\$ 5/kg + IVA.

Comprometiéndonos a mantenerles informados respecto a este tema saludamos a Uds. muy atentamente.

BAYER URUGUAY LIMITADA
Productos Químicos

BAYER

Bayer Uruguay Limitada
Paysandú 1283
Casilla de Correo 304
11000 - Montevideo
Telephone: 92 00 13
Telex: 032 2229 Bayer UY
Fax: (00598-2) 92 11 25
Cable: Uniquim

Gentlemen
Environmental Commission

Eng. Jorge Castro
HAND DELIVERY

Our Reference: E. Rauhut/gr

Montevideo, 8/10/1994

GAS R 141 B FROM ATOCHEM, FRANCE

Dear Eng. Castro:

As per our conversation of this morning, this is to confirm that it is highly probable, although it depends on final confirmation from the supplier (ATO), that Bayer Uruguay Ltda., will be appointed as distributor representative in Uruguay for the above referred gas, which replaces Freón R 11.

If the above mentioned is confirmed, we would either import the material in containers from France, or alternatively, we would get it through the Brazilian distributor.

In the case of the first option, we have calculated an estimated price for user sale of US\$ 5/kg plus VAT.

We will keep you informed on this issue.

Sincerely yours,

BAYER URUGUAY LIMITADA
Chemical Products
(Signed)

Honorable,

ETCHEPARE CIL. S.A.
Fraternidad 3048
CP 11700 MONTEVIDEO
URUGUAY

Attention Ing. Cassiniga

PROFORMA INVOICE:

N° 114/94 WLD 24/38

DATE: 20/03/94

SUBJECT:

CAINON FORMING HIGH PRESSURE MACHINE

No. 1 CAINON high pressure machine model "A-System 40" std version
having the following main technical features:

TANKS GROUP for POLYOL and ISOCYANATE

no. 2 HD Jacketed carbon steel tanks 330 lt. capacity, pressurized
and heated at 11.5 Bar to ISOPEL regulations, insulation by
Armaflex material, tanks group mounted on own frame.

Each tank is composed with:

- no. 1 agitator 0.5 HP (on polyol tank only)
- no. 1 external visual level
- no. 1 three-way manual drain valve
- no. 1 PT 100 temperature sensor and transducer mounted on the tank
- no. 1 air pressure control gauge
- no. 1 set of automatic levels (4 setting points: alarm, min/max
filling, stop filling)
- no. 1 heat exchanger: 2 sqm. surface each on polyol tank
- no. 1 heat exchanger: 2 sqm. surface on isoc. tank

ISO component filling through 1 pneumatic pump complete with
exducer connection and relevant pipes.

POL blend filling through 1 on-off valve, connected to the
EasyFroth unit.

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METERING GROUP composed of:

L-shaped steel frame

no. 1 double shaft motor

no. 2 high pressure pumps

Double speed motor: 725/1450 rpm.

no. 2 manually operated self-cleaning filters

no. 2 high pressure gauges

no. 2 low pressure gauges

connection pipes between machine and tanks group

collecting basins for eventual chemical losses mounted under pumps and hydraulic unit

ELECTRIC/ELECTRONIC CONTROLS

Control panel mounted on machine frame, including:

motor power relays

power relays for heating elements

PLC controller (Siemens model)

high pressure recycle timer

calibration head timer for calibration head

switch and lights

two proportional band regulators

three electronic, digital pouring timers

controls relevant to 1 FPL mix-head with double control valve

The Mini (II) allows the monitoring of the components output,

component ratio and shot weight. It includes a microcomputer to process monitoring, connected to 2 flow transducers).

POURING GROUP including:

- no. 1 high pressure self-cleaning mix-head, model: SPH 30

single component output: min. 90 max. 550 cc/min.

oil consumption: 807 cc/shot

special heads with 112 mm. stroke and 65.5 mm. new head weights: 12.4 kg.

- no. 1 set of 6 mto. flexible hoses

- no. 1 HYDRAULIC unit (for heads operation)

oil tank : 100 lts

hydraulic pump : 10 lts/min. output

electric motor power : 7.5 HP

accumulator : 10 lts (precharged at 100 Atm.)

hydraulic filter with alarm

METERING SYSTEM

The chemicals recirculate under low pressure when they are not actually being dispensed. Each component flows by blanked pressure from the tanks to the metering pumps. Precise and adjustable throughput is provided by two Rexroth positive displacement axial piston pumps which are coupled with a double shaft motor.

This common coupling ensures both components to keep the ratio in the event of power fluctuation or other external occurrence.

In case of a multi-heads plant, the chemicals recirculate under low pressure through the whole ring piping, which connects the dosing machine to the heads. Stream distributors for each component are installed on delivery line, the same are opened by low pressure, so that the material circulates through the valves, back to the head, back to the tanks. By recirculation at low pressure the chemicals can be constantly conditioned without taking the system components. With the valve closed, the material circulates through the mix-head, where an adjustable orifice assembly develops the high pressure required for impingement mixing.

High pressure recirculation through the mix-head and back to the tanks (prior to dispensing) ensures that a homogeneous mixture is dispensed when the pour piston opens.

- CANNON FPL head

Cannon's patented mix-head consisting of two cylindrical chambers and their discharge chambers, each one is activated when the corresponding piston retracts. When the pour piston is retracted, the chemicals enter the mixing chamber under high pressure. Since they are located directly across from each other, they collide violently (high pressure impingement), ensuring thorough mix of the two components. The pressure that is developed at the orifice assembles into the mix-chamber and dissipates as the mixture makes 90° transition into the discharge chamber. The FPL mix-head employs a recirculation groove on each side of the mix-chamber piston. This groove allows the component to circulate through the entire system before pouring occurs, ensuring that a homogeneous mixture is dispensed when the pour occurs.

The chemicals pass over the orifice during both the high pressure recycle and pour sequence. The orifice assemblies are located just upstream of the mix-chamber's inlet port, allowing the component pressure to be adjusted during high pressure recycle, prior to dispensing chemicals.

TEMPERATURE CONDITIONING SYSTEM

Temperature control is provided for each tank by heat exchanger mounted on the chemical return line just upstream of the tank. Analogic-indicating proportional controllers (one for each component) are coupled to two PT 100 temperature sensors in order to provide accurate control of the component temperature. Electrical solenoid valves control the flow of the chilled water.

The tanks group is connected with a chiller unit:

- no. 1 external, separate, self-contained chiller unit 5 HP, complete with thermostat, water circulation pump and pressure switch.
Cooling capacity: 15.000 kcal/h.
Water output: 2.400 lt/h.

VOLTAGE : 380 V. 50 HZ. (pls., confirm it)

PREMIX UNIT EMXYFROTH (TM) 20+4 LTR.

The Emxyfroth is a special developed unit to realize the mixing of conventional Polyol-types with LBBA in accurate ratio.

The here offered unit has the capability to deliver a blend of maximum 20 l/min. Polyol and 4 l/min. LBBA.

The unit is composed by:

- no. 1 carbon steel frame with the following equipment is mounted on
- no. 1 adjustable metering pump for raw Polyol cap. 20 l/min.
- no. 1 flow transducer for the raw Polyol
- no. 1 recirculation valve for raw Polyol
- no. 1 pneumatic booster pump for the LBBA
- no. 1 double acting metering cylinder for the LBBA
- no. 1 flowtransducer for the LBBA
- no. 1 recirculation valve for the LBBA
- no. 1 continuous working static mixer for Polyol and LBBA
- no. 1 hydraulic unit to drive the metering cylinder of the LBBA
- no. 1 control panel with microprocessor, keyboard and display to control the output and ratio of the Polyol and the LBBA and all electrical hardware (relays, motorswitches s.s.o.)

The raw Polyol and the LDBA have to be delivered to the inputs of the unit with a constant flowrate and a pressure of 4 bar for Polyol, at a pressure of 8 bar for the LDBA. Both components are measured and controlled after entering by the no.1 piston pump (Polyol) and by the metering cylinder (LDBA) with flow transducers.

If there is no blend required by the Mid-day-tank both components recirculate back to the Delivery-tank. In the case that blend is required, the recirculation valve guide the material flow to the static-mixer.

With this configuration it is assured, that the ratio is absolutely accurate.

The Polyol/LDBA-blend is delivered from the static mixer to the Polyol-tank of the dosing unit by an adjustable working pressure.

The HCF (gas acid in bottle) is kept in a liquid state by means of a pneumatic booster installed on the Polyol-tank unit.

This liquid is then metered by a double acting Hydraulic cylinder and mixed with Polyol in a high efficiency static mixer, using pressure higher than the blowing agent is critical pressure.

RAW POLYOL TANK

TANK CHIMNEY FOR RAW POLYOL MOUNTED ON A FRAME including:

no.1 Jacketed carbon steel 130 lts. pressurized with Armaflex insulation at 11,5 bar to CORNLI regulations, complete with:

- no.1 agitator 0,5 HP
- no.1 visual level mounted on the tank
- no.1 manual drain valve
- no.1 PT100 temperature sensor and transducer mounted on the tank
- no.1 air pressure control gauges
- no.1 floating level at 4 setting points: alarm, min/max filling, stop level
- no.1 on/off valve for automatic tank filling
- no.2 1,5 KW resistance
- no.1 electric control panel including proportional band thermoregulator

no.1 special pneumatic feeding pump (to load Polyol without raw material drums to the raw Polyol tank (ratio 2:1))

the tank can be connected to your existing chiller or have to be quoted in case of need.

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COLDER S.R.L.

PROJECT COVER SHEET

Country: Uruguay.

Project Objectives:

- a) Elimination of the use of CFC-11 as blowing agent in rigid polyurethane foams used as insulation in cold storage glass cabinets and chambers. Technology using HCFC-141b as blowing agent will be adopted (ODP=0.11).
- b) Substitution of CFC-12 used as refrigerant with HFC-134a (ODP=0).

Sector Covered: Commercial and household refrigeration.

Use of ODPs in the Sector: Approximately 37.0 MT of CFC-11 and 13.0 MT of CFC-12 annually.

Project Impact:

- a) Eliminate consumption of 85 MT of CFC-11, 75.7 MT-ODP weighted (8.5 MT/year, 7.57 MT-ODP weighted MT/year).
- b) This project will eliminate the consumption of 31.9 MT of CFC-12 in 10 years (taking as annual consumption 3.19 MT of CFC-12 per year which is the average yearly consumption of the first four years).

Duration of the Project:

- a) Eight months.
- b) Five months to adopt the use of HFC-134a technology.

Project Economic Life:

- a) Ten years to switch to HCFC-141b technology.
- b) Ten years to switch to HFC-134a.

Total Project Cost:

a) Investments	US\$ 175,000
Incremental Operating Costs (6 mos.)	US\$ 15,150
Subtotal	US\$ 190,150

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b) Investments	US\$ 62,000
Incremental costs (6 mos.)	US\$ 22,250
Subtotal	US\$ 84,250
Total for a) & b)	US\$ 274,400
Total w/contingencies (15%)	US\$ 315,600
Financial/Administrative expenses ¹	US\$ 9,470

Proposed (OTF) financing: US\$ 325,070

Unit Abatement Cost: a) 7.78 US./kg of eliminated CFC-11.
b) 12.66 US\$/kg of eliminated CFC-12.

