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

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PROJECT PROPOSALS: MALAYSIA

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.

Aerosol

- Conversion of the aerosol filling plant Kontrak Manufacturing Services Sdn. Bhd. — IBRD
- Conversion project at Argon Malaysia, Sdn. Bhd — IBRD

Foam

- Phase out of the use of CFC in the manufacture of rigid PU panels at Shaga Cooling Technology — UNDP
- Phase out of CFC in the manufacture of rigid foam for use as imitation wood at Saferay (M) SDN BHD — UNDP
- Phase out of CFC-11 in the manufacture of pipe insulation at Ricwil SDN BHD — UNDP
- Elimination of CFC in the manufacture of rigid foam panels at Rigid Foam Industries, SDN BHD — UNDP
- Elimination of CFC in the manufacture of rigid foam panels and shipyard insulation works at Leading Refrigeration and Engineering, SDN BHD — UNDP
- Elimination of CFCs in the manufacture of moulded and flexible PU foams at Dream Products SND BHD — UNDP

Refrigeration

- Substitution of CFC-12 and CFC-11 with HFC-134a and HCFC-141b respectively and elimination the use of 1,1,1, TCA in household refrigerator manufacturing — IBRD

Solvent

- Elimination of the use of 111 TCA in the metal cleaning processes at Kein Hing Industry Sdn Bhd — UNDP

PROJECT EVALUATION SHEET

COUNTRY OR REGION:	Malaysia	
PROJECT TITLE:	a) Conversion of aerosol filling plant - Kontrak Manufacturing Services Sdn. Bhd. b) Argon Malaysia Sdn. Bhd. conversion project.	
BUDGET:	Capital Costs:	
	a) Kontrak	US $1,538,414
	b) Argon	US $156,200
	Operational Costs:	
	a) Kontrak	US $0
	b) Argon	(US $25,000)
INCREMENTAL COST:	a) Kontrak	US $1,538,414
	b) Argon	US $131,200
ODS PHASE-OUT:	a) Kontrak	200 T ODP
	b) Argon	38 T ODP
COST EFFECTIVENESS:	a) Kontrak	US $7.69/tonne
	b) Argon	US $3.4/tonne
PROJECT DURATION:	One year	
IMPLEMENTING AGENCY:	World Bank	
NATIONAL COORDINATING AGENCY :	Department of the Environment	
TECHNICAL REVIEW COMPLETED:	YES _X_ NO _	

SECRETARIAT'S COMMENTS

1. KMS is the largest contract filler in Malaysia, which provides filling services to companies that do not fill their own cans, with a production capacity of 600,000/month. In 1991, the enterprise consumed 100 tonnes of CFC in filling operations.

2. KMS began aerosol filling operations in 1968. In 1980, the company installed a semi-automatic filling line for insecticide products (11,000 cans/day) using hydrocarbon as propellant. In 1992, the company acquired an automatic filling line for insecticide products (20,000 cans/day) using hydrocarbon as propellant. At that time, the company had two additional filling lines using

CFC as propellant: one semi-automatic line (11,000 cans/day) for personal care and household products, and one manual line (8,000 cans/day) periodically used for testing and short filling runs.

3. In August 1992, the Fund Secretariat received, and commented on, a conversion project proposal in the aerosol sector to phase out 150 tonnes of CFC, at a cost of US $1.661 million. Since no response was received from the Government to the Fund Secretariat's comments (sent in September 1992), the project was not considered by the Committee. The capital cost of the project, including plant configuration, accessories, machinery, safety needs and necessary approvals was US $0.66 million. In addition, US $0.85 million was requested for product design and packaging, training and awareness programme.

4. In June 1993, a fire completely destroyed the KMS aerosol filling facility. At the time of the fire, the facility complied with all relevant regulations corresponding to the use of hydrocarbons. Operations are not resumed, pending settlement of the insurance investigation and reconstruction of the plant.

5. The enterprise is seeking funds to cover retroactively the costs expended in the filling line that had already been converted in 1992, amounting to US $361,000. This line was destroyed by fire and as can be inferred from the project document, the company was insured at the time of the accident. Therefore, the request is to substitute for a damaged line rather than to convert an existing CFC-line.

6. The project proposes to establish a new filling line using hydrocarbon propellant to service small enterprises, phasing out 100 tonnes of CFC. This implies a two-fold increase in the plant capacity, bearing in mind that KMS is the largest contract filler in the country providing filling services to companies that do not fill their own cans. No information is provided on the number of enterprises to be serviced.

7. The additional maintenance cost associated with the use of hydrocarbon propellant, are to be balanced by the recurring savings due to the use of a cheaper propellant. However, no calculations have been provided to support such a statement.

8. Argon project is proposing to replace CFC with hydrocarbon (HC) used as a propellant in the manufacturing of silicon mould release, silicon lubricants and car care products.

9. The company currently fills some products with HC without proper safety equipment installed. The enterprise is willing to provide new facilities for safety reasons at its own expense. A new filling machine with water bath, modifications to current installations, an additional molecular sieve column, and safety equipment are requested.

10. Incremental operating savings in Argon plant has been estimated at US $25,000. Additional costs due to maintenance, higher insurance and regular safety training associated with the use of hydrocarbon propellant, were considered in the calculation of incremental operating costs.

11. The equipment being requested in the Argon project are those necessary for the conversion to the new non-ODS technology. Cost levels have been discussed and agreed between the Secretariat and the World Bank. Due to time constraints, the project document could not be revised to reflect changes in operating costs.

12. The Fund Secretariat and the World Bank are still discussing some issues on equipment and operational costs for the Kontrak project proposal. The Fund Secretariat will communicate the results of the discussion to the Executive Committee at its Fifteenth Meeting.

SECRETARIAT'S RECOMMENDATIONS

13. The Secretariat recommends approval of the requested project costs for the Argon plant at US $131,200.

14. The Fund Secretariat recommends that the Sub-Committee on Project Review discuss the eligibility of retroactively financing the filling line that was destroyed by a fire in Kontrak plant.

PROJECT EVALUATION SHEET

COUNTRY OR REGION:	Malaysia
PROJECT TITLE:	Conversion to CFC-free Technology in the Manufacturing of Rigid and Flexible PU Foam (six enterprises)
BUDGET:	US $1,169,500
INCREMENTAL COSTS:	US $1,169,500
ODS PHASE-OUT:	104 MT CFC-11/yr.
COST EFFECTIVENESS:	US $11.25 per Kg. ODP saved
PROJECT DURATION:	One year
IMPLEMENTING AGENCY:	UNDP
NATIONAL COORDINATING AGENCY :	Department of Environment
TECHNICAL REVIEW COMPLETED:	YES _X_ NO _

SECRETARIAT'S COMMENTS

1. Six project proposals are addressed together in these comments

2. Implementation of the project will lead to the phase-out of 104 MT CFC-11 per year at six enterprises involved in the manufacture of insulation panels, insulated pipes, decorative panels, spray applications of rigid polyurethane foams, and in the manufacture of flexible and cold-cure moulded foams.

3. Five companies covered by the project will phase out the use of CFC-11 for manufacturing of rigid foams applying HCFC-141b blowing agent. The high pressure foam blowing equipment will be required to make conversion possible.

4. One enterprise involved in the manufacturing of flexible and cold-cure foams (Dream Products) will phase out the use of CFC-11 switching over to methylene chloride and all water-blown system respectively. Improved exhaust ventilation and metering systems will be installed. Extensive technical inputs and process trials in the cold-cure foam formulations will be provided for the switch over to the water-blown system.

5. Recurrent incremental costs are calculated in each individual sub-project.

6. The cost-effectiveness of the project is similar to projects approved in this sub-sector for Malaysia.

SECRETARIAT'S RECOMMENDATIONS

7. The Secretariat recommends approval of the project and of the requested incremental costs of US $1,169,500, as itemized in the following table:

Company	CFC phase-out MT/year	Capital Costs	Operating Costs	Total Costs per company
Saferay	11	240,000	6,000	246,000
Leading Refrigeration	10	200,000	14,000	214,000
Rigwil	25	200,000	32,000	118,000[1]
Shaga Cooling	24	190,000	0	190,000
Rigid Foam Industries	19	315,000	20,000	335,000
Dream Products	15	95,000	0	66,500[2]
Total	104	1,240,000	72,000	1,169,500

1. Adjusted according to 51 per cent local ownership.
2. Adjusted according to 70 per cent local ownership.

PROJECT EVALUATION SHEET

COUNTRY OR REGION:	Malaysia
PROJECT TITLE:	Substitution of CFC-12 and CFC-11 with HFC-134a and HCFC -141b respectively and elimination of the use of 1,1,1, TCE in household refrigerator manufacturing at MELCOM
BUDGET:	Capital Costs: US $1,055,841.21 Operational Costs: US $838,008.00
INCREMENTAL COSTS:	US $1,276,500[1]
ODS PHASEOUT:	The implementation of project will lead to elimination of 109.9 MT of ODS
COST EFFECTIVENESS:	US $12.80 per/Kg. ODP saved
PROJECT DURATION:	Three years
IMPLEMENTING AGENCY:	World Bank
NATIONAL COORDINATING AGENCY:	Department of Environment
TECHNICAL REVIEW COMPLETED:	YES _X_ NO _

SECRETARIAT'S COMMENTS

1. This project covers Phase 1 and Phase II of the conversion of the Matsushita Electric refrigerator Manufacturing Company (MELCOM) to HFC-134a as refrigerant and HCFC-141b as blowing agent. Phase I will address engineering development, prototyping, testing of new refrigerator models and testing of the new manufacturing technology. Implementation of Phase I is already underway. About 65 percent of capital costs have already been incurred and funding is requested retroactively.

2. Phase II will be the mass production of CFC-free refrigerators.

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[1] The incremental costs differ from the budget by accounting for 43.1 per cent trans-national ownership. Grant request includes 3 per cent financial administration fee.

3. The technology selected by Melcom is not an ultimate solution. The company is going to introduce cyclopentane as a blowing agent by early 1997. It is understood that by the beginning of 1995 a second project proposal will be submitted on the cyclopentane system. The Secretariat will need guidance from the Executive Committee regarding any future requests for cyclopentane conversion for Melcom.

4. The project proposal at capital costs of US $1,585,701.45 was considered at the Thirteenth Meeting of the Executive Committee. The Executive Committee decided to grant permission to proceed to the World Bank with the view that the incremental costs of the project should be revised taking into account the Fund Secretariat's and technical reviewer's comments and the project resubmitted to the next meeting of the Executive Committee.

5. The World Bank discussed with the enterprise the recommendation of the Executive Committee and informed the Secretariat on the follow-up of these discussions, with some corresponding reduction in capital costs.

6. Cost items related to production process conversion now seem to be in line with similar projects approved so far, reflecting an effective outcome to the review of the project by the World Bank. However, despite the removal from the project of one testing room, costs of testing (about US $600,000) and training (US $170,000) remain very high and are not comparable with similar conversion projects in this sub-sector.