Beneficiary Company: COLDER S.R.L.

Coordinating National Authority: Comisión Técnica Gubernamental de Ozono, Ministerio de
Vivienda, Ordenamiento Territorial y Medio Ambiente.

Executing Agency: World Bank

¹ Three percent financial/administration expenses.

1. Project Summary:

a) This Project will eliminate the annual consumption of 8.5 MT of CFC-11 used in the production of rigid polyurethane foams as insulation for cold storage chambers and glass display cases by COLDER S.R.L. This alternative is proposed given the availability in the country of chemical products and equipment that allow the use of HCFC-141b in foams.

The Company is aware that this is only a temporary solution and that eventually it must search for a definitive technology. The adoption of high-pressure injection equipment proposed here prepares the company for that final transition. Cyclopentane is not an option for this company because its urban location and the associated municipal regulation rule out the use of flammable materials.

b) This Project will also eliminate the annual consumption of 3.19 MT of CFC-12 used as refrigerant. This will be carried out through the use of a technology that uses HFC-134a as a refrigerant (ODP=0). This alternative is proposed because equipment vendors will soon have available the adequate equipment to apply this technology.

2. Project Objectives:

a) Replace the use of CFC-11 as blowing agent in the production of rigid polyurethane foams used as insulation for cold storage chambers and glass display cases. To achieve this, the adoption of HCFC-141b is recommended.

b) Replace CFC-12 use by HFC-134a as refrigerant.

3. Sector Information:

COLDER S.R.L. is the most important company within the commercial refrigeration industry in Uruguay.

4. Company Information:

COLDER S.R.L. is a company that began operations in 1986, manufacturing cold storage chambers and glass display cases. Currently, the Company uses CFC-11 for thermal insulation of its products, using its own manual injection equipment. The Company uses CFC-12 and HCFC-22 as refrigerants in sealed and semi-opened compressors, consuming 1.5 MT and 0.5 MT, respectively, in 1993.

In 1993, COLDER S.R.L. consumed 4 MT of CFC-11 and manufactured 150 horizontal glass display case units, 50 vertical glass display case units, 30 mini cold storage chambers, and 70 modular cold storage chambers.

The Company's share of the domestic cold storage chambers and glass display cases market is estimated at 90%. COLDER S.R.L. does not receive foreign technical assistance.

COLDER S.R.L. is 100% owned by domestic capital.

5. Project Description:

a) COLDER S.R.L. will consume an annual average of 8.5 MT of CFC-11 in the manufacture of rigid foams (calculated as consumption average for the production projected between 1995 and 1998).

The Project proposes the use of HCFC-141b as blowing agent, for which the use of other chemical products and equipment must be adopted. The current low-pressure injection equipment produces a large amount of waste material and cannot be economically modified. High pressure equipment would be adopted in this project to eliminate waste and to prepare the company to a definitive no-ODP alternative. Chemical products supplier companies would provide the necessary technical assistance to implement the new process.

b) COLDER S.R.L. currently uses CFC-12 as refrigerant in its equipment. The project proposes the substitution of CFC-12 by HFC-134a as refrigerant. The project includes the services of an international expert to guide the process of HFC-134a conversion.

6. Justification of Selected Technology:

a) This alternative was studied along with a potential cyclopentane option; however, the latter was dismissed on the basis that municipal regulations would not permit the use of flammable materials in COLDER's site. The characteristics of the foams produced with HCFC-141b are similar to those currently produced, and there is ample experience on its use at the international level. The necessary chemical products and equipment would be available in the domestic market and supplier companies may provide the technical assistance on them. Any potential plastic liner compatibility problems would be addressed by the company at its own expense.

HCFC-141b is slightly flammable (although it has not flash point). This firm's facilities are reported to have sufficient ventilation to dissipate accumulation of HCFC-141b.

This alternative is only a temporary solution, entailing the need for future reconversion. Such final conversion will be less costly as the necessary injection equipment proposed in this project would accommodate the definitive blowing agent.

b) Reconversion to HFC-134a is a technology on which there is enough information, and Brazilian compressors could be readily available in the short term (EMBRACO BITZER and SICOM), as well as refrigerants (HOECHST from Brazil and DUPONT from USA).

Other technologies to replace CFC-12 in domestic refrigeration (such as hydrocarbons and other blends) are not commercially available in Uruguay; therefore, they could not be evaluated as a feasible option for a company that is willing to undertake the necessary conversions in 1995.

7. Project Costs:

Summary of Project Costs:

Capital Costs (see Annex 1):

- a) US\$ 175,000
- b) US\$ 62,000

Incremental Costs (six months) (see Annex 2):

- a) US\$ 15,150
- b) US\$ 22,250

Contingencies (15%) and Financial Intermediation fees (3%): US\$ 50,670

Share of Domestic Capital in the Company: 100%

Unit Abatement Cost (CAU) (See Annex 3):

- a) 7.78 US\$/kg of eliminated CFC-11.
- b) 12.66 US\$/kg of eliminated CFC-12.

8. Project Implementation:

a) Replacement of CFC-11 by HCFC-141b

	M O N T H S						
Activities	1	2	3	4	5	6	7
Project Evaluation	*						
Acquisition of equipment		*	*	*			
Equipment Installation					*		
Staff training						*	
Initial Tests						*	
Implementation							*

It is estimated that Project implementation could begin next year. An evaluation period is included in view of the unreliability of the information.

b) Substitution of CFC-12 by HFC-134a

Activities	Month 1	Month 2	Month 3	Month 4	Month 5
Obtain equipment samples	-----				
Redesign of cold circuits		-----			
Purchase of service equipment	-----				
Staff training			-----		
Tests				-----	
Implementation					-----

10. Results:

- a) This project eliminates consumption of 85 MT of CFC-11, 75.7 MT-ODP weighted (8.5 MT/year, MT-ODP weighted MT/year).
- b) This project eliminates consumption of 31.9 MT of CFC-12 in 10 years (based on annual consumption of 3.19 MT of CFC-12 which is the average consumption of the first four years).

Annex 1

Investment Breakdown

a) Replacement of CFC-11 by HCFC-141b.

High pressure equipment for use with HCFC-141b and accessories	US\$ 150,000*
Molds Modification	US\$ 10,000
Tests	US\$ 5,000
Staff Training	US\$ 10,000

TOTAL	US\$ 175,000

* Based on quote by Cannon (Italy) for a high-pressure machine model "A-System 40", standard version, ancillary equipment, and spare parts -- see Annex 4. As per the Secretariat's review more competitive equipment may exist in the marketplace; therefore, alternative quotes will be obtained as part of the procurement process.

b) Substitution of CFC-12 used as refrigerant with HFC-134a.

Review of cold circuit design	US\$ 10,000
Staff training by International expert	US\$ 15,000
Plant Trials	US\$ 4,000
Leak detector	US\$ 10,000
Charge equipment	US\$ 18,000
Service equipment	US\$ 5,000

TOTAL	US\$ 62,000

Annex 2

Breakdown of Incremental Costs/Savings

Values expressed in US\$

a) Substitution of CFC-11 by HCFC-141b.

Year	<u>Base Costs</u>		
	Unit Cost #	Units Produced	Total Cost
1995	246	450	110,700

Calculation assumptions:

Considering polyol, isocyanate and CFC-11.

CFC-11 market price: US\$2.84. Source: ORBEN (DUPONT).

Average CFC-11 use per assembled unit: 13.33 Kg CFC-11/unit.

A 10% annual CFC-11 price increase has been estimated.

Polyol market price: US\$2.11/kg.

Isocyanate market price: US\$2.49/kg.

Mix composition:	polyol	100 parts
	isocyanate	140 parts
	CFC-11	40 parts

Source: BAYER

Density: 30 kg/m³

102.5 kg of foam/unit are used

Cost of foam in 1995: US\$2.40

Year	<u>Project Costs</u>		
	Unit Cost #	Units Produced	Total Cost
1995	313.35	450	141,008

Estimated HCFC-141b price: US\$ 5.00/kg. (Source: Bayer -- see annex for quote)

the prices of polyol and isocyanate are equal to those of current technology.

Composition of the mix is as follows:

HCFC-141b 30 parts
isocyanate 159 parts
polyol 100 parts

Density: 35 kg/m³

Cost of foam: US\$ 2.62/kg.

Foam mass to be used: $102.5 \times 35 / 30 = 119.6$ kg/unit.

Cost of foam per unit: US\$ 313.35

Incremental Costs

Cost	1995
Base Cost	110,700
Project Cost	141,008
Incremental Costs	30,308 (one year)
	15,154 (six months)

b) Substitution of CFC-12 by HFC-134a:

Base Costs				
Year	CFC-12 Unit Cost	Total Unit Cost	Units Produced	Total Cost
1995	18.0	451	450	202,950

The following components of the refrigeration equipment are used for the base price (which would vary with the use of HFC-134a):

0.5 Hp Compressor	US\$ 300
Expansion Valve	US\$ 25
Humidity filter	US\$ 10
Fluid viewer	US\$ 18
Oil Separator	US\$ 80
TOTAL	US\$ 433

An average use of 5 kg of CFC-12 per unit has been estimated and that its market price is US\$3.60/kg Source: ORBEN (DUPONT).

Project Costs

Year	Unit Cost #	Units Produced	Total Cost
1995	550	450	247,500

Total cost was estimated as follows:

The base cost of US\$433 was increased by 10%, resulting in US\$476. Compressor suppliers still have no prices available but they estimated the increase by the percentage cited, which was taken as valid for the rest of the components.

It is estimated that 90% of the CFC-12 charge is used for HFC-134a, considering an average of 4.5 kg/unit. The HFC-134a market price is US\$16.5/kg (Source: ORBEN (DUPONT, USA). Thus, the unit cost is $\$476 + (4.5 \text{ kg} * \$16.50/\text{kg}) = \$550$

Incremental Costs

Cost	1995
Base Cost	202,950
Project Cost	247,500
Incremental Cost	44,500 (one year)
	22,250 (six months)

Annex 3

Unit Abatement Cost Calculation

a) Substitution of CFC-11 by HCFC-141b.