7. The project documentation states that Melcom, as a subsidiary of Matsushita Japan, is required to establish technical capabilities and take additional responsibilities for testing non-ODS technologies, to assist Matsushita sister companies in the ASEAN region. These additional responsibilities apparently have a bearing on the higher request for funding for this project proposal. However, there is no indication of any corresponding reductions in testing requirements for other projects in the region for Matsushita subsidiaries. It is considered that additional costs for testing and training at Melcom should not be met by the Fund.

SECRETARIAT'S RECOMMENDATION

8. The Fund Secretariat recommends final approval of the project, with the allocation for testing and training reduced by 50 per cent to US $385,000.

9. Approval of US $858,535.20 in incremental costs is recommended.

PROJECT EVALUATION SHEET

COUNTRY OR REGION:	Malaysia
PROJECT TITLE:	Elimination of the use of 1.1.1 TCA in the Metal Cleaning Processes at Kein Hing Industry Sdn.Bhd.
BUDGET:	US $222,000 (Capital investment cost) US $ 14,000 (Operating Cost)
INCREMENTAL COSTS:	US $236,000
ODS PHASE-OUT:	11 MT of 1.1.1 TCA (1.1 MT ODP) per year.
COST EFFECTIVENESS:	US $232.73 per Kg. ODP saved
PROJECT DURATION:	9 months
IMPLEMENTING AGENCY:	UNDP
NATIONAL COORDINATING AGENCY :	Malaysia Department of Environment
TECHNICAL REVIEW COMPLETED:	YES _X_ NO _

SECRETARIAT'S COMMENTS

1. The project will eliminate 11 MT of 1.1.1 TCA (1.1 MT ODP) annually by replacing two vapour degreasers with a closed loop aqueous cleaning machine.

2. Incremental operating costs are calculated for four years.

3. The waste water effluents will be filtered and treated prior to discharge to drain in compliance with local regulations.

4. The cost-effectiveness is extremely low.

SECRETARIAT'S RECOMMENDATIONS

5. The Fund Secretariat recommends approval of the project and funding at US $236,000.

PROJECT COVER SHEET

COUNTRY	Malaysia
PROJECT TITLE	Conversion of Aerosol filling plant - Kontrak Manufacturing Services Sdn. Bhd.
SECTOR COVERED	Aerosols
ODS USE IN SECTOR (1991)	350 Tonnes CFC (350 tonnes ODP)
PROJECT IMPACT	Phaseout 200 tonnes per year of CFC 12 and CFC-11/12 Mixture (200 tonnes ODP).
PROJECT ECONOMIC LIFE	10 years
TOTAL PROJECT COST	USD 1,538,414
PROPOSED OTF FINANCING (Includes 15% contigency and 3% LFI Fee).	USD 784,591
COST EFFECTIVENESS	USD 0.62/kg ODP
IMPLEMENTING ENTERPRISE	Kontrak Manufacturing Services Sdn. Bhd. (KMS)
COORDINATING NATIONAL BODY	Department of Environment (DOE)
IMPLEMENTING AGENCY	The World Bank

PROJECT SUMMARY

This proposed project will complete the conversion from CFC to hydrocarbon (HC) propellants at KMS.

At present, KMS is not filling aerosols due to a serious hydrocarbon related fire that occurred in June 1993. Before the fire, KMS was one of the major aerosol fillers in Malaysia. In 1991, KMS used 100 tonnes of CFC 11/CFC 12 mixture and pure CFC 12. KMS began phasing out CFCs for environmental reasons before its factory fire and does not want to return to filling aerosol products with CFCs.

In August, 1992, KMS submitted to the Multilateral Fund Executive Committee (MFEC) a project proposal for machinery, safety equipment and related training for using hydrocarbons. Financial assistance was not approved by the MFEC at that time because the funding request was premature.

In this revised proposal, KMS is seeking funds to cover:

(1) Retroactive costs for its purchase of a hydrocarbon filling line in 1992.

(2) Costs for converting its remaining CFC filling line to hydrocarbons.

Some additional funding is also being requested to enable KMS to act as a filling centre for small fillers in Malaysia who cannot cost-effectively convert to HAPs. Overall, the project expects to eliminate 200 tonnes of annual consumption of CFCs.

Malaysia has received funding through UNDP for a sector-wide aerosols technical assistance program. The program will, however, not be a substitute for the company-specific training proposed as a part of this project.

TECHNICAL ASSESSMENT:

This proposal is supported by the OORG technical reviewer DR. Harry McCain, as indicated in his review of July 1994.

PROJECT OBJECTIVES:

The project will phase out the use of 100 tonnes per year of CFC 11/CFC 12 mixture and pure CFC 12 aerosol propellant at KMS by completing its conversion from CFCs to HAPs. Reduction of an additional 100 tonnes consumption per year by small contract and self-fillers will also result from KMS operating a filling services centre. The total project impact is therefore anticipated to be approximately 200 tonnes per year ODS eliminated.

SECTOR BACKGROUND:

The Malaysia Country Program, as approved in February 1992, identifies aerosols as the fourth largest consuming sector of CFC 11 and CFC 12 in Malaysia. In 1990, aerosol fillers accounted for 11 percent of ODS consumption, or 250 metric tonnes. This estimate was developed from data provided in accordance with the Customs Act (1967), Customs Duties (Amendment) Order 1989, as reported in the Country Program. Unofficial industry figures, however, indicate that 1991 consumption was considerably higher than 1990 consumption, possibly exceeding 350 metric tonnes. The rise is explained partly by the rapidly increasing demand for personal care and industrial aerosol products, and partly by under reporting in officially collected data. Imports of aerosols cans are small and confined to specialty items, but exports account for about 25 percent of the total production in the sector.

Most insecticide and some paint manufacturers in Malaysia have already converted to hydrocarbon or dimethyl ether (DME) propellants, and CFC usage is largely limited to room deodorants; personal care products (deodorants, hair sprays, and so on); and industrial, automotive, and medical aerosols.

In general, two types of aerosol fillers exist in Malaysia - self-fillers and contract fillers. Self-fillers devise their own formulations, fill the aerosol cans themselves, and market the products. Contract fillers provide filling services to companies that do not fill their own cans. The customer of a contract filler typically provides the filler with a concentrate and the specifications of the product formulation. The filler mixes the components, fills and gassers the cans, packages the product, provides warehouse space, and arranges for shipment of the product to wholesale and retail establishments. This service is provided on a contractually specified cost plus profit margin basis, with margins of 10 to 15 percent typical. Costs include those for raw materials (including propellant), labour, capital investments, insurance, and utilities. This business arrangement protects the contract filler from unanticipated increases in raw material costs; similarly, any savings caused by lower propellant prices are passed on to the customer, who has the right to inspect invoices detailing on the filler's variable operating expenses.

No industry association exists covering aerosols in Malaysia, and most companies are not willing to share information, so it has not been possible to generate completely reliable figures for the aerosol sector. Estimates are that production of aerosol products (CFC and non-CFC) is split equally by self- and contract fillers, although the lines are blurred somewhat as one contract filler fills for a single customer. There are four major and several medium and small contract fillers operating in Malaysia. The total of contract fillers and self fillers in Malaysia is between 45 to 60. Some of the small fillers - both self- and contract - use CFC propellants, as the costs of switching to a safe hydrocarbon operation are excessive. Small fillers typically operate in small shops, often in urban and sub-urban settings.

ENTERPRISE BACKGROUND:

Kontrak Manufacturing Services is 51 percent owned by Malaysian interests and 49 percent by Inchcape PLC, England. Until June 1993, when a fire suspended operations, Kontrak was the largest contract filler in Malaysia being approximately the same size as the largest self-filler. The company fills about 30 percent of the aerosol cans produced in Malaysia and has a capacity of about 40,000 cans a day (or about 600,000 cans a month) on a single shift operation. In 1991, KMS used 100 tonnes of CFC 11/CFC 12 mixture and pure CFC 12 as aerosol propellants in filling operations.

Aerosol filling constitutes about 15 to 20 percent of KMS's overall revenues. The company also produces and packages food products, candy, over-the -counter pharmaceutical, household products, and toiletries. Operations are centred in Shah Alam west of Kuala Lumpur, where KMS has factories on two sites and a warehouse on a third site. KMS does only contract packaging and has no aerosol products of its own.

KMS began aerosol filling operations in 1968 with one manual filling line that used CFCs. Other filling lines were added over the years as the company expanded. In 1980, KMS became the first company in Malaysia to use hydrocarbons in insecticide formulations, and was largely responsible for leading other manufacturers of insecticides to use HCs. In 1992, KMS applied for assistance from the Multilateral Fund to purchase a hydrocarbon filling line to replace an existing CFC line. The application was premature as the funding mechanisms were just then being set up and in 1992 KMS purchased a new hydrocarbon filling machine together with other equipments using its own funds.

In June 1993, a fire completely destroyed the KMS aerosol filling facility. The fire started in the air compressor section of the plant, and spread rapidly to the staging warehouse where filled cans were kept for shrinkwrap packing and then to the filling line. It proved impossible to extinguish the fire with the extinguishers available, but the safety and evacuation programs in place allowed the supply of gas to be shut down and the plant evacuated in an orderly manner and there were no injuries. At the time of the fire, the KMS facility complied with all relevant Malaysian regulations corresponding to the use of hydrocarbons. Operations have not resumed pending settlement of the insurance investigation and reconstruction of the plant. Since the time of the fire, KMS affiliate companies in Singapore, Thailand and Indonesia have produced aerosol products for KMS's customers.

PROJECT DESCRIPTION:

Before the fire KMS's facility, it was operating four aerosol filling lines: The first (semi-automatic) line had a capacity of 11,000 cans/day, used hydrocarbons, and was filling for insecticide products. The second (semi-automatic) line had a capacity of 11,000 cans/day, used CFCs, and was filling personal care and household products. The third (automatic) line was purchased after submission of KMS's initial draft proposal in 1992, had a capacity of 20,000 cans/day, used hydrocarbons, and was filling insecticide products. A fourth (manual) line with a capacity of approximately 8,000 cans/day used CFCs and was periodically used for testing and short filling runs to be cost effective.

KMS is seeking funds to cover:

(1) Retroactive costs for its purchase of the hydrocarbon filling line in 1992.

(2) Costs for converting its remaining CFC filling line to hydrocarbons.

Some additional funding is also being requested to enable KMS to act as a filling centre for small fillers in Malaysia who cannot cost-effectively convert to HAPs.

This project proposes to eliminate more than just KMS's past and anticipated future annual use of 100 tonnes of CFCs. The Department of Environment (DOE) of Malaysia recognizes that it will not be economically feasible to convert all of the many small fillers to HAPs. DOE therefore supports the installation of KMS as a filling centre that will permit these small companies to stop filling aerosol with CFCs, and market their products with HAPs without incurring the expense of installing to handle these flammable and explosive gases. By filling at a central location, small fillers will be able to eliminate a further approximately 100 tonnes of CFCs per year.