1. CFC-11 Savings (ODP=1)

Annual average CFC-11 consumption ^a	8.5 MT
Average use of HCFC-141b	8.5 MT
ODP of HCFC-141b	0.11
Weighted use per ODP/year	0.94 MT
<u>Weighted savings per ODP/Year</u>	<u>7.56 MT</u>

2. Annual Capital Costs

Total Investment	US\$ 175,000
Project Economic Life	10 years
Discount Rate	10%
<u>Annual Capital Incremental Costs</u>	<u>US\$ 28,480</u>

3. Operational Costs

<u>Annual incremental costs</u>	<u>US\$ 30,308</u>
---------------------------------	--------------------

4. Unit Abatement Cost (US\$/kg eliminated CFC-11)

$$\frac{28,480 + 30,308}{7560} = 7.78$$

b) Substitution of CFC-12 by HFC-134a:

1. CFC-12 Savings (ODP=1)

<u>Average annual CFC-12 savings^b</u>	<u>3.19 MT</u>
--	----------------

2. Annual Capital Costs

Total Investment	US\$ 62,000
Project Economic Life	10 years
Discount Rate	10%
<u>Annual Capital Incremental Costs</u>	<u>US\$ 10,090</u>

3. Operational Costs

<u>Annual Incremental Costs</u>	<u>US\$ 30,308</u>
---------------------------------	--------------------

4. Unit Abatement Cost (US\$/kg eliminated CFC-11)

$$\frac{10,090 + 30,308}{3,190} = 12.66$$

^b Based on average annual production over the next four years (638 units * 5 Kgs/unit of CFC-12).

Note:

Production projections used for the last calculation represent an increase in capacity utilization responding to growth in domestic demand (new supermarkets and shopping centers, and equipment replacement). In addition, the company foresees exports to MERCOSUR trading partners.

Annex 4

OORG Review

Country of origin: URUGUAY

Project title: b) Substitution of CFC-12 used as refrigerant with HFC-134a at COLDER S.R.L

Sector/sub-sector Commercial and household refrigeration

Relationship to country program (World Bank)

Note *This review addresses only the refrigerant conversion part of the project, it does not address the part related to the foam blowing agent conversion.*

Technology

In this project HFC-134a is selected as the substitute refrigerant for CFC-12. In commercial refrigeration, unitary equipment, HFC-134a technology is a proven and acceptable (nontransitional) technology to reduce CFC-12 consumption.

The company COLDER S.R.L. does not have a formal technology transfer partner. However, the company intends to develop the HFC-134a technology with assistance from compressor and refrigerant suppliers. Furthermore provisions for external assistance are present. Due to these facts, a successful project implementation can be expected.

Other technologies than HFC-134a were considered but were not selected mainly because of lack of commercial availability of requested components. 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 unitary equipment a GWP of this magnitude is negligible.

Project costs

The equipment requested by the manufacturer is essential for the conversion process. Costs of equipment are reasonable as well as costs for redesigning, training, testing and external support. With respect to the operational costs the following remarks are made:

- Operational costs are claimed for one year.
- Costs are claimed for 450 units which is the projected production of appliances in 1995 (1993 base was 300). The costs of the different items claimed are correct.
- The refrigerant price applied is high (16.5 USD/kg) but is based on demonstrated quotations. The UAC calculation in annex 3 (11.29 USD/kg/y) contains some mistakes. If the correct numbers are used a value of 16.8 is obtained which is almost equal to the value reported on the cover page (15.74). This is a reasonable number compared to similar projects. (It should be mentioned that the calculated CFC-12 reduction is based on the average of units expected to be produced in the next four years).

Implementation timeframe

Probably too strict

Relevance and adequacy of information provided

The project description, together with comments from the responsible World Bank officers, supplied sufficient information for a judgment.

Recommendations

Approval as proposed



Janssen M.J.P., OORG MM338, Eindhoven, The Netherlands, 2-November-1994

URUGUAY - COLDER

TECHNOLOGY

Technology based on HCFC 141b is viable for this application. It is well proven and is in widespread use. It is a transitional technology and the enterprise recognises that it will eventually have to switch to a zero ODP option.

Cyclopentane-based technology was also considered but was rejected on the grounds of safety. In addition, the cost effectiveness would have been poor for this scale of operation.

As a future replacement for HCFC 141b the enterprise can consider the use of liquid HFCs now under development or improved CO₂-based technology.

Any issue regarding compatible plastic liners will be covered by the enterprise at its own expense.

ENVIRONMENTAL ISSUES

The use of HCFC 141b is recognised by the enterprise as constituting a transitional step only.

There is sufficient ventilation in the factory to cope with the slight flammability of HCFC 141b.

PROJECT COSTS

The purchase of a high pressure injection machine is justifiable - it would also align the enterprise for a future zero ODP step - but the precaution should be taken to obtain equipment which can be converted to handle flammable blowing agents.

The operating costs are approved on the basis that the enterprise will cover aspects relating to liners.

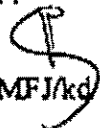
The cost effectiveness is low due to the overall low CFC usage rather than high capital or operating costs.

TIMEFRAME

This is acceptable.

RECOMMENDATION

Approved.


GMFJ/kd/16/11/94

Annex 5

Supporting Documentation



Bayer Uruguay Limitada

Señores
Comisión medio ambiente

Ing. Jorge Castro

Presente

Paysandú 1283
Casilla de Correo 304
11000 - Montevideo
Teléfono 92 00 13
Télex 032 22228 Bayer UY
Fax (00598-2) 92 11 25
Cables: Uniquim

Su referencia:

Su carta:

Nuestra referencia:

Montevideo,

E. Rauhut/grc

10.8.1994

GAS R 141 B DE ATODHEM / FRANCIA

Estimado Ing. Castro:

Según lo conversado esta mañana confirmamos a Uds. que es altamente probable, aunque dependiente de una confirmación final del proveedor (ATO), que Bayer Uruguay Ltda. sea designada distribuidor en Uruguay para el gas de la referencia, sustituto del Freon R 11.

De confirmarse lo antedicho, o bien importaríamos el material en contenedores desde Francia o alternatively seríamos provistos a través del distribuidor brasileño.

Para el caso de la primera opción, hemos calculado un precio orientativo de venta al usuario de US\$ 5/kg + IVA.

Comprometiéndonos a mantenerles informados respecto a este tema saludamos a Uds. muy atentamente.

BAYER URUGUAY LIMITADA
Productos Químicos

BAYER

Bayer Uruguay Limitada
Paysandú 1283
Casilla de Correo 304
11000 - Montevideo
Telephone: 92 00 13
Telex: 032 2229 Bayer UY
Fax: (00598-2) 92 11 25
Cable: Uniquim

Gentlemen
Environmental Commission

Eng. Jorge Castro
HAND DELIVERY

Our Reference: E. Rauhut/gr

Montevideo, 8/10/1994

GAS R 141 B FROM ATOCHEM, FRANCE

Dear Eng. Castro:

As per our conversation of this morning, this is to confirm that it is highly probable, although it depends on final confirmation from the supplier (ATO), that Bayer Uruguay Ltda., will be appointed as distributor representative in Uruguay for the above referred gas, which replaces Freón R 11.

If the above mentioned is confirmed, we would either import the material in containers from France, or alternatively, we would get it through the Brazilian distributor.

In the case of the first option, we have calculated an estimated price for user sale of US\$ 5/kg plus VAT.

We will keep you informed on this issue.

Sincerely yours,

BAYER URUGUAY LIMITADA
Chemical Products
(Signed)

Intercomerz Uruguay S.A.

REPRESENTACIONES

Senor Coordinador Tecnico
COMISION TECNICA GUBERNAMENTAL DE OZONO
P R E S E N T E

DIRECCION (ADDRESS)
INTERCOMERZ URUGUAYA S.A.
BUENOS AIRES 307 - ESC. 402
TELEFONOS (PHONES): 85 27 23 - 84 22 44
TELEX: KARY UY 26215
Cables: Intercomerz - Montevideo
P.O. BOX (Casilla Correo): 8748
FAX: 00 59 82 - 98 33 87
C.P. 11000 MONTEVIDEO - URUGUAY

S/REF. (YOUR RE.)

N/REF. OUR RE.

180/94-RG/db

MONTEVIDEO,

9 de agosto de 1994.

De nuestra consideracion:

Nos dirigimos a Ud. para informarle que la empresa INTERCOMERZ URUGUAYA S.A. esta en condiciones de suministrar, a traves de sus empresas representadas equipos de frio que utilizan el HFC-134a.

DANFOSS A/S - DINAMARCA
DANFOSS IND. E COM. LTDA. - BRASIL

Proveedores de controles para plantas de refrigeracion con refrigerante R 134a.

DANFOSS A/S - DINAMARCA
DANFOSS A/S - ALEMANIA
MANEUROP - FRANCIA Y ESTADOS UNIDOS
(pertenecientes al Grupo DANFOSS)

Proveedores de compresores hermeticos para refrigerante R 134a.

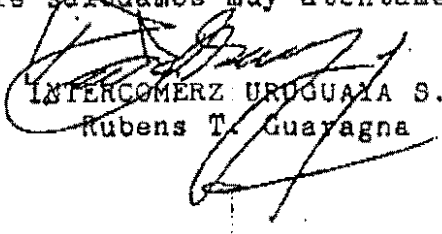
EMBRACO - BRASIL

Compresores hermeticos para refrigeracion domestica y comercial para refrigerante R 124a.

ASPERA - ITALIA

Compresores hermeticos para refrigerante R 134a.

Sin otro particular le saludamos muy atentamente.


INTERCOMERZ URUGUAYA S.A.
Rubens T. Guayagna

Intercomerz Uruguay S.A.
Buenos Aires 397 - Esc. 402
Telephones: 95 27 23 - 96 22 46
Telex: KARY UY 262215
Cable: Intercomerz - Montevideo
P.O. Box 6746
Fax: 005982 - 96 33 67
C.P. 11000 MONTEVIDEO - URUGUAY

Our Reference: 180/94-RG/db

Montevideo, August 9, 1994

To
Technical Coordinator
COMISION TECNICA GUBERNAMENTAL DE OZONO
HAND DELIVERY

Dear Sir:

This is to advise you that INTERCOMERZ URUGUAYA S.A. is in a position to provide, through its represented companies, cold storage equipment that use HFC-134a.

DANFOSS A/S - DENMARK
DANFOSS IND. E COM. LTDA. - BRAZIL

Suppliers of controls for refrigeration plants with refrigerant R 134a.

DANFOSS A/S - DENMARK
DANFOSS A/S - GERMANY
MANEUROP - FRANCE AND UNITED STATES
(part of the DANFOSS Group)

Suppliers of sealed compressors for refrigerant R 134a.

EMBRACO - BRAZIL

Sealed compressors for household and commercial refrigeration for refrigerant R 124a.

ASPERA - ITALY

Sealed compressors for refrigerant R 134a.

Sincerely yours,

(Signed)
INTERCOMERZ URUGUAYA S.A.
Rubens T. Guaragna

- 19 -

OCTOBER 28, 1994

154 2820068 14114

X 114 X 114114 HOECHST URUGUAY

31

F A X

FAX Nr. 2994 Fecha: 8.8.94

DE/From: Industrial Draper/Gawenda

Para/To: Ing. Jorge Castro

Attn:

HOECHST DEL URUGUAY S.A.
Br. Gral. Artigas 3098
11700 Montevideo-URUGUAYTel/Phone: (005982) 205022
FAX : (005982) 290955
Telex : 22418 Hoe UYKecilin 134 A

Precio: US\$ 18,75/kg - en cilindros retornables de 10 y 20 kg

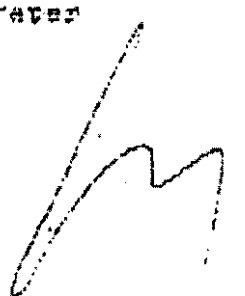
US\$ 15.-/kg - en cilindros retornables de 50 kg

US\$ 12,50/kg - en tanques retornables de 900 kg

precio fob Sao Paulo.