In its post-fire operations, KMS envisions having two separate aerosol filling lines, both using HCs. One will supply Kontrak's traditional customers (many of whom have had to make dangerous, temporary arrangements, or are being filled outside of Malaysia), and the other will act as a service centre to serve the small marketing companies currently using CFCs.

KMS requests assistance from the Multilateral fund for the following:

* One fully pneumatic (explosion proof) automatic aerosol filling line for KMS's traditional customers (retroactive costs) and one semi auto fully pneumatic (explosion proof) filling line to serve as a filling centre for small marketing companies (new costs). Since both lines are for hydrocarbon propellant filling, there is also a need to purchase two units of modular explosion proof gassing room complete with automatic shut-off valves, dual speed ventilation and gas detection system.

* Additional hydrocarbon storage tanks of 10,000 litres capacity for both regular filling and service centre filling lines. Extension of gas detection system to the tank farm area.

* A sprinkler system for the entire plant and tank farm, fire safety equipments, and water storage tank of 30,000 gallons capacity.

* Deodorizing columns for purification of gas and Sch.80 pipelines for transfer of Hydrocarbon to deodorizing columns and filling lines and an extension of gas detection system.

* Relevant quality control instruments that directly pertain to the safe filling of hydrocarbon propellant and to ensure the end product meets the specifications for customer safety.

KMS is not requesting for the Land and Building cost. This cost would be absorbed by the company in order to justify the company's commitment to this project.

Based on it's plans, the company needs about 36,000 to 40,000 sq ft of land with a build up area of 20,000 sq ft for the storage and filling plant. KMS do not intend to keep large stocks of locally available materials by following a Just In Time (JIT) System. This approach would require a smaller build up area.

The 20,000 sq ft build up would include the basic needs like washroom/destruction storage facility yard, office,and a good training room. This concept would allow a good ventilation in the filling plant since KMS expect to fill about 40,000 to 45,000 cans a day.

The estimated land cost for the company's new aerosol plant is expected to be USD 310,000 with some contingencies for increase in land price from now, until the time of purchase could be around another USD 10,000. Therefore, the total land cost could be around USD 320,000.

There would be a fair amount of money spent on the infrastructure works and KMS estimates this cost to be around USD 50,000.

The company is prepared to absorb the above mention cost into our budget.

KMS has estimated the building cost to be around USD 1,500,000. This cost would cover the building and the basic facilities including office and training room. As the company has requested for funding for safety equipments and accessories under this project, (annex # 2) KMS is prepared to meet the building cost under its budget. This step is part of the company's commitment towards the success of the new aerosol plant.

Any additional revenue KMS receives from the Filling Centre will be used towards off-setting the building cost. KMS expects that this might take up to 60 months based on a production capacity of 2.5 million cans a year for the filling centre against KMS filling capacity of 10.5 million cans a year for the main production line which would be primarily dedicated to insecticide line. The filling centre would cater for other product lines like Personal Care and Household products (non-insecticide).

JUSTIFICATION FOR ALTERNATIVE TECHNOLOGY SELECTION:

Hydrocarbon aerosol propellants have been the principal alternatives to CFC 12 employed worldwide. They are approved by the 1991 UNEP Technical Options Report on Aerosols, Sterilant, and Miscellaneous Uses and Carbon Tetrachloride.

Malaysia does not have aerosol-grade hydrocarbon propellant available, but the commercial grade that is available can be upgraded for use in aerosols by setting up deodorizing columns. KMS will supply the molecular sieve and would undertake to safely dispose the used molecular sieves.

PROJECT COST:

As detailed in the relevant annexes, the total project costs are USD1,345,875 plus a 15% contingency to derive at a total project cost of USD1,538,414.

Investment Costs:

USD 1,345,875 for the equipment and training specified in Annexes 1 and 2, plus 15% contingency to derive at a total investment cost of USD1,538,414.

Operating Costs/Savings:

In fully converting from CFCs to hydrocarbons, some operating costs will increase while others may decrease. As described below, however, overall, KMS will not realize any nett incremental operating costs or savings.

There is a slight increase in maintenance cost when using HAPs. The company is willing to absorb this cost. In contract packaging, no client will accept changing from CFCs to HAPs without a reduction in price. Thus as a contract filler, KMS will never receive even a short term savings. Here these savings will go to the marketer, the owner of the brand.

It should be noted that many of the products that KMS makes with CFCs, such as mold releases, are also produced with HAPs. The consumers consider these products (with hydrocarbons) to be of inferior quality, due to their light weight and to their flammability. Since at this time parallel markets exist.

Some customers are willing to purchase the "cheap product" with hydrocarbon, and accept the light weight and flammability problem. Others pay a higher price for a "quality product" with CFCs. No one will pay CFC prices for hydrocarbons. In all cases, if there are some savings it goes to the owner of the brand. KMS charges for CFCs when we fill CFCs and for HAPs when we fill HAPs. By absorbing the additional maintenance costs, it can be said that in this project, the recurring savings may well be about the same as the recurring cost.

Requested Funding:

The proposed OTF grant for KMS is USD 784,591 and was calculated as follows:

The total investment cost was increased by a 15 percent contingency to yield the total project costs. This figure was then multiplied by 51 percent to account for the proportion of Malaysian ownership.

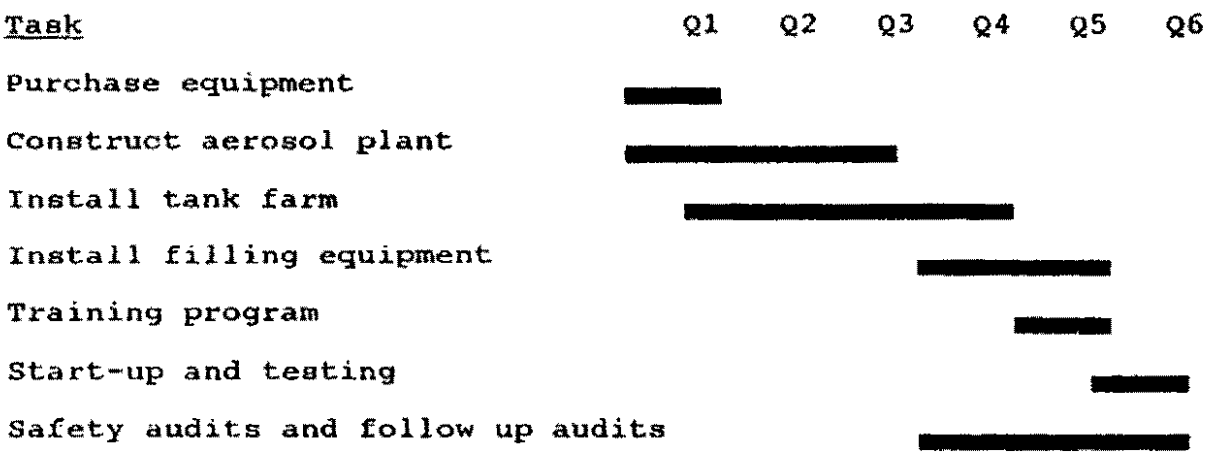
The resulting figure was then increased by 3% to account for the local financial intermediary fee.

UNIT ABATEMENT COSTS:

USD 0.62 per ODP-weighted kilogram (see Annex #3).

IMPLEMENTATION:

This project can be implemented over 6 quarters in the following manner:



PROCUREMENT:

The aerosol filling equipment, flame proof modular filling room, gas detection system, and quality control instruments for safe filling of HCs will be purchased from foreign suppliers on a competitive tender basis. Everything else will be purchased locally, also on a competitive tender basis.

REQUIRED REGULATORY ACTIONS:

DOE already has in place a prohibition on production of CFC filled aerosol products that took effect June 1, 1994.

RESULTS:

This project will result in an immediate reduction of 100 tonnes per year of CFC at KMS and an additional 100 tonnes per year from small fillers which will be able to use KMS as a filling center.

ENTERPRISE COMMITMENT :

As fund is requested for only 51% of the total incremental cost, the parent company would be providing the remaining funds.

ANNEX # 1 - KMS PROJECT EQUIPMENT SPECIFICATIONS:

1). 2 Units unscrambling tables

2a). 1 complete unit Rotary fully automatic pneumatic Aerosol machine inclusive of product filler, crimper and gasser (for traditional clients).

2b). 1 complete unit of semi automatic aerosol machine inclusive of product filler, crimper and gasser (for service center).

3). 1 complete unit valve inserter with hopper elevator.

4). 1 complete unit rotary over capper with hopper elevator.

5). 2 units 30' water baths.

6). 2 units Blow - off units complete with air-jets.

7). 2 units date coders.

8). 2 units explosion proof filling room adequate for two aerosol filling lines, complete with automatic cut-off valves, dual speed or duplicate ventilation system, and gas detection system.

9). 1 complete unit of the gas detection system to the tank farm.

10). 2 units 10,000 litres gas storage tank inclusive of installation.

11). 2 units "Corken" or equivalent rotary vane pumps complete with continuous recirculating system and an accumulator.

12). 1 complete set of 150' long Sch.80 gas pipelines.

13). 4 units of deodorizing columns with 1000 PSI Heavy Duty flexible gas hose and an extension of 1 gas detection system for this installation.

14). Sprinkler and other necessary fire fighting systems (fire-alarm, smoke and heat detectors, water storage tanks and Hydrants).

15). 1 unit Rotary Air Compressor with Air Receiver tank and Accessories.

16). 1 unit air filter, dryer and cooler.

17). Air pipe lines complete with installation.

18). Explosion proof Electrical Wiring and Explosion proof control panels.

19). 1 unit defunct can recovery unit.

20). 2 sets of quality control instruments.

21). A complete set of training manual.

ANNEX # 2 KMS PROJECT COSTS:

The project costs are as follows:

#	CONCEPT	RETROACTIVE/ COST IN USD	NEW EXPENSES/ COST IN USD	
1).	Unscrambling table (2 units)	13,000.00	13,000.00	*
2).	Filling lines (2 units)	250,000.00	121,000.00	*
3).	Valve placer	-	78,025.00	
4).	Cap placer	-	46,850.00	
5).	Water bath (2 units)	60,000.00	33,000.00	*
6).	Blow-off complete with air-jets (2 units)	5,000.00	5,000.00	*
7).	Coders (2 units)	16,000.00	16,000.00	*
8).	Modular gassing houses (2 units)	-	120,000.00	
9).	Gas detection system (filling area)	-	20,000.00	
10).	Gas detection system (gas deodorizing column area)		7,000.00	
11).	LPG storage tanks and installation (2 units)	-	36,000.00	
12).	Pumping system Accumulator and installation	-	26,000.00	
13).	Schedule 80 pipelines for gas transfer	-	20,000.00	
14).	Deodorizing Columns	-	16,000.00	
15).	Heavy Duty Flexible Gas Hose	-	8,000.00	
16).	Smoke, Heat detectors and Sprinklers with pumps and water storage tank	-	75,000.00	
17).	Fire-fighting equipments	-	45,000.00	
18).	Shipping and Insurance	-	40,000.00	
19).	Q. C. Equipment	-	8,000.00	
20).	Rotary air compressor	-	56,000.00	

21). Air Filter Dryer and Cooler	-	15,000.00	
22). Air Receiver Tank	-	7,000.00	
23). Air Pipe Line and Installations	-	25,000.00	
24). Explosion proof Electrical Wiring and Explosion proof control panels	-	70,000.00	
25). Pack-off conveyers and tables (2 units)	10,000.00	10,000.00	*
26). Explosion proof shrinkwrap tunnels (2 units)	7,000.00	7,000.00	*
27) Manufacturing and storage tank facilities(s/s tanks,s/s stirrers and flame proof motors)	KMS to provide	20,000.00	*
29). Can/product recovery unit	-	10,000.00	
30). Consulting/Engineering Charges	-	8,000.00	
SUB TOTAL PURCHASES	361,000	961,875	
31). Foreign/Local assistance for start-up, commissioning and training	-	18,000.00	
32). Training Manual	-	5,000.00	
SUB TOTAL	361,000	984,875	
33). 15% Contingencies to new expenses	Nil	147,731	
SUB TOTAL	$ 361,000.00	1,132,606	
TOTAL : Retroactive and New Cost :		1,493,606.00	
Final Project Cost inclusive of a 3% local financial intermediary fee. :		USD 1,538,414	

CONTINUED - ANNEX # 2 KMS PROJECT COST.