Pago: L/C 90 dias fecha B/L

Con respecto al tipo 141/E estamos esperando noticias de Alemania.

Saludos
Draper

FAX

FAX NUMBER 2994

Date: 8/9/1994

HOECHST DEL URUGUAY S.A.
Boulevard General Artigas 3898
11700 Montevideo - URUGUAY

From: Industrial Draper/Gawenda

To: Eng. Jorge Castro

Phone: (005982) 205022

Fax: (005982) 290966

Telex: 22418 Hoe UY

Reclin 134A

Price: US\$ 18.75/Kg - in returnable cylinders of 10 and 20 kg.

-- US\$ 15.00/Kg - in returnable cylinders of 50 kg.

US\$ 12.00/Kg - in returnable tanks of 500 kg.

FOB Prices Sao Paulo

Payment: 60 days from date of Bill of Lading

With respect to type 141/B we are awaiting news from Germany.

Regards,
Draper

HOECHST

Hoechst del Uruguay S.A.
Casilla de Correos 582
Boulevard Artigas 3896
11700 Montevideo
Telephone: 20 50 22
Fax: 29 08 58
Cable: Farmanil

Representatives of
Hoechst AG
Frankfurt (M) Germany

Our Reference JD/CF

Montevideo, 8/12/1994

Gentlemen
COMISION TECNICA GUBERNAMENTAL DE OZONO
Montevideo

Re: RECLIN 134a

This is to advise you that the above referenced product is manufactured by our representative
Hoechst do Brasil Química y Farmacéutica S.A.

Sincerely yours,

HOECHST DEL URUGUAY S.A.

(Signed) DRAPER
(Signed) GAWENDA

Hoechst 

Sres.
COMISION TECNICA GUBERNAMENTAL DE OZONO

Presente

Hoechst del Uruguay, S.A.

Casilla de Correos 582

Bv. Artigas 3898

11.700 Montevideo

Tel. 20 50 22

Telex: UY 22418

Fax: 29 08 58

Cables: Farmanil

Representantes de

Hoechst AG

Frankfurt (M), Alemania

Su referencia

Su carta del

Nuestra referencia

Montevideo,

JU/cf

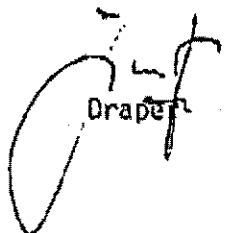
12.08.94

RECLIN 134 A

Por la presente informamos que el producto de referencia es fabricado por nuestra representada Hoechst do Brasil Química y Farmacéutica S.A.

Sin otro particular le saludamos muy atentamente.

HOECHST DEL URUGUAY S.A.


Draper


Gavenda

74 35/17 14144

E 127 2 255978 HOECHST URUGUAY

91

F A X

FAX Nr. **2387** Fecha: 14.06.94
DE/From: Industrial Draper/Gawenda
Para/To: Ing. J. Castro
Att:

HOECHST DEL URUGUAY S.A.
Br. Gral. Artigas 3598
11700 Montevideo-URUGUAY
Tel/Phone: (005982) 205022
FAX : (005982) 290258
Telex : 22418 Hox UY

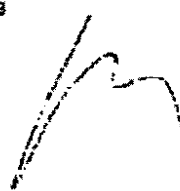
Reclon 134 A- Su fax del 10.6.94

Valores estimados para camión lleno (22 to bruto): US\$ 2.000.-
US\$ 75.-/to flota de ingreso + US\$ 25.- despacho + 1% fob (ad
valorem)

Para retorno estimar mismo flete.

Con respecto a los cilindros de 10 y 20 kg por error indicamos
que eran retornables, cuando en realidad están incluidos en el
precio.

Saludos
Draper





XAMAMUN HIEROCONTINENTAL DE COMPRESSORES HERMETICOS SIGMA LTDA.

C. Postal 54 CEP 13570-900 S. Carlos - SP - Brasil
Tel 55-(0) 162-71-1212 Fax-(0)162-72-7002 TLX 162415 SICH-BR

TECUMSEH



FAX

DATA DATE	19.05.94	Nº CONTROLE CONTROL NR	3022	Nº DE PÁGINAS, INCLUINDO ESTA NR OF PAGES, INCLUDING THIS COVER SHEET	1
PARA TO	INDUNOR - URUGUAY	FAX			
ATENÇÃO ATTENTION	SR. JORGE SILVA	DEPTO DEPT			
DE FROM	JANUÁRIO SOLIGON	DEPTO DEPT			
ASSUNTO SUBJECT	NUESTRA CONVERSACIÓN DE HOY	FAX			

Estuvimos analizando los ensayos efectuados con su refrigerador, donde cambiamos el compresor AE1343AS por el AZ1340DS en R-12. Como no tenemos los ensayos para ese sistema en R-134a, le describimos abajo, cambios aproximados en el sistema en base a los resultados obtenidos en los ensayos del AZ1340DS, colocado en su refrigerador.

SITUACIÓN ACTUAL

- . Sistema con el AZ1340DS (R-12) US\$ 30,00

CAMBIOS

- . Compresor AZ1335YS (R134a) US\$ 33,00
- . Aumento del largo del capilar en hasta 30%.
- Reducción de carga de gas en hasta 20%.
- . Condensador debe mantenerse el mismo.

Datos más apurados son obtenidos solamente con ensayos en cámara. Enviaremos por courier el día de hoy nuestros boletines técnicos sobre utilización del R-134a, tubos capilares y aceites lubricantes.

Atentos Saludos,

JANUÁRIO SOLIGON
VENTAS AM. LATINA

INDUNOR S.A.

PROJECT COVER SHEET

Country: Uruguay.

Project Title: a) Elimination of the use of CFC-11 as a blowing agent in rigid polyurethane foams used as insulation for refrigerators. Technology using cyclopentane as blowing agent will be adopted.
b) Substitution of CFC-12 used as refrigerant.

Covered Sector: Commercial and household refrigeration.

Use of ODPs in the Sector: Approximately 37.0 MT of CFC-11 and 13.0 MT of CFC-12 annually.

Project Impact: a) Eliminate consumption of 101.1 MT of CFC-11 (10.1 MT/year).
b) Eliminate consumption of 7.8 MT of CFC-12 (7.8 MT/year).

Duration of the Project: a) 8 months.
b) 6 months.

Project Economic Life: Ten years

Total Cost of the Project:

a) Investments	US\$ 249,280
Incremental costs (6 mos.)	US\$ 31,190
Subtotal	US\$ 280,470
b) Investments	US\$ 42,900
Incremental Costs (6 mos.)	US\$ 54,970
Subtotal	US\$ 97,870

NOVEMBER 18, 1994

Total for a) & b)	US\$ 378,340
Total w/contingencies (15%)	US\$ 435,090
Financial/Administrative expenses ¹	US\$ 13,050

Proposed OTF Financing: US\$ 448,140*

* All figures take into account a domestic capital share of the Company (66%).

Unit Abatement Cost:

- a) 15.44 US\$/kg of eliminated CFC-11.
- b) 22.66 US\$/kg of eliminated CFC-12.

Beneficiary Company: INDUNOR S.A.

Coordinating National Authority: Comisión Técnica Gubernamental de Ozono,
Ministerio de Vivienda, Ordenamiento Territorial y
Medio Ambiente.

Executing Agency: World Bank.

¹ Three percent financial/administration expenses.

1. Project Summary:

a) This Project will eliminate the consumption of CFC-11 used in the manufacturing of rigid polyurethane foams as insulation for refrigerators by INDUNOR S.A. The adoption of this technology is proposed given the domestic availability of chemical products and equipment that will allow the use of cyclopentane in foams. INDUNOR is located in an area for which local regulations can allow the use flammable materials.

b) This Project will eliminate the consumption of CFC-12 used as refrigerant.

2. Project Objectives:

a) Substitute the use of CFC-11 as a blowing agent in the production of rigid polyurethane foams as insulation of refrigerators. The adoption of foaming with cyclopentane is proposed to achieve this objective.

b) Substitute CFC-12 by HFC-134a as refrigerant.

3. Sector Information:

INDUNOR S.A. is the most important company in the domestic refrigeration sector in Uruguay.

4. Company Information:

INDUNOR S.A. is a company that began operations in 1984, manufacturing refrigerators. Currently, the Company uses CFC-11 (reduced by 50%) in the thermal insulation of its products, using a Hennecke HK 75 high pressure injection equipment. The Company uses CFC-12 as refrigerant, consuming 5.6 MT in 1993. In 1993, INDUNOR S.A. consumed 7.2 MT of CFC-11 and produced 18,200 units of the four different models of refrigerators it manufactures. Its share of the refrigerator domestic market is estimated at 45%. INDUNOR S.A. is constituted by domestic capitals (66%) and GENERAL ELECTRIC, USA (34%).

5. Project Description:

a) INDUNOR S.A. currently uses CFC-11 to manufacture rigid foams. This project proposes the use of cyclopentane as blowing agent, for which the use of other chemical products and equipment must be adopted. Chemical products and equipment supplier companies will provide the necessary technical assistance to implement the new process. Staff training is included to adopt the new technology and the associated safety guidelines as recommended by suppliers.

b) INDUNOR S.A. currently uses CFC-12 as refrigerant in its equipment. This project proposes substitution of CFC-12 by HFC-134a as refrigerant. GE does not have a technology transfer agreement with the company. The proposed project includes fund for services of an international expert to guide the process of HFC-134a conversion.

6. Justification of Selected Technology:

a) This alternative was studied along with HCFC-141b that were analyzed separately. The characteristics of the foams obtained with cyclopentane are similar to those currently produced, and experience in its use is available at the international level. The necessary chemical products and equipment are available in the domestic market, with supplier companies able to provide the necessary technical assistance. Cyclopentane is considered superior over HCFC-141b because it represents a final no-ODP alternative and is more cost-effective.

b) The reconversion to HFC-134a is a technology for which there is information, compressors and refrigerants readily available in the domestic market. The possibility of other refrigerants was considered; however, the HFC-134a technology is the only option commercially available in Uruguay for a changeover in the short term (1995).

7. Project Cost:

Capital Costs (See Annex 1): a) US\$ 249,280

b) US\$ 42,900

Incremental Costs (six months): a) US\$ 31,190
(See Annex 2).

b) US\$ 54,970

Share of domestic capitals in the Company: 66% (already considered in the amounts listed above)

Contingencies: 15% of the cost was included for contingencies and 3% for financial intermediation (considered in the amounts reported in the cover sheet).