FOOTNOTE : i). Asterix indicates that these expenses are purely for the filling centre.

ii). Other costs shown under the new expense column are for the completion of the total conversion of KMS filling line and will also be a common utility for the KMS filling line and the filling centre. Using common utilities would reduce the total cost considerably.

iii). Costs shown in the retroactive column are costs which were spent. Some of the costs are not shown in the retroactive column because, they have to be treated as new expenses since both lines can share these expenditures/installations.

ANNEX # 3 - UNIT ABATEMENT COSTS:

The unit abatement costs for Kontrak Manufacturing Services aerosol conversion project are calculated as follows:

Using the formula $A = \frac{C(F) + (OC-OS)}{W}$

Where C = USD 761,739.00

OC = 0

(C)F = USD 123,970.00

OS = 0

W = 200,000 kg. per year

Unit abatement cost = USD 0.62/kg ODP

ANNEX # 4 ENVIRONMENT ASSESSMENT (EA)

Hydrocarbon aerosol propellants have been the principal alternatives to CFC 12 employed worldwide. They are approved by the 1991 UNEP Technical Options Report on Aerosols, Sterilant, and Miscellaneous Uses and Carbon Tetrachloride.

The substitute propellant, a mixture of butane and propane, does not damage the ozone layer. It does not contribute to acid rain, nor is it carcinogenic, mutagenic, or toxic. The butane/propane mix does not pollute the soil or ground water. This mixture is a volatile organic compound (voc) that contributes some what to ground level contamination. This mixture does have a global warming potential, albeit very low.

Hydrocarbons are extremely flammable and explosive. The storage of the hydrocarbon propellants must be accomplished by strict adherence to the U.S. National Fire Protection pamphlet # 58 Standard for the Storage and Handling of Liquefied Gases as well as all applicable local codes and regulations.

AEROPRES
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July 7, 1994

TO : Jessica Poppele
Ozone Ops Coordinator-Asia
Global Environment Coordinator
Room S 2-113
The World Bank

Fax Tel. No. : 202-477-5752
Dept./Div. : 655-37

FROM : Harry B. McCain HBMc

Fax No. : 318-429-6739

SUBJECT : MALAYSIA AEROSOL PROJECT-INCHAPE CONTRACT MANUFACTURING (KMS)

How nice to hear from you. I had thought that my friends at the World Bank had forgotten me!

Regarding the Malaysia Aerosol Project, I have reviewed this project twice, once on November 3, 1993 at which time I took exception to the cost effectiveness of the project. The project was reviewed again by the original writers, and the total project cost of $1,850,350.00 was reduced to $1,364,906.00; and the proposed OTS financing on the project of $943,678.00 was reduced to $696,102.00. I then reviewed and approved that revision on January 20, 1994.

The report you sent today contains no different information or figures that would affect the content of my report to Konrad von Ritter of January 20, 1994. I therefore submit it to you.

Attached you will find the reports of November 3 and January 20.

If I have missed the issue at hand, please call me.

HBMcC/gba

Attachments (6 pages)

AEROPRES
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November 3, 1993

TO	:	Konrad von Ritter Economist, The World Bank Department 1 East Asia Region	FAX: 202-477-2743
COPY TO	:	Tom Waltz ENVGC, The World Bank	FAX: 202-676-0483
FROM	:	Harry B. McCain OORG Sector Reviewer Aeropres Corporation P. O. Box 78588 Shreveport, LA 71137	FAX: 318-429-6739
SUBJECT	:	Malaysia - Montreal Protocol Projects **Kontrak Manufacturing Services Sdn. Bhd.** **Aerosols** **Malaysia**	

- **SCOPE**

The project under review will result in the partial conversion to hydrocarbon (HC) propellants from CFC-11 and CFC-12 in the aerosol industry in Malaysia. Safety programs in the use of hydrocarbon propellants and public awareness regarding non-CFC use in aerosols will also be accomplished. The focus of this project is Kontrak Manufacturing Services Sdn. Bhd (KMS).

- **RECOMMENDATION**

The project is supported contingent upon new cost analyses. When these cost analyses are determined to be correct based on usage of HC propellant, then the project should proceed quickly since KMS has a previous successful history with the use of HC propellants. (See **Cost Effectiveness** of this report.)

- **RELEVANCE AND ADEQUACY OF INFORMATION PROVIDED**

Information provided is comprehensive, complete, and well set out to the standards in keeping with producing an adequate and timely conversion from CFCs to HC propellants.

- **TECHNICAL SOUNDNESS**

KMS is familiar with all aspects of the required technology that relates to HC filling, use and safety.

- **LESSONS FROM EXPERIENCE**

Aerosol products with (HC) propellants have a lower selling price than those of aerosol products with CFCs. This is a market incentive to convert from CFCs to HCs for the seller, not the filler, of aerosols. If the World Bank provides financial support to KMS (the filler) this project will proceed rapidly. Without World Bank financing the conversion at KMS may not proceed at all.

- **ENVIRONMENTAL ISSUE**

This project when completed will phase out 200 tons of CFCs (ODP-200 tons) by the year 1996.

- **SAFETY ISSUES**

The safety issues have been well addressed in KMS's proposal. The technology of HCs is intrinsic with the safe use of HCs, and KMS understands this well because of a prior history of filling with hydrocarbon propellant.

- **COST EFFECTIVENESS**

The project cost may not be effective at a UAC of 0.766 USD/Kg for the following reasons:

It is presented in KMS's proposal that 200 tons of CFCs/year will be replaced by HCs (see KMS's "Project Objectives." It takes approximately half as much HCs to do the same work as CFCs. Therefore, approximately 100 tons or approximately 91,000 Kg or 200,000# or 44,500 gallons of HC propellant will be consumed in one year at

KMS. If this is correct, then the cost figures for the project are greatly inflated at $1,850,350 USD.

On the other hand, if one looks at the "Enterprise Background" section of KMS's report and uses the figure 600,000 cans/month, this equals 7,200,000 cans/year. If one assumes that 30,000 US gallons of propellant will fill approximately 1,000,000 cans, then KMS might use 216,000 gallons of HC propellant/year. Even at this rate of usage the cost of the project is too high.

It is recommended that the original writer of the report determine how many gallons of HC propellant must be processed and filled by KMS/year. If the figure is indeed 44,500 gallons/year, then all cost must be reviewed for accuracy. If the figure is 216,000 gallons/year, then the cost must be reviewed for accuracy again. Present reported cost of $1,850,350 USD (includes 15% for contingencies) is approximately 30% in excess if 216,000 gallons/year at KMS is used and 60% in excess if 44,500 gallons is used.

- **OTHER**

  None

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January 20, 1994

TO	:	Konrad von Ritter Economist, The World Bank Department 1 East Asia Region	FAX: 202-477-2743
COPY TO	:	Tom Waltz ENVGC, The World Bank	FAX: 202-522-3258
FROM	:	Harry B. McCain OORG Sector Reviewer Aeropres Corporation P. O. Box 78588 Shreveport, LA 71137	FAX: 318-429-6739
SUBJECT	:	Malaysia - Montreal Protocol Projects **Kontrak Manufacturing Services Sdn. Bhd.** **Aerosols** **Malaysia** SECOND REVIEW	

- **SCOPE**

The project under review will result in the partial conversion to hydrocarbon (HC) propellants from CFC-11 and CFC-12 in the aerosol industry in Malaysia. Safety programs in the use of hydrocarbon propellants and public awareness regarding non-CFC use in aerosols will also be accomplished. The focus of this project is Kontrak Manufacturing Services Sdn. Bhd (KMS).

- **RECOMMENDATION**

The project is supported. The project should proceed quickly since KMS has a previous successful history with the use of HC propellants.

- **RELEVANCE AND ADEQUACY OF INFORMATION PROVIDED**

Information provided is comprehensive, complete, and well set out to the standards in keeping with producing an adequate and timely conversion from CFCs to HC propellants.

- **TECHNICAL SOUNDNESS**

KMS is familiar with all aspects of the required technology that relates to HC filling, use and safety.

- **LESSONS FROM EXPERIENCE**

Aerosol products with (HC) propellants have a lower selling price than those of aerosol products with CFCs. This is a market incentive to convert from CFCs to HCs for the seller, not the filler, of aerosols. If the World Bank provides financial support to KMS (the filler) this project will proceed rapidly. Without World Bank financing the conversion at KMS may not proceed at all.

- **ENVIRONMENTAL ISSUE**

This project when completed will phase out 200 tons of CFCs (ODP-200 tons) by the year 1996.

- **SAFETY ISSUES**

The safety issues have been well addressed in KMS's proposal. The technology of HCs is intrinsic with the safe use of HCs, and KMS understands this well because of a prior history of filling with hydrocarbon propellant.

- **COST EFFECTIVENESS**

The project is cost effective at a UAC of 0.566 USD/Kg.

- **OTHER**

None

SUB PROJECT PROPOSAL REPORT

COUNTRY:	Malaysia
PROJECT TITLE:	**Argon Malaysia Sdn. Bhd. Conversion Project**
SECTOR COVERED:	Aerosols
ODS USE IN SECTOR:	350 tons CFC (1991); 350 tons ODP
PROJECT IMPACT:	Phase out 38 tons per year of CFC (38 tons ODP).
PROJECT DURATION:	12 months
PROJECT ECONOMIC LIFE:	10 years
TOTAL PROJECT COST:	U.S. $ 156,200.00
PROPOSED OTF FINANCING:	U.S. $ 156,200.00 (includes 10% contingency)
IMPLEMENTING ENTERPRISE:	Argon Malaysia Sdn. Bhd.
COORDINATING NATIONAL BODY:	THE DEPARTMENT OF ENVIRONMENT
IMPLEMENTING AGENCY:	The World Bank

PROJECT SUMMARY:

This project will complete the conversion of Argon Malaysia's aerosols from CFC to hydrocarbon (HC) propellants. The company now fills some products with HCs, but we do not have the proper safety equipment installed, and our locale is not adequate. We are willing to relocate and provide new plant facilities for safety sake, but then we will be financially unable to improve our safety in other aspects.

We are requesting assistance to buy a new filling machine complete with water bath, some modifications to our installations, an additional molecular sive colume, and safety equipment, which will allow us to work in a safe fashion.

Technical Assessment: This project was reveiwed by OORG reviewer Dr. Harry McCain. His recommendation for project approval is attached.

PROJECT OBJECTIVES:

Avoid the use of 38 tons of CFC annually at ARGON by completing the conversion process from CFCs to HAPs.

SECTOR BACKGROUND:

There are more than 30 aerosol fillers in Malaysia, of which 12-15 are filling insecticides and paints, the two largest product categories. The insecticide and paint fillers are using 100% hydrocarbons.

The other fillers do a variety of aerosol products, including personal care products (hair spray, hair mousse, personal deodorants, perfumes, and shaving creams). What is perfectly certain is that a major reduction in the use of CFC in the aerosol sector has occurred. Current CFC usage is still estimated at 150 to 200 metric tons per year, mainly in the personal care and industrial-/automotive categories.

ENTERPRISE BACKGROUND:

Argon was founded in 1982 as a family owned private enterprise, with 100% Malaysian ownership. This industry fills mainly silicon mold release, silicon lubricants, and car care products. We have one locally made filling machine which has leakage problems and should not be used for hydrocarbons. Because of economic limitations we have not been able to put in the necessary desired filling safety equipment.

Our company is sound and growing. We currently occupy a small factory, and have 15 persons total, 12 working on aerosols and 3 in sales and marketing.

PROJECT DESCRIPTION:

This project will complete the conversion of Argon Malaysia's aerosols from CFC to hydrocarbon (HC) propellants. We will relocate and provide new plant facilities for safety sake reasons. The filling machine that we have leaks too much and must be replaced. We need a water bath for testing each can, some modifications, and safety equipment, which will allow us to work in a safe fashion. Simple safety equipment must be purchased and safety/startup training will be provided by a foreign expert.

JUSTIFICATION FOR ALTERNATE TECHNOLOGY SELECTION:

Hydrocarbon propellants are identified in the 1991 UNEP Technical Options Report on Aerosols, Sterilants, Miscellaneous Uses and Carbon Tetrachloride, as the principal alternates to CFCs for aerosols. They have been employed worldwide.

Hydrocarbon propellants are readily available, although they technically do not qualify as hydrocarbon aerosol propellants (HAPs) because they are not pure enough. For our type of industrial propellants the purity is adequate if they are further purified with molecular sieves.

PROJECT COST:

The total project incremental cost of $ 142,000.00 plus 10% contingency was calculated as the economic capital cost (see "Recurring Costs/Savings" below).

Capital Costs:

$ 142,000.00 for the above specified equipment and training, plus 10% contingency.

Recurring Costs/Savings:

Argon considers that any changes in operating savings will be balanced by operating costs. There will be a marked reduction in the price of propellant when substituting HCs for CFCs, but this will be offset by higher insurance, regular maintenance, and by future expenses in safety needs and ongoing safety training programs.

UNIT ABATEMENT COSTS:

The calculated unit abatement costs for this project is $ 0.67 per kilogram (see Annex #2).

IMPLEMENTATION:

The following implementation schedule will begin with approval by the Multilateral Fund, and will end when monitoring confirms that the factory is safe and suitable for hydrocarbon filling.

Task	Q1	Q2	Q3	Q4
Purchase equipment	XXXX			
Install fire safety and ventilation systems		XXXX		
Install machine and production trials			XXXX	
Start up / monitoring / training visit				XXXX

PROCUREMENT:

The filling machine must be purchased in the U.S. or Europe. Everything else should be purchased locally. The person contracted for training must be fully prepared concerning aerosol filling plant safety with HC aerosol formulations.

DISBURSEMENTS:

As negotiated with the suppliers.

REQUIRED REGULATORY ACTIONS:

None.

RESULTS:

This project will result in the elimination of 38,000 kilograms of CFC in the first year. If our volume grows with CFC propellants, the actual affect could be to reduce CFC consumption considerably more.

ANNEX #1 ARGON PROJECT CONVERSION COSTS:

The project costs are as follows:

1).	1 ea.	Semi automatic aerosol filling machine	$ 45,000.00
2).	1 ea.	Water bath for testing cans	32,000.00
3).	1 ea.	Moving expenses	20,000.00
4).	2 ea.	Portable gas detectors	5,000.00
5).		Fire fighting system	15,000.00
6).		Flame proof lighting / electric	5,000.00
7).		Modifications at new location	5,000.00
8).		Additional molecular sieve colume	10,000.00
9).		Safety training	5,000.00
		Sub total	142,000.00
		10 % Contingency	14,200.00
		Total	$ 156,200.00

ANNEX # 2 - ARGON UNIT ABATEMENT COSTS:

The unit abatement costs of our aerosol conversion project are calculated as follows:

Using the formula $A = \frac{C(F) + (OC-OS)}{W}$

where C = $ 156,200.00. OC = 0

(C)F = $ 25,387.56 OS = 0

W = 38,000

Doing the calculation, unit abatement cost = $ 0.67 / kg.

ANNEX # 3 ENVIRONMENTAL IMPACT ASSESSMENT (EIA)

The substitute propellant, a mixture of butane and propane, does not damage the ozone layer. It does not contribute to acid rain, nor is it carcinogenic, mutagenic, or toxic. The butane/propane mix does not pollute the soil or ground water. This mixture is a vola-tile organic compound (voc) that contributes somewhat to ground level contamination. This mixture does have a global warming potential, albeit very low.

Hydrocarbons are extremely flammable, and explosive. The storage of the hydro-carbon propellants must be accomplished by strict adherence to the U.S. National Fire Protection pamphlet # 58 Standard for the Storage and Handling of Liquefied Gases, as well as all applicable local codes and regulations.

The controlling concept for the proper handling of LPG is double protection:

* Eliminate sources of ignition
* Absolutely avoid a dangerous concentration of HAP.

The foreign expert employed to do the training should be familiar with how to man-age the control of these two factors.

- LESSONS FROM EXPERIENCE

  None.

- ENVIRONMENTAL ISSUES

  This project will result in the elimination of 38,000 kilograms of CFC in the first year.

- SAFETY ISSUES

  The safety issue for the manufacturing of aerosols is addressed specifically and appropriately in this report. The safety of the storage of HC propellants is not. Although this may be a moot point in that Argon already has storage, one must consider the manufacture of aerosols using HC propellants cannot be accomplished safely without adequate hydrocarbon storage.

- COST EFFECTIVENESS

  The project is cost effective at a unit abatement cost of $0.67/Kg.

PROJECT COVER SHEET

COUNTRY:	Malaysia
PROJECT TITLE:	Elimination of the use of 111 TCA in the metal cleaning processes at Kein Hing Industry Sdn Bhd
SECTOR COVERED:	Solvent
ODS USE IN SECTOR:	1308 MT of CFC-113 in 1991 2829 MT of 111 TCA in 1991
PROJECT IMPACT:	11 MT of 111 TCA per year
PROJECT DURATION:	9 months
PROJECT USEFUL LIFE:	10 years
TOTAL PROJECT COSTS:	Capital investment cost: USD 222,000 NPV of incremental operating cost: USD 14,000
PROPOSED MLF GRANT:	USD 236,000
COST EFFECTIVENESS:	USD 220 $/kg (ODP Basis)
NATIONAL COORDINATING AGENCY:	Malaysia Department of Environment (DOE)
IMPLEMENTING AGENCY:	UNDP

PROJECT SUMMARY

Kein Hing Industry Sdn Bhd (Kein Hing) is one of the metal stamping companies in the supporting industry in Malaysia. The products are mainly distributed to electrical appliance, air conditioner, automotive and electronics manufacturers. The company is a Malaysian private enterprise. 111 TCA (1,1,1-trichloroethane) is currently used to remove metal stamping oils during production of Kein Hing products. Under this project, the company will eliminate the use of 111 TCA by converting to an aqueous degreasing process to remove the metal stamping oils. The waste water from this process will have to be treated prior to discharge to drain to remove both heavy metals and stamping oil residues.

PROJECT OF THE GOVERNMENT OF MALAYSIA:

ELIMINATION OF THE USE OF 111 TCA IN THE METAL CLEANING PROCESS AT KEIN HING INDUSTRY SDN BHD

1. PROJECT OBJECTIVE

The objective of this project is to phase out the use of 111 TCA in the metal cleaning processes at Kein Hing Industry Sdn Bhd.

2. SECTOR BACKGROUND

The ODS consumption in the Malaysian solvent sector is estimated to have reached at least 1308 MT of CFC-113 and 28929 MT of 111 TCA in 1991. The industry is expected to grow rapidly in view of the foreign investment brought into Malaysia; in particular the electronics industry. ODS consumption in the solvent using industries is split between the electronics and metal cleaning processes. Electronic cleaning is concentrated on flux residue removal from printed wiring assemblies after soldering. Metal cleaning includes most gross cleaning of large or heavily soiled parts such as sheet metal cleaning, cleaning prior to painting or surface finishing and cleaning to remove machine oils from manufactured parts. Precision cleaning of medical devices, guidance systems, miniature bearings, etc., represent a special sub-category of metal cleaning.

3. ENTERPRISE BACKGROUND

Kein Hing Industry was established in 1981 and commenced operations in the same year. It is a 100% Malaysian owned private enterprise. The company produces a wide range of stamped and turned metal parts for the electronics, electrical appliance, air conditioner and automotive industries. Specific examples are for fans, videos and automobile radiators. In 1992, the company consumed approximately 11 MT of 111 TCA in the degreasing of metal parts.

4. PROJECT DESCRIPTION

4.1 PROCESS SOILS

Stamping oils of various weights and viscosities, deep drawing oils, metal turnings and factory particulates. The "high viscosity chloride oil" is characterized as the most difficult to remove.

4.2 PRESENT PROCESS

Kein Hing used about 11 MT of 111 TCA in the vapor degreasing of metal parts in 1992. The metals processed by Kein Hing are various ferrous and non-ferrous materials. Specifically the metals were mild steel, cold rolled steel, hot rolled steel, dip galvanized and electro-galvanized steels, tin plate, and aluminum, all in sheet form plus stamped and formed aluminum parts. The present cleaning processes to be replaced consists of two 111 TCA cleaning stations. Details are given below:

1) A three sump 111 TCA open top batch unit (ultrasonic wash, rinse and vapor dry) for high volume parts to remove light and medium oils, as well as other solvent soluble or removable soils. More than 100,000 parts per month are cleaned in this unit, however this varies depending on the types of parts being run under the various contracts.

2) A hand cleaning 111 TCA station for those parts that are difficult to clean in the batch unit, as well as those needing additional cleaning to meet quality standards.