Unit Abatement Cost (UAC): a) 15.44 US\$/kg

b) 22.66 US\$/kg (See Annex 3)

8. Project Implementation Timetable:

a) Use of cyclopentane

M o n t h s								
Activity	1	2	3	4	5	6	7	8
Development of detailed project installation	*	*	*					
Purchase of Equipment			*	*	*	*		
Installation and Tests							*	
Staff Training							*	
Implementation								*

b) Use of HFC-134a:

M o n t h s						
Activity	1	2	3	4	5	6
Production of Prototypes	*	*				
Plant Tests			*			
Tests in Brazil				*	*	
Purchase of new Materials						*
Staff Training					*	
Implementation						*

9. Results:

- a) This project will eliminate the consumption of 101.1 MT of CFC-11 over 10 years based on projected production levels (on average 10.104 MT/year).
- b) This project will eliminate the consumption of 78 MT of CFC-12 over 10 years based on projected production levels (on average 7.8 MT/year).

Annex 1**Investment Breakdown****a) Use of cyclopentane**

Conversion and complementing of existing equipment	US\$ 262,700
Installation and safety equipment	US\$ 80,000
Molds	US\$ 20,000
Tests	US\$ 5,000
Staff Training	US\$ 10,000

TOTAL	US\$ 377,700
--------------	---------------------

Elegible Portion of Investment (66% domestic ownership)	US\$ 249,280
--	---------------------

b) Use of HFC-134a

Redesign of cold circuits and plant trial	US\$ 10,000
Staff training by International expert	US\$ 15,000
Leak detection equipment (similar to that of halogen, helium leak detector is not considered)	US\$ 10,000
Gas charge equipment for plant	US\$ 18,000
Charge equipment for Service	US\$ 12,000

TOTAL	US\$ 65,000
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Elegible Portion of Investment (66% domestic ownership)	US\$ 42,900
--	--------------------

MINISTERIO
DE VIVIENDA
ORDENAMIENTO
TERRITORIAL
MEDIO AMBIENTE

COMISION TECNICA GUBERNAMENTAL DE OZONO

D.I.N.A.M.A.



Annex 1 (continued)

Annex 1

Investment Breakdown

a) Use of cyclopentane

CONVERSION AND COMPLEMENTING OF EXISTING EQUIPMENT

- High Pressure pumps (2), specially sealed for pentane	U\$S 39.500
- Computer controlled metering unit	U\$S 25.000
- Tandem Feed Pump	U\$S 14.000
- Piping and sealings	U\$S 8.800
- Safety valves	U\$S 5.500
- Automatic switch-off devices	U\$S 3.800
- Supply stoppers	U\$S 4.900
- Nitrogen inertizing equipment for molds	U\$S 18.800
- Other complementary devices	U\$S 4.000
- Encasings	U\$S 12.000
- Aeration and ventilation systems	U\$S 4.700
- Pentane sensors and gas warning systems	U\$S 9.200
- Pentane exhaustin systems	U\$S 8.600
- Safety Control Systems	U\$S 5.900
- Leakage monitoring and watchdogs	U\$S 4.200
- Stainless Steel work tanks (2) approved by TÜV (Germany)	U\$S 29.500
	<u>U\$S 198.400</u>
U\$S PIF (Put in factory)	U\$S 262.700

Annex 2

Breakdown of Incremental Costs

a) Foam Insulation

(Values expressed in US\$)

Year	<u>Base Costs</u>		
	Unit Cost #	Units produced	Total Cost
1995	12.92	26,400	341,088

Assumptions:

Considering polyol, isocyanate and CFC-11.

CFC-11 market price: US\$ 2,84. Source: ORBEN (DUPONT).

Average CFC-11 use per assembled unit: 0.327 Kg CFC-11/unit (5.45 kg foam/unit).

Polyol market price: US\$ 2.11/kg

Isocyanate market price: US\$ 2.49/kg

Composition of the mixture:

polyol	100 parts
isocyanate	148 parts
CFC-11	17 parts

Density: 30 kg/m³

Source: BAYER

Cost of foam in 1995: US\$ 2.37/kg

Year	<u>Project Costs</u>		
	Unit Cost #	Units Produced	Total Cost
1995	16.5	26,400	435,600

Assumptions:

Cyclopentane market price: US\$ 6.50/kg (estimated on the basis of data provided by BAYER).

It was estimated that the polyol and isocyanate prices are the same as those of the traditional technology.

The composition of the mix is as follows:

cyclopentane	12 parts
isocyanate	156 parts
polyol	98 parts

Density: 35 kg/m³

Source: BAYER.

Foam Cost: US\$ 2.53/kg

Foam mass to be used: $5.45 \times 36/30 = 6.54$ kg/unit

Incremental Operating Costs for 1995: US\$435,600 - 341,088 = US\$ 94,512 (one year)

Six Months: US\$ 47,256

Elegible share: US\$31,190
(66% local ownership)

b) Use of HFC-134a

<u>Base Cost</u>		
Unit Cost #	Units produced	Total Cost
32.09	26,400	847,176

The following has been estimated for the incremental costs:

- CFC-12 market price of US\$ 3.60/kg.
- Average gas charge is 0.253 kg/equipment.
- 1995 incremental costs have been estimated.

The following will have an impact on the incremental costs:

Price of refrigerant.

Micrangium (US\$ 0.67).

Characteristic of humid filter (US\$ 0.513).

Compressor Price (US\$ 30).

b) HFC-134a (continued)

<u>Project Cost</u>		
Unit Cost #	Units produced	Total Cost
38.4	26,400	1,013,760

Calculation Assumptions:

- HFC-134a market price of US\$ 16.50/kg. Source: ORBEN (DUPONT) and HOECHST (Brazil).
- The average refrigerator charge is 0.228/kg (90% of the above).
- Price of new micrangium (US\$ 0.871 (30% increase). Source: suppliers.
- Price of new filters - US\$ 0.59
- Price of new Compressor - US\$ 33 (see Annex 4 for SICOM quote)

Incremental Cost

Cost

Base Cost	847,176
Project Cost	1,013,760
Incremental Cost	166,584 (one year)

83,292 (six months)

Eligible share 54,973
(66% local ownership)

Annex 3

Calculation of Unit Abatement Cost

a) Use of cyclopentane as blowing agent:

1. CFC-11 Savings (ODP=1)

<u>Average Annual CFC-11 Savings^a</u>	<u>10,104 MT</u>
--	------------------

2. Annual Capital Costs

Total Investment	US\$ 377,700
Project Economic Life	10 years
Discount Rate	10%
<u>Annualized Capital Costs</u>	<u>US\$ 61,470</u>

3. Operational Costs

<u>Annual Incremental Costs</u>	<u>US\$ 94,512</u>
---------------------------------	--------------------

4. Unit Abatement Cost (US\$/kg of eliminated CFC-11)

$$\frac{61,470 + 94,512}{10,104} = 15.44$$

^a Based on average production over the next four years (30,900 units * 0.327 kg of CFC-11/unit)

b) Use of HFC-134a

1. CFC-12 Savings (ODP=1)

<u>CFC-12 Average Annual Savings^b</u>	<u>7,818 MT</u>
--	-----------------

HFC-134a ODP	0
--------------	---

^b Based on average production over the next four years (30,900 units * 0.253 kg of CFC-12 per unit)

2. Annual Capital Costs

Total Investment	US\$ 65,000
Project Economic Life	10 years
Discount Rate	10%
<u>Annualized Capital Costs</u>	<u>US\$ 10,578</u>

3. Operational Costs

<u>Annual Incremental Costs</u>	<u>US\$ 166,584</u>
---------------------------------	---------------------

4. Unit Abatement Cost (US\$/kg of eliminated CFC-11)

$$\frac{10,578 + 166,584}{7,818} = 22.66$$

INDUNOR S.A.

SUPPORTING DOCUMENTATION

(eleven pages including this page):

- INDUNOR's commitment letter
- 134a-associated cost changes
- availability of HFC-134a in Uruguay
- price of HFC-134a in Uruguay (2 letters)



Montevideo, 2 de febrero de 1994

Ministerio de Vivienda,
Ordenamiento Territorial y
Medio Ambiente
Comisión Técnica Gubernamental de Ozono

Atención: Ing. Quim. Luis A. Santos
Coordinador Técnico

Estimado Ing. Quim. Santos:

El día 28/01/94 tuvimos el agrado de mantener una reunión en nuestra Planta de Manufactura de Refrigeradores con la Ing. Quim. Mirian Vega y Ud., como integrantes de la Comisión Técnica Gubernamental de Ozono y el Sr. Sergio Oxman, como representante del Banco Mundial.

Como consecuencia de lo allí conversado, manifestamos nuestro interés en acceder a la asistencia gestionada ante los Organismos del Protocolo de Montreal, con el fin de reconvertir procesos de nuestra producción de refrigeradores para llegar a eliminar el uso de sustancias que agreden la capa de ozono.

Agradeciendo su colaboración, saludamos a Ud. muy atentamente.

P. INDUNOR S.A.

Ing. Ind. Pedro Vilanova
Gerente General de Electrodomésticos

OCTOBER 28, 1994

INDUNOR S.A.

MAXILUM - NIRPOL

Montevideo, February 2, 1994

Ministerio de Vivienda
Ordenamiento Territorial y Medio Ambiente
Comisión Técnica Gubernamental de Ozono

Attention: Chem. Eng. Luis A. Santos
Technical Coordinator

Dear Mr. Santos:

On 1/28/94 we had the pleasure of meeting Chem. Eng. Mirian Vega and you in our Refrigerator Manufacturing Plant as members of the Governmental Technical Commission on the Ozone as well as Mr. Sergio Oxman, representing the World Bank.

As a result of our discussions, we hereby express our interest in obtaining the assistance provided by Montreal Protocol agencies with a view to reconvert our refrigerator production processes to eliminate the use of substances that deplete the ozone layer.

Thank you very much for your cooperation.

We remain,

Sincerely yours,

for INDUNOR S.A.

Pedro Vilanova, Industrial Engineer
General Manager, Domestic Appliances



VALADARI INTERCONTINENTAL DE COMPRESSORES HERMÉTICOS S/COM LTDA.

C. Postal 54 CEP 13570-900 S. Carlos - SP - Brasil
 Tel 55-(0) 162-71-1212 Fax-(0) 162-72-7002 Tlx 162415 SICH-BR



TECUMSEH



B6



B6

FAX

DATA 19.05.94
 DATE

IN CONTROL 3022
 CONTROL NR

Nº DE PÁGINAS, INCLUIDO ESTA
 NR OF PAGES, INCLUDING THIS COVER SHEET

PARA INDUNOR - URUGUAY
 TO

ATENÇÃO SR. JORGE SILVA
 ATTENTION

FAX

DEPTO
 DEPT

DE JANUÁRIO SOLIGON
 FROM

ASSUNTO NUESTRA CONVERSACIÓN DE HOY
 SUBJECT

DEPTO
 DEPT
 FAX

Estuvimos analizando los ensayos efectuados con su refrigerador, donde cambiamos el compresor AE1343AS por el AZ1340DS en R-12. Como no tenemos los ensayos para ese sistema en R-134a, le describimos abajo, cambios aproximados en el sistema en base a los resultados obtenidos en los ensayos del AZ1340DS, colocado en su refrigerador.