4.3 PROPOSED ALTERNATIVE PROCESS

Under this project, the present vapor degreaser will be replaced with an aqueous cleaning machine. The new machine must be capable of handling and cleaning parts ranging in size from 60 x 40 mm to 200 mm in diameter. Cleaning is important since all parts, regardless of size, must be oil free before shipment to the customer. The new cleaning process will be divided into three parts:

i) Aqueous cleaning process (wash stage) - this is where the stamping oil is completely washed off the parts

ii) Rinse stage - the washed parts are rinsed in deionized (D.I.) water to remove all residues from the wash stage. The clean, water-wet parts are then sent to the drying stage.

iii) Drying stage - the parts are dried without water marks or water spots prior to shipping to the various customers.

Besides the aqueous cleaning equipment, a water treatment facility is required to ensure that all waste water, which contains aqueous cleaning chemicals, stamping oil and heavy metals (both dissolved and particulate), is treated in conformance with the strict government regulations before discharge to drain. Because of the many and varied products made for various customers, startup will require process and material compatibility tests to ensure customer parts are not damaged by the cleaning process. The new process may also require some processing oil changes to be tested, when compatibility or

cleaning effectiveness are maintained as a result of the change over to non-ODS. Ventilation changes in and around the new machine will be made to help reduce the increased heat and humidity emitted by the new equipment, and to reduce personnel exposure to emissions in and around the new unit.

5. TECHNOLOGY

In the solvent sector, there are several options to the use of 111 TCA for metal cleaning:

- aqueous
- semi-aqueous
- chlorinated solvents
- hydrocarbon solvents

The company has chosen to use the aqueous based process because it is the most practical and widely accepted technology. The installation of the aqueous process will eliminate the use of organic solvent and will not damage the environment, provided the waste water is treated properly to remove all contaminants prior to discharge to drain. Raw water is plentiful in Malaysia, so there will not be a problem with continuous supply of water to the process.

6. PROJECT COSTS

6.1 TOTAL CAPITAL COSTS

The following summarizes the anticipated investment cost and related activities:

DESCRIPTION	SUB-TOTAL	TOTAL
· Aqueous Cleaning system(walking conveyor)		$120,000
Freight and Installation		12,000
		$132,000
· Oil separation, filtration, closed loop rinse, and waste treatment	50,000	
· Water piping	5,000	
· Electrical wiring	3,000	
· Ventilation improvement	5,000	
		63,000
· Salvage		(1,000)
· Training & engineering		6,000
· Process & material compatibility testing		4,000
· Contingency & rounding		18,000
		$222,000

6.2 INCREMENTAL OPERATING COSTS

The following table summarizes the incremental operating cost:

ITEM		PRESENT SYSTEM	PROPOSED AQUEOUS SYSTEM
1)	Solvent or chemical cost	$10080 (10.5MT x $0.96)	$6000 (1.5MT x $4.00)
2)	Labour cost	$16,000	$16,000
3)	Energy cost ($0.06/hp x 8/day x 312 x 5hp)	$748.80	$7,488 ($0.06 x 8 x 312 x 50)
4)	Water consumption		$439.92 (3m3 x 312 x $0.47)
5)	Maintenance	$1,000	$2,500
	Total	$27828.80	$32427.92
	Difference		$4599

NPV of 4 Year Difference = 0.7925 x 4599 x 4 = $14,579

6.3 UNIT ABATEMENT COST

- ODS reduction capital cost.....USD 222,000
- Annual incremental cost.....USD 4,600
- Project useful life..... 10 years
- ODS reduction..... 11,000Kg

. Unit Abatement Cost [(a/c + b) /d] US/kg/ 24.9
(ODP Basis)

7. FINANCING PLAN

The company requests reimbursement of the complete project costs, which are estimated to be: USD 222,000+14000=236,000

8. PROJECT IMPLEMENTATION

8.1 MANAGEMENT

UNDP will oversee the completion of this project.

8.2 SCHEDULE

The project will be considered complete when monitoring has confirmed that production volumes and cleanliness levels of parts either exceed or are equivalent to the 111 TCA process and the water waste stream treatment prior to discharge to drain is in compliance with all DOE regulations. It will be carried out according to the schedule below

	Time for Completion							
	1994				1995			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Project Preparation				X				
MLF Approval				X				
Order Equipment				X	X			
Process Modification				X	X			
Installation					X	X		
Trial Runs						X		
Compatibility Test for customers						X	X	
Training					X	X	X	
Operation (routine monitoring shows parts are meeting customer needs)							X	X

9. PROJECT IMPACT

This project will eliminate the use of at least 11 MT of 111 TCA during the first year of implementation.

10. ENVIRONMENTAL ASSESSMENT

Under this project, Kein Hing will convert to an aqueous based cleaning system which is technologically accepted world-wide. The waste water effluent stream will be filtered and treated prior to discharge to drain in compliance with the standards of the DOE. Since this is a metal cleaning process, removing processing oils (as opposed to removal of acidic flux residue), it is unlikely that this project will have an adverse environmental impact.

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TECHNICAL REVIEW

I have reviewed the Malaysia Project, ""Elimination of the Use of 111 TCA in the Metal Cleaning Processes at Kein Hing Industry Sdn Bhd" from the solvent sector, based on discussions with the author, as well as review of the project document.

1	Country of Origin	Malaysia
2	Project Title	"Elimination of the Use of 111 TCA in the Metal Cleaning Processes at Kein Hing Industry Sdn Bhd"
3	Sector	Solvents
4	Relationship to C.P.	The project addresses how this factory ODS phase out fits in with the ODS using solvent subsectors in Malaysia. The Project relates to the C.P. via the description of the solvents used and the amounts to be phased out, although it does not directly write about the country programme.

5 Technology

Technical Soundness

This project substitutes accepted, effective non-ODS aqueous detergent technology for the current solvent cleaning operations to be replaced. It includes the process definition, qualification, and installation of cleaning technology that will meet the needs of cleaning and rust-free drying of metal parts, as described in the project document.

The project preparers are cognizant of the need to perform compatibility testing and process optimization testing to ensure meeting quality standards without parts damage or corrosion (rusting). The need to optimize stamping oil selection for ease of cleaning and incorporate rust inhibitors when necessary has also been recognized. Aqueous detergent technology has been in use world-wide for many years and has generally demonstrated at least equivalent performance vs. ODS cleaning processes.

Safety

The use of aqueous technology for metal cleaning operations employs acidic or alkaline substances which may be corrosive. The use of properly designed equipment and established processes ensures that the appropriate safeguards are designed into the replacement technology. Thus chemical misting, heat and humidity emanating from the new process will be controlled via the improved ventilation part of the project. Thus, in order to control exposure to chemicals and provide a safe working environment, it is important that handling such as loading, unloading, solution make-up, and maintenance procedures (including spent materials handling) be spelled out and people trained before they are permitted to become operators in the cleaning area. Periodic retraining is also recommended.

6 Environmental Impact

It is unlikely that this project will have an adverse environmental impact, since the project includes provision for oil separation from the wash solution, close looped rinse water, and treatment of the aqueous waste stream. The filtration will remove any metal particulates arising from the stamping processes while the water treatment will take care of dissolved contamination, including cleaning chemicals, in the water waste prior to release to the drain. Proper waste stream monitoring will enable factory personnel to adjust waste process settings for minimum environmental impact.

7 Project Costs

The cost components identified in the project cover the equipment required, including oil separation, walking beam conveyor materials handling, rinse water recycling, spent wash tank disposal and waste rinse water treatment plus operational cost components needed to run safely and under adequate environmental control. The cost of safety training and ongoing updates of that training are not included. These costs are not normally considered to be major elements in a project, and would not normally change the project cost materially.

Even though aqueous cleaning of stamping oils is a standard process world-wide, Kein Hing Industry Sdn Bhd as a contract manufacturer realizes compatibility testing is essential to ensure clean, damage-free parts in view of the wide range of metals and soils encountered.

8 Implementation Timeframe

The proposed implementation timeframe is feasible from an elapsed time standpoint. The actual date of startup, however, will be dependent upon the approval date.

9 Recommendation

The project is sound, needed, and has a level of ODP unit abatement cost - about $24.9/Kg. and a ODP cost effectiveness of $220/Kg. that is within the accepted range of experience. Approval as proposed is recommended, with the proviso that the compatibility, safety and environmental issues will be addressed.

William G. Kenyon
22 October, 1994

PROJECT COVER SHEET

COUNTRY:	Malaysia
PROJECT TITLE:	SHAGA COOLING TECHNOLOGY - Phaseout of the use of CFC in the manufacture of Rigid PU panels
SECTOR COVERED	Foamed Plastics
ODS USE IN SECTOR:	600 Tonnes of CFC (= ODS) base 1991
PROJECT IMPACT:	24 M Tonnes of CFC (= ODS)
PROJECT DURATION:	One Year
PROJECT ECONOMIC LIFE:	10 years
TOTAL PROJECT COST:	Incr. Capital Costs - USD 190,000
PROPOSED MLF GRANT:	USD 190,000
COST EFFECTIVENESS:	US$ 1.29 Kg/Yr. (unit abatement cost)
NATIONAL COORDINATING: AGENCY	Department of Environment (DOE)
IMPLEMENTING AGENCY:	UNDP
APPRAISAL DATES:	15 September, 25 October 94

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PROJECT SUMMARY

SHAGA COOLING (Shaga) is a 100% Malaysian-owned company established in 1991, and is owned by Mr. K. C. Yeoh. This enterprise specializes in the manufacture of modular insulated panels for cold storage and walk-in chambers and in the supply of "CLEAN AIR" rooms for multinationals with a unique "H bar" suspension for roofs. At present they use two book moulds - 40' long and 24' long presses. The material is mixed by electric drill mounted on a pillar post and material filled from open mix buckets. The company produces excellent panels with in-house sheet metal shop. Monthly production is about 8000 Sq. Ft of panels.

The Company is anxious to switch over to non-CFC blowing agents using HCFC 141b. Investment costs will include a high pressure machine, a premixer unit, technology transfer and trials.

Prepared by: Mr. M. Sarangapani
Reviewed by: Dr. Hubert Creyf

PROJECT FOR THE GOVT. OF MALAYSIA

SHAGA COOLING TECHNOLOGY - NIBONG TEBAL - KEDAH
ELIMINATION OF CFC-11 IN THE MANUFACTURE OF POLYURETHANE RIGID FOAM PANELS

1. PROJECT OBJECTIVE

The objective of this project is to phase out the use of CFCs in the manufacture of Rigid Foam panels.

2. SECTOR BACKGROUND

CFC consumption in Malaysia as per 1991 figures was 600 Metric Tonnes. CFC-11 in PU foams. CFC-12 for Polystyrene and Polyethylene foams, with smaller quantities of MC, CFC-114, CFC-115. Refrigerant Industry consumes nearly 1500 Metric Tonnes of CFC.