SITUACIÓN ACTUAL

. Sistema con el AZ1340DS (R-12) US\$ 30,00

CAMBIOS

- . Compresor AZ1335YS (R134a) US\$ 33,00
- . Aumento del largo del capilar en hasta 30%.
- Reducción de carga de gas en hasta 20%.
- . Condensador debe mantenerse el mismo.

Datos más apurados son obtenidos solamente con ensayos en cámara. Enviaremos por courier el día de hoy nuestros boletines técnicos sobre utilización del R-134a, tubos capilares y aceites lubricantes.

Atentos Saludos,

JANUÁRIO SOLIGON
 VENTAS AM. LATINA

SICOM
SOCIEDADE INTERCONTINENTAL DE COMPRESSORES HERMETICOS SICOM LTDA.
P.O. Box 54
CEP 13570-900, Sao Carlos, SP, Brasil
Telephone: 55-0 162-71-1212
Fax: (0) 162 72-7002
Telex: 164215 - SICH-BR

FAX

DATE: 5/19/94 CONTROL N° 3022

TO: INDUNOR - URUGUAY
ATTENTION: MR. JORGE SILVA

FROM: JANUARIO SOLIGÓN

SUBJECT: OUR CONVERSATION OF TODAY

We analyzed the tests made on your refrigerator, where we changed the AE 1343S compressor with the AZ 1340DS compressor in R-12. Since we do not have tests available for that system in R-134a, described below are the approximate changes with the system, based on the results obtained in the AZ1340DS test, placed in your refrigerator.

CURRENT SITUATION

- System with the AZ1340DS (R-12) US\$ 30

CHANGES

- Compressor AZ1335YS (R134a) US\$ 33.00.
- Increase of the micrangium length by up to 30%.
- Gas charge reduction by up to 20%.
- The same condenser should be kept.

Faster data can only be obtained with chamber tests. We are sending via courier today our technical bulletins on R-134a use, micrangiums and lubrication oils.

Sincerely yours,

JANUARIO SOLIGON
Latin American Sales

OCTOBER 28, 1994

Hoechst 

Sres.
COMISION TECNICA GUBERNAMENTAL DE OZONO

Presente

Hoechst del Uruguay, S.A.

Casilla de Correos 502

Bv. Artigas 3896

11.700 Montevideo

Tel. 20 50 22

Telex: UY 22418

Fax: 29 06 58

Cables: Farmanil

Representantes de

Hoechst AG

Frankfurt (M), Alemania

Su referencia

Su carta del

Nuestra referencia

Montevideo,

JU/cf

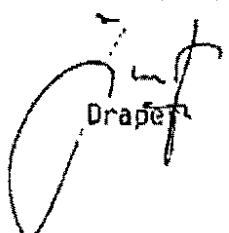
12.00.94

RECLIN 134 A

Por la presente informamos que el producto de referencia es fabricado por nuestra representada Hoechst do Brasil Química y Farmacéutica S.A.

Sin otro particular le saludamos muy atentamente.

HOECHST DEL URUGUAY S.A.


Drafer


Gavenda

HOECHST

Hoechst del Uruguay S.A.
Casilla de Correos 582
Boulevard Artigas 3896
11700 Montevideo
Telephone: 20 50 22
Fax: 29 08 58
Cable: Farmanil

Representatives of
Hoechst AG
Frankfurt (M) Germany

Our Reference JD/CF

Montevideo, 8/12/1994

Gentlemen
COMISION TECNICA GUBERNAMENTAL DE OZONO
Montevideo

Re: RECLIN 134a

This is to advise you that the above referenced product is manufactured by our representative
Hoechst do Brasil Química y Farmacéutica S.A.

Sincerely yours,

HOECHST DEL URUGUAY S.A.

(Signed) DRAPER
(Signed) GAWENDA

114 28/11 14:24

S 174 2 110777 HOECHST URUGUAY

01

F A X

FAX Nr. 2994 Fecha: 9.6.94

HOECHST DEL URUGUAY S.A.
Bd. Gral. Artigas 3898
11700 Montevideo-URUGUAY

DE/From: Industrial Draper/Gamenda

Para/To: Ing. Jorge Castro

Tel/Phone: (005952) 205022

Atte:

FAX : (005952) 290956

Telex : 22418 Hoe UY

Reclm. 134 A

Precio: US\$ 18,75/kg - en cilindros retornables de 10 y 20 kg

US\$ 18.-/kg - en cilindros retornables de 50 kg

US\$ 12,50/kg - en tanques retornables de 500 kg

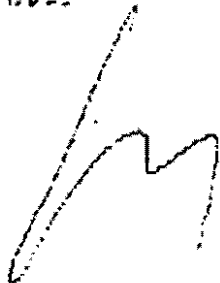
precio fob San Paulo.

Pago: L/C 90 dias fecha B/L

Con respecto al tipo 141/E estamos esperando noticias de
Alemania.

Saludos

Draper



FAX

FAX NUMBER 2994

Date: 8/9/1994

HOECHST DEL URUGUAY S.A.
Boulevard General Artigas 3898
11700 Montevideo - URUGUAY

From: Industrial Draper/Gawenda

To: Eng. Jorge Castro

Phone: (005982) 205022
Fax: (005982) 290966
Telex: 22418 Hoe UY

Reclin 134A

Price: US\$ 18.75/Kg - in returnable cylinders of 10 and 20 kg.
US\$ 15.00/Kg - in returnable cylinders of 50 kg.
US\$ 12.00/Kg - in returnable tanks of 500 kg.

_FOB Prices Sao Paulo

Payment: 60 days from date of Bill of Lading

With respect to type 141/B we are awaiting news from Germany.

Regards,
Draper

74 05/17 14144

C 123 2 390004 MONTEVIDEO URUGUAY

91

F A X

FAX Nr. 2307 Fecha: 14.05.94

DE/From: Industrial Draper/Gawenda

Para/To: Ing. J. Castro

Att:

MOCHIST DEL URUGUAY S.A.

Br. Gral. Artigas 3398

21700 Montevideo-URUGUAY

Tel/Phone: (005982) 205022

FAX : (005982) 290858

Telex : 22418 Hcs UY

Recibo 134 A- Su fax del 10 A Flota

Valores estimados para camión lleno (22 to bruto): US\$ 2.000.-

US\$ 75.-/to flota de ingreso + US\$ 95.- despacho + 1% fob (ad
valorem)

Para retorno estimar mismo flete.

Con respecto a los cilindros de 10 y 20 kg por error indicamos
que eran retornables, cuando en realidad están incluidos en el
precio.Saludos
Draper

FAX

FAX NUMBER 2387

Date: 6/14/1994

HOECHST DEL URUGUAY S.A.
Boulevard General Artigas 3898
11700 Montevideo - URUGUAY

From: Industrial Draper/Gawenda

To: Eng. Jorge Castro

Phone: (005982) 205022

Fax: (005982) 290966

Telex: 22418 Hoe UY

Re: Reclin 134a. Your fax dated 6/10 Freight

Estimated values for full truck (22 to gross): US\$ 2,000.

US\$ 75/to incoming freight - US\$ 95.00 dispatch plus 1% FOB (ad valorem)

For return, estimate the same freight.

With respect to the 10 and 20 kg. cylinders, we erroneously indicated that they were returnable,
when in fact they are included in the price.

Regards,

Draper

ETCHEPARE-GIL

PROJECT COVER SHEET

Country: Uruguay.

Project Title: Elimination of the use of CFC-11 as a blowing agent in rigid polyurethane foam used as insulation in water heater tanks. HCFC-141b as blowing agent will be adopted to replace the reduced CFC-11 technology now in place.

Covered Sector: Insulation of thermal tanks.

Use of ODPs in the Sector: 12.5 MT of CFC-11 annually.

Project Impact: Eliminate consumption of 4.4 MT of CFC-11 per year (effective ODP weighted reduction is 3.43 MT)

Duration of the Project: 8 months.

Project Economic Life: 10 years.

Total Cost of Project:

Investments	US\$ 175,000
Incremental Operational Costs (6 mos.)	US\$ 23,430
Subtotal	US\$ 198,430
Total Cost w/Contingencies ¹	US\$ 228,200
Financial/Administrative expenses ²	US\$ 6,850.

Proposed OTF Financing: US\$ 235,050

Unit Abatement Cost: 21.96 US\$/kg of eliminated CFC-11³

Beneficiary Company: ETCHEPARE-GIL S.A.

Coordinating Authority: Comisión Técnica Gubernamental de Ozono, Ministerio de Vivienda, Ordenamiento Territorial y Medio Ambiente.

Executing Agency: World Bank.

¹ Includes 15% for contingencies.

² Three percent.

³ If reduction from the original 100% CFC-11 is considered, the UAC is 50% this amount.

1. Project Summary:

This Project will eliminate the consumption of CFC-11 used in the manufacturing of rigid polyurethane foams as insulation of thermal tanks by ETCHEPARE-GIL S.A. HCFC-141b is the proposed alternative given the domestic availability of chemical products and equipment that will allow the adoption of this technology. Cyclopentane is not an option for this company because its urban location and the associated municipal regulation rule out the use of flammable gases. Future alternatives to replace HCFC-141b could be the liquid HFCs under development.

The Company is aware that this is only a temporary solution and that eventually it must convert to a definite technology. The adoption of high-pressure injection equipment proposed here prepares the company for that final transition.

2. Project Objectives:

Substitute the use of CFC-11 as a blowing agent in the manufacturing of rigid polyurethane foams for insulation of thermal tanks. The adoption of HCFC-141b is proposed to achieve this objective.

3. Sector Information:

The Sector is represented by two large companies, one of them using the traditional CFC-11 technology and ETCHEPARE-GIL S.A., which has already reduced its use by 50%.

4. Company Information:

ETCHEPARE-GIL S.A. is a company that began operating in 1963, manufacturing household appliances. Currently, the Company uses CFC-11 (substituted by 50%) in thermal insulation of thermal tanks, using CANNON 15 low pressure injection equipment. In 1993, the Company produced 40,000 thermal tanks, 115,000 stoves, and 92,500 exhaust fans. Thirty-eight per cent of the units produced were exported to MERCOSUR countries (Argentina, Brazil, and Paraguay) and Chile.

Its maximum annual production capacity is 60,000 thermal tanks, 120,000 stoves and 150,000 exhaust fans, per shift. Currently, there is a single production shift. The Company controls approximately 60% of the thermal tank domestic market. The company does not receive foreign technical assistance. ETCHEPARE-GIL S.A. is 100% owned by domestic capitals. Future company plans include increasing exports to Brazil and Argentina.

NOVEMBER 18, 1994

5. Project Description:

Currently ETCHEPARE-GIL S.A. uses reduced CFC-11 technology for the manufacture of rigid foams (i.e., technology that reduced CFC-11 use by 50% from the original process design). This project proposes the use of HCFC-141b as a blowing agent, for which the use of other chemical products and equipment must be adopted. Suppliers of chemical products will provide the necessary technical assistance to implement adjustments to the new process.