3. ENTERPRISE BACKGROUND

'SHAGA' was established nearly three years ago for the manufacture of insulated modular RF panels. The company employs about 115 workers, using 2 presses for panels manufacturing. Raw materials (MDI and Polyol) are purchased separately and blended with CFC-11 manually. The mixing of chemicals is done in an open bucket in split quantities from 2 pillar mounted electric stirring arrangement. The mix is poured from 2 or 3 pour points in the horizontal mould - which is tilted at 5 degrees, to allow free flow. This system helps in getting uniform cells as the rise is limited. Like all other manufacturers in Malaysia, this company too has its own sheet profiling section.

4. PROJECT DESCRIPTION

'SHAGA' utilizes about 24 Metric Tonnes of CFC-11 in the manufacture of Rigid Foam Panels. The company has decided to phase out CFC-11 and to switch to an alternate technology, initially through a combination of reduced CFC technology and HCFC 141b which will require a high pressure machine and a pre-blending unit. Project costs include trials and technology transfer.

5. TECHNOLOGY

5.1. OVERVIEW

There are several routes to replace CFCs in production of rigid PUF

(R-PUF)

- o CFC-11 > Partial water/HCFC-141b > ?
- o CFC-11 > Partial water/HCFC-22 > HFC-134a, 152a
- o CFC-11 > (cyclo) pentane

In addition, compounds such as Methylene Chloride, HCFC-123, and water blown technologies have been suggested, but these are immature in technology, limited available or limited applicable.

The first solution --also called the "liquid" solution -- employs technology that is closely related to the existing one. The final step in this process is not yet decided. One potential solution is HCFC-356, but full water blown foam with improved skin formation remains an option, specifically in "lesser demanding" systems.

The second one--also called the "gas" solution -- utilizes a gaseous mixture of physical blowing agents, requires high pressure equipment, and process adjustments. The final step in this process is seen as the introduction of (gaseous) HFCs. The high diffusion rate of HCFC-22 limits its use to encapsulated systems.

(Cyclo-) pentane technology is lately commercially introduced on several occasions, but its flammable nature requires safety conditions and limits its use to enterprises that can cope with such substances.
Cyclopentane is also regionally restricted in availability, but is likely to change soon.

5.2. IMPACT IN PRODUCTION PROCESS

The use of 141b will require a High Pressure Foam Dispenser. 141b is moderately flammable, but in the intended usage as a blend it should not cause any risk. The current hand mixing in the open bucket will result in
savings of CFC consumed - ensuring a good insulation with lesser 141b used as a blowing agent.

6. PROJECT COST

6.1. INCREMENTAL CAPITAL COSTS

1.	High Pressure Foaming machine	USD 100,000
2.	Preblender	60,000
3.	Startup trials & Technology Transfer	15,000
		175,000
5.	Contingencies @ 10% approx.	15,000
TOTAL INCREMENTAL CAPITAL COSTS		USD 190,000

6.2. OPERATING COSTS

The proposed change over will result in higher recurrent costs, calculated as follows:

OLD 24000 Kg of CFC-11 @ USD 1.65	USD 39,600/-
NEW 8000 Kg of 141b @ USD 3.80	30,400/-
	9,200/-
Additional MDI, 14000 kg @ USD 1.85	25,900/-
TOTAL ANNUAL INCREMENTAL COSTS	16,700/-
NET PRESENT VALUE (2 Yrs. 10% Discounted)	USD 29,000/-

This incremental cost will be counted against as of yet unspecified savings to be expected when the company changes from the current handmixed operations to machine process. Therefore, no incremental recurrent cost is allowed.

6.3. UNIT ABATEMENT COST

a)	Capital cost of project	: USD 190,000
b)	Life time of investment	: 10 years
c)	Incremental recurring costs	: USD 0/-
d)	CFC consumption in 1993	: 24,000 Kg
f)	Capital recovery factor	: 0.16275

Unit abatement cost = [(a(f)+c)/ d]: USD 1.29 Kg /Yr.

7. FINANCIAL PLAN

The Company requests funding of the total project, cost estimated at **USD 190,000**

8. PROJECT IMPLEMENTATION

8.1. UNDP will oversee completion of this project and provide technical assistance. UNDP/OPS will oversee the procurement activities.

8.2. SCHEDULE

TASK	TIME FOR COMPLETION Q1	Q2	Q3	Q4	Q5	Q6
1. **Preparation**						
MLF approval		X				
pre audit		X				
order confirmation			X			
2. **Installation**						
arrivals			X			
clearance			X			
3. **Startup, training**					X	X
4. **Post audit / Commissioning**						X

9. PROJECT IMPACT

This project will eliminate at least 24 Tonnes of CFC in the first year of implementation. The project employs commercially viable and environmentally acceptable technologies.

10. ANNEXES

Annex 1: Technical Review

TECHNICAL REVIEW

1.	COUNTRY :	Malaysia
2.	PROJECT TITLE :	**SHAGA Cooling Technologies** Phase out of the use of CFC in the manufacture of rigid PU panels.
3.	(SUB) SECTOR :	Foams Plastics
4.	CP RELATIONSHIP :	Unknown
5.	TECHNOLOGY :	The replacement of CFC11 to HCFC 141b in insulating panels is acceptable. The use of HCFC 141d does not bring about exceptional fire on health risks.
6.	ENVIRONMENTAL IMPACT :	HCFC 141b has a low ODP (0,1) and a low GWP (0,11) vs. CFC11.
7.	PROJECT COST :	The process costs as presented are acceptable. A small calculation error has been compensated by the contingencies. No recurrent operation costs are to be foreseen. The cost for reducing one ton of ODS is 9,991 USD.

8. IMPLEMENTATION : **One year must be sufficient for the transition.**

9. RECOMMENDATION : **to be accepted as presented**

PREPARED BY : **Dr.Hubert Creyf**
UNDP Foam Sector Project Reviewer
DATE : **25 October 1994**

PROJECT COVER SHEET

COUNTRY:	Malaysia
PROJECT TITLE:	SAFERAY (M) SDN BHD - Phaseout of CFC in the manufacture of Rigid Foam for use as Imitation wood
SECTOR COVERED:	Foamed Plastics
ODS USE IN SECTOR:	600 M Tonnes CFC (=ODS) base 1991
PROJECT IMPACT:	11 T Tonnes in 1993/94
PROJECT DURATION:	One year
PROJECT ECONOMIC LIFE:	10 years
TOTAL PROJECT COST:	USD 240,000 Incr. Capital Costs USD 6,000 Incr. Recurrent Costs
PROPOSED MLF GRANT:	USD 246,000
COST EFFECTIVENESS:	USD 4.10Kg/Yr.(unit abatement cost)
NATIONAL COORDINATING AGENCY:	Department of Environment
IMPLEMENTING AGENCY:	UNDP
APPRAISAL DATES:	July, October 1994

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PROJECT SUMMARY

"SAFERAY" is a 100% Malaysian-owned company established in 1993. It manufactures wood imitations and has an annual turnover of about RM. 1,000,000. Under the project, the company will phase out the use of CFC-11 with HCFC-141b. The two existing low pressure machines will be replaced by high pressure machines. The existing common blender station will still be used to feed the new foaming units. Technology transfer and the cost of process trials will also be provided.

Prepared by: Mr. M. Sarangapani
Reviewed by: Dr. Hubert Creyf

PROJECT OF THE GOVERNMENT OF MALAYSIA

SAFERAY (E) SDN BHD - PHASEOUT OF CFC IN THE MANUFACTURE OF RIGID FOAM FOR WOOD IMITATION PRODUCTS

1.PROJECT OBJECTIVE

The project will phase out the use of CFCs used in the manufacture of rigid foam articles used as decorative moldings or wood imitations.

2.SECTOR BACKGROUND

CFC consumption in Malaysia as per 1991 figures was 600 Metric Tonnes. CFC-11 in PU foams. CFC-12 for Polystyrene and Polyethylene foams, with smaller quantities of MC, CFC-114, CFC-115. Refrigerant Industry consumes nearly 1500 Metric Tonnes of CFC.

3. ENTERPRISE BACKGROUND

"SAFERAY" was established in July 1993 with Mr. Ong Kah Keong as Executive Director. It has an annual turn-over of about RM 1,000,000.

Production is run on two Canon 15RF2 low-pressure machines that are mounted on rails. The foaming units are serviced by a common CFC blending station placed in the mezzanine area. The machines are on parallel rails that reach out to several molds which are lined up on either side of the plant. Between them, they fill four rows of different kinds of carved molds for a variety of designs. Where the carving is deep, a thin PVC foil is spread to facilitate easy removal without damage to the designs. The foil is then stripped. Trimming is done and the final coat of paint is done against a water curtain. The unit is very well designed with excellent housekeeping practices. The company has skilled operators and good technical staff.

4. PROJECT DESCRIPTION

The company has decided to phase out the use of CFC-11 as early as possible. The project envisages the use of 141 b for one year with a rapid change over to all water blown systems. The technology for water blown wood stations is fast gaining acceptance. Two high pressure foaming dispensing units will be provided, as well as process trials and training.

5. TECHNOLOGY

5.1. OVERVIEW

There are several routes to replace CFCs in production of rigid PUF (R-PUF)

- o CFC-11 > Partial water/HCFC-141b > ?
- o CFC-11 > Partial water/HCFC-22 > HFC-134a, 152a
- o CFC-11 > (cyclo) pentane

In addition, compounds such as Methylene Chloride, HCFC-123, and water blown technologies have been suggested, but these are immature in technology, limited available or limited applicable.

The first solution --also called the "liquid" solution -- employs technology that is closely related to the existing one. The final step in this process is not yet decided. One potential solution is HCFC-356, but full water blown foam with improved skin formation remains an option, specifically in "lesser demanding" systems.

The second one--also called the "gas" solution -- utilizes a gaseous mixture of physical blowing agents, requires high pressure equipment, and process adjustments. The final step in this process is seen as the introduction of (gaseous) HFCs. The high diffusion rate of HCFC-22 limits its use to encapsulated systems.

(Cyclo-) pentane technology is lately commercially introduced on several occasions, but its flammable nature requires safety conditions and limits its use to enterprises that can cope with such substances. Cyclopentane is also regionally restricted in availability, but this is likely to change soon.

Saferay will use 141b in preference to Cyclo pentane, as they cannot guarantee 100% safety standards in the work area. However, as pointed out in the project description under para 4, the 141 b system will be phased out during the year. to all water blown formulations. This system is fast getting accepted by both processors and their clients. The high pressure machine is well suited for the application.

5.2. SELECTION AND PRODUCTION PROCESS

The company has decided to use, as a first step, HCFC-141b as its choice for alternative blowing agent. The water-blown system will be introduced during the year, by which time sufficient experience in formulations would have been accumulated from the chemical suppliers like BASF.