High pressure equipment would be adopted to prepare the company to a definitive no-ODP alternative. The existing low pressure injection machine currently in use would be decommissioned and not reused as the company believes this would go against the goals of this project (i.e., reduce consumption of CFC-11).

The existing molds which were used with the 100% CFC-11 technology would need to be adapted or replaced to accommodate the need for heating which prevents foam adherence problems.

6. Justification of the Selected Technology:

Cyclopentane is not an option for this company because municipal regulations ban the use of flammable industrial materials in urban locations, such as the company's site. A relocation of the plant to another site would cost much more than the proposed project. In addition, the company's management is unwilling to relocation for strategic reasons.

The characteristics of the foams produced with HCFC-141b are similar to those currently produced, and there is ample experience in its use at the international level. The necessary chemical products and equipment are available in the domestic market, and supplier companies can provide the necessary technical assistance.

The company's current facilities are capable of safely handling chemical materials with slight flammability, such as HCFC-141b. In addition, the company is committed to adopt any special precautionary measures that may be specified by equipment and HCFC-141b suppliers for safely handling HCFC-141b. The project costs included in this proposal include resources for staff training which includes addressing the slight flammability of HCFC-141b.

This alternative is only a temporary solution, entailing the need for future reconversion. Such final conversion will be less costly as the necessary injection equipment proposed in this project would accommodate the definitive blowing agent.

7. Project Cost:Summary of Project Costs:Capital and One-time Costs: US\$ 175,000 (Sec Annex 1)Incremental Operating Costs (six months): US\$ 23,430 (sec Annex 2).Share of Domestic Capital in the Company: 100%.Contingencies and financial fees: 18% = US\$ 36,620.Total Costs: US\$ 235,050Cost Abatement Unit (UAC): 21.96 US\$/kg (sec Annex 3)8. Project Implementation:

Estimated timetable:

Months

Activity	1	2	3	4	5	6	7	8
Project Evaluation	*							
Purchase of equipment		*	*	*	*			
Equipment Installation						*		
Staff Training							*	
Initial Tests							*	
Start-up								*

10. Results:

With this Project, 44 MT of CFC-11 (4.4 MT/year) consumption will be eliminated in ten years. Because HCFC-141b has an ozone depletion potential of 0.11 the net reduction is 3.43 MT/year.

Annex 1

Investment Breakdown

Substitution of CFC-11 by HCFC-141b.

Adequate high pressure equipment
for use with HCFC-141b and accessories

US\$ 150,000*

Mold Modifications
(6 molds * 2 models = 12 molds)

US\$ 10,000

Tests

US\$ 5,000

Staff Training

US\$ 10,000

TOTAL

US\$ 175,000

* Based on quote by Cannon (Italy) for a high-pressure machine model "A-System 40", standard version, ancillary equipment, and spare parts (see Annex 4). As per the Secretariat's review more competitive equipment may exist in the marketplace; therefore, alternative quotes will be obtained as part of the procurement process.

Annex 2

Breakdown of Incremental Costs

Values expressed in US\$

Substitution of CFC-11 by HCFC-141b.

Year	Base Costs		
	Unit Cost #	Units Produced	Total Cost
1995	2.45	60,000	147,000
1996	2.47	70,000	172,900
1997	2.49	75,000	186,750
1998	2.51	80,000	200,800

#Considering polyol, isocyanate and CFC-11.

CFC-11 market price: US\$ 2.84. Source: ORBEN (DUPONT -- see Annex 4).

Average use of CFC-11 per assembled unit: $0,124/2 = 0,062$ Kg CFC-11/unit (1.03 kg of foam/unit).

An annual increase of 10% in the price of CFC-11 has been estimated.

Polyol market price: US\$ 2.11/kg.

Isocyanate market price: US\$ 2.49/kg.

Composition of the mixture:	polyol	100 parts
	isocyanate	148 parts
	CFC-11	17 parts

Density: 30 kg/m³

Source: BAYER

Cost of foam:

Year	Cost US\$/kg
1995	2.37
1996	2.39
1997	2.41
1998	2.43

Estimated average base cost for the first four years: US\$ 176,863.

Project Costs

Year	Unit Cost #	Units Produced	Total Cost
1995	3,14	60,000	188,400
1996	3,14	70,000	219,800
1997	3,14	75,000	235,500
1998	3,14	80,000	251,200

Average Project Cost: US\$ 223,725

Price of HCFC-141b: US\$ 5/kg. (Source: BAYER, see Annex 4)

It was estimated that the HCFC-141b expense per unit is 0.111 kg., considering the differences in foam density.

#The prices of polyol and isocyanate are equal to those of the traditional technology.

The mix is made in the following proportions:

HCFC-141b	30 parts
Isocyanate	159 parts
Polyol	100 parts

Density: 35 kg/m³

Foam Cost: US\$ 2.98/kg

Foam mass to be used: $1.03 \times 35 / 30 = 1.20$ kg/unit

Incremental Costs

Cost	
Base Cost	176,863
Project Cost	223,725
Incremental Cost	46,862 (Annual)
	23,430 (six months)

Annex 3

Calculation of Unit Abatement Cost

Substitution of CFC-11 by HCFC-141b.

1. CFC-11 Savings (ODP=1)

Average Yearly Consumption of CFC-11 (estimated average consumption for the first four years)	4.4 MT
Average Use of HCFC-141b	8.8 MT
HCFC-141b ODP	0.11
Weighted Use by ODP/year	0.97 MT
<u>Weighted Savings of ODP/year</u>	<u>3.43 MT</u>

2. Annual Capital Costs

Total Investment	US\$ 175,000
Project Economic Life	10 years
Discount Rate	10%
<u>Annual Capital Incremental Costs</u>	<u>US\$ 28,480</u>

3. Operational Costs

<u>Annual Incremental Costs</u>	<u>US\$ 46,862</u>
---------------------------------	--------------------

4. Unit Abatement Cost (US\$/kg of eliminated CFC-11)

$$\frac{28,480 + 46,862}{3430} = 21.96^*$$

* The UAC denominator is [eliminated amount of CFC-11] - [ODP/year of quantity of 141b used] = 4400 - 970 = 3430 kg.

Note: In this denominator, the quantity actually eliminated in the project was used starting with an initial situation in which there is already a 50% substitution of CFC-11 use. If this is considered in connection with the original use of CFC-11 technology, the UAC would be 50% lower.

Annex 4

HCFC-141b and Injection Machine Supplier Quotes



Bayer Uruguay Limitada

Señores
Comisión medio ambiente

Ing. Jorge Castro

Presente

Paysandú 1263
Casilla de Correo 304
11000 - Montevideo
Teléfono 92 00 13
Télex 032 22228 Bayer UY
Fax (00598-2) 92 11 25
Cables: Uniquim

Su referencia:

Su carta:

Nuestra referencia:

Montevideo,

E. Rauhut/grc.

10.8.1994

GAS R 141 B DE ATOCHEM / FRANCIA

Estimado Ing. Castro:

Según lo conversado esta mañana confirmamos a Uds. que es altamente probable, aunque dependiente de una confirmación final del proveedor (ATO), que Bayer Uruguay Ltda. sea designada distribuidor en Uruguay para el gas de la referencia, sustituto del Freon R 11.

De confirmarse lo antedicho, o bien importaríamos el material en contenedores desde Francia o alternativamente seríamos provistos a través del distribuidor brasileño.

Para el caso de la primera opción, hemos calculado un precio orientativo de venta al usuario de US\$ 5/kg + IVA.

Comprometiéndonos a mantenerles informados respecto a este tema saludamos a Uds. muy atentamente.

BAYER URUGUAY LIMITADA
Productos Químicos

BAYER

Bayer Uruguay Limitada
Paysandú 1283
Casilla de Correo 304
11000 - Montevideo
Telephone: 92 00 13
Telex: 032 2229 Bayer UY
Fax: (00598-2) 92 11 25
Cable: Uniquim

Gentlemen
Environmental Commission

Eng. Jorge Castro
HAND DELIVERY

Our Reference: E. Rauhul/gr

Montevideo, 8/10/1994

GAS R 141 B FROM ATOCHEM, FRANCE

Dear Eng. Castro:

As per our conversation of this morning, this is to confirm that it is highly probable, although it depends on final confirmation from the supplier (ATO), that Bayer Uruguay Ltda., will be appointed as distributor representative in Uruguay for the above referred gas, which replaces Freón R 11.

If the above mentioned is confirmed, we would either import the material in containers from France, or alternatively, we would get it through the Brazilian distributor.

In the case of the first option, we have calculated an estimated price for user sale of US\$ 5/kg plus VAT.

We will keep you informed on this issue.

Sincerely yours,

BAYER URUGUAY LIMITADA
Chemical Products
(Signed)

Monsieur,

ETCHEPARE CIL. S.A.
Fraternidad 3048
CP 11700 MONTEVIDEO
URUGUAY

Attention Ing. Cassiniga

PROFORMA INVOICE:

N° 112/94 WLD 98/38

DATE: 20/03/94

SUBJECT:

CANNON FORMING HIGH PRESSURE MACHINE

No.1 Cannon high pressure machine model "A-System 40" std. version
having the following main technical features:

TANKS GROUP FOR POLYOL AND ISOCYANATE

no. 2 NO Jacketed carbon steel tanks 330 lt. capacity, pressurized
and tested at 11.6 Bar to ISPECC regulations, insulation by
Armaflex material, tanks group mounted on own frame.

Each tank is composed with:

- no.1 agitator 0.5 HP (on polyol tank only)
- no.1 external visual level
- no.1 three-way manual drain valve
- no.1 PT 100 temperature sensor and transducer mounted on the tank
- no.1 air pressure control gauge
- no.1 set of automatic levels (4 setting points: alarm, min/max
filling, stop filling)
- no.2 heat exchanger: 2 sqm. surface each on polyol tank
- no.1 heat exchanger : 2 sqm. surface on isoc. tank

ISO component, filling through 1 pneumatic pump, complete with
reducer, connection and relevant pipes.

POL blend filling through 1 on-off valve, connected to the
FARYFroth unit.

Fax no. 568

Page 2

COSMOS

COSMOS

METERING GROUP composed of:

L-shaped steel frame

- no. 1 double shaft motor
- no. 2 high pressure pumps
- double speed motor: 725/1450 rpm.
- no. 2 manually operated self-cleaning filters
- no. 2 high pressure gauges
- no. 2 low pressure gauges
- connection pipes between machine and tanks group
- collecting basins for eventual chemical losses mounted under pumps and hydraulic unit

ELECTRIC/ELECTRONIC CONTROLS

Control panel mounted on machine frame, including:

- motor power relays
- power relays for heating elements
- PLC controller (Siemens model)
- high pressure recycle timer
- calibration head timer for calibration head
- switch and lights
- two proportional band regulators
- three electronic, digital pouring timers
- controls relevant to 1 FPL mix head with double control valve
- INO Hini: (1. allows the monitoring of the components output, component ratio and shot weight. It includes a minicomputer to process monitoring, connected to 2 flow transducers).

POURING GROUP including:

- no. 1 high pressure self-cleaning mix-head, model: FPL 10
 - single component output: min. 90 max. 550 cc/min.
 - oil consumption: 807 cc/shot
 - special heads with 112 mm. stroke and 65.5 mm. nose
 - head weight: 10.4 kg.
- no.1 set of 6 mts. flexible hoses
- no.1 HYDRAULIC unit (for heads operation)
 - oil tank : 100 lts
 - hydraulic pump : 10 lts/min. output
 - electric motor power : 7.8 HP
 - accumulator : 10 lts (precharged at 100 Atm.)
 - hydraulic filter with alarm

METERING SYSTEM

The chemicals recirculate under low pressure when they are not actually being dispensed. Each component flow is blanked pressure from the tanks to the metering pumps. Precise and adjustable throughput is provided by two hexroth positive displacement axial piston pumps which are coupled with a double shaft motor.

This common coupling ensures both components to keep the ratio in the event of power fluctuations or other external occurrence.

In case of a multi-heads plant, the chemicals recirculate under low pressure through the whole ring piping, which connects the dosing machine to the heads. Stream distributors for each component are installed on delivery line, the same are opened by low pressure, so that the material circulates through the valves, back to the heat exchangers and into the tanks. By recirculation at low pressure the chemicals can be constantly conditioned without taking the system components. With the valve closed, the material circulates through the mix-head, where an adjustable orifice assembly develops the high pressure required for impingement mixing.

High pressure recirculation through the mix-head and back to the tanks (prior to dispensing) ensures that a homogeneous mixture is dispensed when the pour piston opens.

CANNON FPL head

Cannon's patented mix-head consisting of two cylindrical chambers and the discharge chamber, each one is furnished when the corresponding piston retracts. When the pour piston is retracted, the chemicals enter the mixing chamber under high pressure. Since they are located directly across from each other, they collide violently (high pressure impingement), ensuring thorough mix of the two components. The pressure that is develop at the orifice assemblies into the mix-chamber and dissipates so the mixture makes 90° transition into the discharge chamber. The FPL mix-head employs a recirculation groove on each side of the mix-chamber piston. This groove allows the component to circulate through the entire system before pouring occurs, ensuring that a homogeneous mixture is dispensed when the pour occurs.

The chemicals pass over the orifice during both the high pressure recycle and pour sequence. The orifice assemblies are located just upstream of the mix-chamber's inlet port, allowing the component pressure to be adjusted during high pressure recycle, prior to dispensing chemicals.

TEMPERATURE CONDITIONING SYSTEM

Temperature control is provided for each tank by heat exchanger mounted on the chemical return line just upstream of the tank. Analogic-indicating proportional controllers (one for each component) are coupled to two PT 100 temperature sensors in order to provide accurate control of the component temperature. Electrical solenoid valves control the flow of the chilled water.

The tanks group is connected with a chiller unit:

- no. 1 external, separate, self-contained chiller unit: 5 HP, complete with thermostat, water circulation pump and pressure switch.
Cooling capacity: 15.000 kcal/h.
Water output: 2.400 lt/h.

VOLTAGE : 380 V. 50 HZ. (pls., confirm it)

PREMIX UNIT EASYFROTHER (TM) 20+4 LTR.

The Easyfroth is a special developed unit to realize the mixing of conventional Polyol-types with LBSA in accurate ratio.

The here offered unit has the capacity to deliver a blend of maximum 20 l/min. Polyol and 4 l/min. LBSA.

The unit is composed by:

- no. 1 stainless steel frame where the following equipment is mounted on:
- no. 1 adjustable metering pump for raw Polyol cap. 20 l/min.
- no. 1 flow transducer for the raw Polyol
- no. 1 recirculation valve for raw Polyol
- no. 1 pneumatic booster pump for the LBSA
- no. 1 double acting metering cylinder for the LBSA
- no. 1 flowtransducer for the LBSA
- no. 1 recirculation valve for the LBSA
- no. 1 continuous working static mixer for Polyol and LBSA
- no. 1 hydraulic unit to drive the metering cylinder of the LBSA
- no. 1 control panel with microprocessor, keyboard and display to control the output and ratio of the Polyol and the LBSA and all electrical hardware (relais, motorswitches a.s.o.)

The raw Polyol and the LBA have to be delivered to the inputs of the unit with a constant flowrate and a pressure of 4 bar for Polyol, at a pressure of 8 bar for the LBA. Both components are measured and controlled after metering by the well fitted pump (Polyol) and by the metering cylinder (LBA) with flow transducers.

If there is no blend required by the Polyol-tank both components recirculate back to the delivery-tank. In the case that blend is required, the recirculation valve guide the material flow to the static-mixer.

With this configuration it is assured, that the ratio is absolutely accurate.

The Polyol/LBA-blend is delivered from the static mixer to the Polyol-tank of the dosing unit by an adjustable working pressure.

The HCF (gas sold in bottles) is kept in a liquid state by means of a pneumatic booster installed on the dosing unit.

This liquid is then metered by a double acting Hydraulic cylinder and mixed with Polyol in a high efficiency static mixer, using pressure higher than the blowing agent is critical pressure.

RAW POLYOL TANK

TANK SKETCH FOR RAW POLYOL MOUNTED ON A FRAME including:

No.1 Jacketed carbon steel 330 lbs. pressurized with Armaflex insulation at 11,5 bar to thermal regulations, complete with:

- no.1 agitator 0,5 HP
- no.1 visual level mounted on the tank
- no.1 manual drain valve
- no.1 PT100 temperature sensor and transducer mounted on the tank
- no.1 air pressure control gauges
- no.1 floating level at 4 setting points: alarm, min/max filling, stop level
- no.1 on/off valve for automatic tank filling
- no.2 1,5 KW resistance
- no.1 electric control panel including proportional band thermoregulator

No.1 special pneumatic feeding pump (to load Polyol without raw material drums to the raw Polyol tank (ratio 2:1):

the tank can be connected to your existing chiller or have to be quoted in case of need.

P R I C E S

CANNON PROPOSAL composed by:

- HIGH PRESSURE UNIT "A-system 40"
- EASYFROTH (cm)
- POLYOL TANK

TOTAL AMOUNT, EX-WORKS	LIT. 212.000.000.-
OVERSEA PACKING COST.....	LIT. 2.000.000.-
F.O.B. ITALIAN PORT	LIT. 1.300.000.-

TOTAL AMOUNT, PACKING AND F.O.B. INCLUDED	LIT. 215.300.000.-
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OPTIONALS:

EXTRA COST TO SUPPLY "1HD VIDEO"	LIT. 4.000.000.-
--	------------------

SET OF SUGGESTED SPARE PARTS: H.P. unit	LIT. 15.000.000.-
Premix unit	LIT. 5.000.000.-

START-UP by one Cannon technician for 5 (five)
working days, air ticket included LIT. 4.000.000.-

EXCLUSION: board/lodging at Contractor charge

Fax no. 565

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- PAYMENT: Irrevocable and confirmed letter of credit to be opened on one of the following Banks:

- "Banca Nazionale del Lavoro" - Saronno branch (VARESE)

- "Banca Commerciale Italiana" - Museo Adriano branch - 61-

- "Credito Italiano" - Saronno branch (VARESE)

- "Banca di Roma" - Saronno branch (VARESE)

(L/C) having at least 120 days validity without any extra charges to A.C.O.'s account. The L/C validity for negotiation to be at least 15 days longer than the L/C validity for shipment.

The L/C must be confirmed by your Bank and sure and the total amount must be deposited to the Italian Bank.

The L/C must be issued at ARKOV S.P.A. name and be payable against shipping documents.

NOTE: F.O.B. ITALIAN PORT, packing included

- DELIVERY: 12/14 working weeks after receipt of yr regular order and L/C details

- VALIDITY OF QUOTE PRICES: till 31th August 1994

- WARRANTY: 6 months for all mechanical parts being defectively manufactured. The warranty does not include any right of indemnity for damages and/or working interruptions.
The shipment of defective parts is at buyer's charge.

- GOODS OF ITALIAN ORIGIN

Awaiting your news on the matter, best regards

G. MAGGIARA / WLD SALES DEPT.

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Annex 5

OORG Review

**Polyurethanes**

TELEFAX

To Ms. L. Tlalya
The World Bank

cc: Mr. T. W. Waltz

Dr. Mike Jeffs
International Environmental
Affairs Manager

Everslaan 46,
B-3078 Everberg
Belgium

Telephone (02) 758 9394
Telex 26332 ICIEVB B
Telefax (02) 758 9894

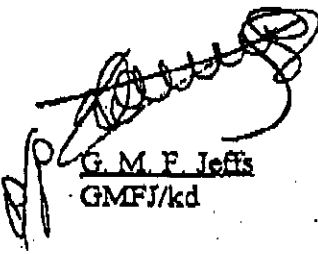
20th October, 1994

URUGUAY - HOT WATER TANK PROJECTS

My reviews follow.

You will see that they are identical for the two enterprises. I have approved both projects, subject to some revision along the lines indicated in the comments, because they are basically sound and about as cost effective as they can be considering the small CFC use.

Regards,


G.M.F. Jeffs
GMFJ/kd

URUGUAY - ETCHEPARE - GIL S.A.TECHNOLOGY

The application is the thermal insulation of domestic hot water tanks. The choice of HCFC 141b in place of CFC 11 is well proven and in use in both developed and developing countries. It offers an almost equivalent insulation value to CFC 11-based foam and is relatively cost effective to implement.

The use of pentane (cyclopentane) has been considered but not pursued because of the urban location of the enterprise and local regulations - the latter exclude the use of flammable blowing agents - presumably for as long as the regulation lasts.

Alternatives to eventually replace HCFC 141b could be the liquid HFCs now being developed.

ENVIRONMENTAL ISSUES

The enterprise recognises that HCFC 141b is a transitional product and will have to be replaced in the future.

In addition, HCFC 141b is slightly flammable, although it does not have a flash point. There is no indication of any modifications to ensure adequate ventilation or for specific staff training.

PROJECT COSTS

Although the issues are not detailed there the enterprise currently uses a low pressure (?) dispensing machine which it proposes to replace by new high pressure equipment. If this is so this is justified but any residual value of the old equipment should be offset versus the new equipment. In addition, justification of the need for new moulds is necessary.

The operating cost calculation is significantly affected by the HCFC 141b price used of 5.0\$/kg. To the reviewer's knowledge the market price of this blowing agent is falling and it is recommended that the operating cost element be reviewed at the time of implementation. The UAC is inevitably high because of the small CFC usage.

IMPLEMENTATION TIMEFRAME

This would appear to be too short - are the equipment supplies able to deliver all the necessary items in three months?

- 2 -

RECOMMENDATION

Approved subject to the comments above, specifically:

- ◆ More information on a zero ODS strategy
- ◆ Justification for the new moulds
- ◆ Consideration of safety issues (ventilation)
- ◆ Residual value of redundant equipment
- ◆ Acceptance that operating costs are reconsidered. ×



GMFJ/kd/21/10/94