6. PROJECT COST

6.1 INCREMENTAL CAPITAL COSTS

1.	2 High Pressure machines @ each US$110,000	USD 200,000
2.	Start up and trials	USD 10,000/-
3.	Technology Transfer & Training	USD 10,000/-
	Sub-total:	USD 220,000/-
	Contingencies @ 10 % approx.	USD 20,000/-
	TOTAL CAPITAL COSTS	USD 240,000/-

6.2. OPERATING COSTS

OLD 11000 Kg of CFC @ USD 1.65	(USD 18,100/-)
NEW 9.500 Kg of 141b @ USD 3.80	USD 36,100/-
	USD 12,000/-

"Saferay" is currently testing production with 141b. It is anticipated that within one year it will switch to full water-blown system, therefore **incremental cost is calculated for six months amounting to $6,000.**

6.3. UNIT ABATEMENT COST

a)	Capital cost of project	:	USD 240,000/-
b)	Life time of investment	:	10 years
c)	Incremental recurring costs	:	USD 6,000/-
d)	CFC consumption in 1993	:	11 t
e)	Capital recovery factor	:	0.16275
	Unit abatement cost = [(a(e)+c)/ d]	:	USD 4.10 Kg/Yr.

7. FINANCIAL PLAN

The Company requests a grant of **USD 246,000.**

8. PROJECT IMPLEMENTATION

8.1. Project Management

UNDP will oversee completion of this project and provide technical assistance. UNDP/OPS will oversee procurement.

8.2 Schedule

TASK	TIME FOR COMPLETION Q1	Q2	Q3	Q4	Q5	Q6
1 . Preparation						
MLF approval	X					
pre audit	X					
order confirmation		X				
2. Installation						
arrivals			X			
clearance			X			
3. Start-up, training				XX		
4. Post audit / Commissioning				X		

9. PROJECT IMPACT

The company will eliminate 1100 Kg of CFC in it's first year of implementation with environmentally acceptable technology,into a zero ODP technology of all water blown formulations.

10. ANNEXES

Annex 1 - Technical Review

TECHNICAL REVIEW

1.	COUNTRY :	Malaysia
2.	PROJECT TITLE :	**SAFRAY (M) SDW BHD** Phase out of CFC in the manufacture of rigid foam for use as imitation wood.
3.	(SUB) SECTOR :	Foamed Plastics
4.	CP RELATIONSHIP :	Unknown
5.	TECHNOLOGY :	Although the rigid foam has no insulation function, it can be agreed that in a first stage HCFC 141 is proposed, because this product represents already a substantial improvement of the actual ozone depletion caused by the CFC11 used. However, it is strongly suggested that the company, perhaps in collaboration with its raw material supplier, looks at a water-blown solution.
6.	ENVIRONMENTAL IMPACT :	The ODP of HCFC 141b is 0,1, as is its GWP.

7. PROJECT COST :	**The costs can be accepted as proposed. In case the company changes later to a water-solution, the high pressure machines can also be used. The price to remove 1 tonne of ODS = 27,273 USD.**
8. IMPLEMENTATION :	**One year is certainly enough for this project.**
9. RECOMMENDATION :	**It is recommended to accept the project on the condition that the company actively seeks for a total water-solution.**

PREPARED BY : **Dr.Hubert Creyf**
UNDP Foam Sector Project Reviewer
DATE : **25 October 1994**

PROJECT COVER SHEET

COUNTRY:	Malaysia
PROJECT TITLE:	RICWIL (MALAYSIA) SDN BHD - Phaseout of CFC-11 in the manufacture of pipe insulation
SECTOR COVERED:	Foamed Plastics
ODS USE IN SECTOR:	600 M Tonnes of CFC(=ODS)base 1991
PROJECT IMPACT:	Phaseout of 25 MT CFC-11 (1993) annually
PROJECT DURATION:	One year
PROJECT ECONOMIC LIFE:	10 years
TOTAL PROJECT COSTS:	USD 200,000 Incr. Capital Costs USD 32,000 Incr. Recurrent Costs
PROPOSED MLF GRANT:	USD 118,000/- (representing 51% Malaysian holding)
COST EFFECTIVENESS:	US$ 2.05/Kg/Yr. (unit abatement cost)
NATIONAL COORDINATING AGENCY:	Department of Environment (DOE)
IMPLEMENTING AGENCY:	UNDP
APPRAISAL DATES:	August, 25 October 1994

PROJECT SUMMARY

"RICWIL" is a joint venture company registered in 1984 - Malaysian 51% and Japanese 49% - engaged in pipe insulation and roof spray works with mobile Graco unit. The company sources its raw materials from local Malaysian suppliers (ICI and COSMO) and preblends the CFC at the factory and has good technical support. The company is anxious to change to alternate blowing agent since a large amount of the finished products are exported, and has adopted the use of HCFC-141b as an interim technology; this will require a replacement of the existing foaming unit and modification of the Graco machine. A preblender for 141b will be required. Training and startup/trials will also be covered.

Prepared by: Mr. M. Sarangapani
Reviewed by: Dr. Hubert Creyf

PROJECT OF THE GOVERNMENT OF MALAYSIA

RICWIL (MALAYSIA) SDN BHD - ELIMINATION OF CFC-11 IN THE MANUFACTURE OF RIGID FOAM IN PIPE INSULATION AND ROOF SPRAY

1. PROJECT OBJECTIVE

The project will phaseout use of CFC-11 in the manufacture of insulated pipes, roof and tank insulation by spray.

2. SECTOR BACKGROUND

CFC consumption in Malaysia as per 1991 figures was 600 Metric Tonnes. CFC-11 i PU foams. CFC-12 for Polystyrene and Polyethylene foams, with smaller quantities of MC, CFC-114, CFC-115. Refrigerant Industry consumes nearly 1500 Metric Tonnes of CFC.

3. ENTERPRISE BACKGROUND

The enterprise was incorporated in Malaysia in 1984 as a joint venture with RICWIL of USA/Japan, with a Malaysian holding of 51% and RICWIL/Japan of 49%. The company is managed by Mr. Jeffrey Low - Managing Director and the Japanese interest is represented on the board by Mr. Hiroaki Inoue. The company has a Graco King spray unit and Maruka Kakooki low pressure R-PUF machine. The subject of business is pipe and roof insulation. The products are widely accepted by all international companies; in 1993, 25 MT CFC-11 was consumed. The company's turnover was RM.5.1 Million for 1993.

4. PROJECT DESCRIPTION

Under the project, RICWIL will switch to the use of HCFC-141b as an interim alternate technology to replace CFC-11. The existing foaming unit will be replaced with a high pressure machine for pipe insulation, and the Graco spraying unit will be modified. The change of blowing agent to HCFC-141b will also require the use of a blending unit and will result in a marginal increase in MDI inputs as a recurrent cost.

5. TECHNOLOGY

There are several routes to replace CFCs in production of rigid PUF (R-PUF)

- CFC-11 > Partial water/HCFC-141b>?
- CFC-11 > Partial water/HCFC-22>HFC-134A, 152A
- CFC-11 > (cyclo) pentane

In addition, compounds such as Methylene Chloride, HCFC-123, and water-blown technologies have been suggested, but these are immature in technology, limited availability or applications.

The first solution -- also called the "liquid" solution -- employs technology that is closely related to the existing one. The final step in this process is not yet decided. One potential solution is HCFC-356, but full water blown foam with improved skin formation remains an option, specifically in "lesser demanding" systems. The second one -- also called the "gas" solution -- utilizes a gaseous mixture of physical blowing agents, requires high pressure equipment, and process adjustments. The final step in this process is seen a the introduction of (gaseous) HFCs. The high diffusion rate of HCFC-22 limits its use of encapsulated systems.

(Cyclo-) pentane technology is lately commercially introduced on several occasions, but its flammable nature requires safety conditions and limits its use to enterprises that can cope with such substances. Cyclopentane is also regionally restricted in availability, but this changes quickly.

5.1. IMPACT ON PRODUCTION PROCESS

Use of HCFC 141b will require a high pressure foam dispenser. Though 141b is moderately inflammable, when blended into Polyol is a safe material to handle without risk. The current low pressure machine will be changed to a high pressure dispenser for the pipe insulation section for the spray unit and additional fittings will be provided to make the spray unit for the HCFC blend.

6. PROJECT COST

6.1 INCREMENTAL CAPITAL COSTS

1.	High Pressure Foaming Machine	USD 100,000/-
2.	Additional retrofitting for GRACO	USD 10,000/-
3.	Pre blender for 141b	USD 60,000/-
5.	Technology Transfer/Training	USD 10,000/-
6.	Trials and start up	USD 6,000/-
	TOTAL	USD 186,000/-
	Contingency/Rounding	14,000/-
THE TOTAL INCREMENTAL CAPITAL COSTS		USD 200,000/-

6.2 OPERATING COSTS

The proposed change over from CFC-11 to 141b will result in recurrent incremental operating costs calculated as under

OLD 25,000 Kg of CFC-11 @USD 1.65	USD 41,250/
NEW 8,500 Kg of 141b @USD 3.80	32,300/-
Additional 15,500 Kg of MDI @1.85	27,750/-
ANNUAL INCREMENTAL OPERATING COSTS:	USD 18,750
TWO YEARS INCREMENTAL OPERATING COSTS (DISCOUNTED, 10%):	USD 32,438

Say **USD 32,438**

6.3 UNIT ABATEMENT COST

a)	Capital cost of project	: USD 200,000/-
b)	Life time of investment	: 10 years
c)	Incremental recurring costs	: USD 18,750/-
d)	CFC consumption in 1993	: 25,000 Kg
e)	Capital recovery factor	: 0.16275
Unit abatement cost=[(a(e)+c)/d]		: USD 2.05/Kg/Yr.

7. FINANCIAL PLAN

The company requests 51% of the total project cost (US$ 290,000) amounting to: **US$ 118,000.**

8. PROJECT IMPLEMENTATION

8.1 PROJECT MANAGEMENT

UNDP will oversee completion of this project and provide technical assistance. UNDP/OPS will oversee the procurement activities.

8.2 Schedule

TASK	TIME FOR COMPLETION Q1	Q2	Q3	Q4	Q5	Q6
1. **Preparation**						
MLF approval		X				
pre audit		X				
order confirmation		X				
2. **Installation**						
arrivals			X			
clearance			X			

TASK	TIME FOR COMPLETION Q1	Q2	Q3	Q4	Q5	Q6
3. Startup, training				X	X	
4. Post audit/Commissioning					X	

9. PROJECT IMPACT

This project will eliminate at least 24 Tonnes of CFC in the first year of implementation. The project employs commercially viable and environmentally acceptable technologies.

10. ANNEXES

Annex 1: Technical Review

TECHNICAL REVIEW

1. COUNTRY :	Malaysia
2. PROJECT TITLE :	**RICWIL (Malaysia) SDN BHD** Phase out of CFC11 in the manufacture of pipe insulation.
3. (SUB) SECTOR :	Foamed Plastics
4. CP RELATIONSHIP :	Unknown
5. TECHNOLOGY :	The proposed change-over from CFC11 to HCFC 141b can be accepted for this project, in which the PU foam has an insulating function.
6. ENVIRONMENTAL IMPACT :	HCFC 141b has a low ODP and GWP value.
7. PROJECT COST :	The project operating costs have been wrongly calculated : in the first place, it is usual to use the same unit prices of 1,65 USD/kg of CFC11, and 3,80 USD/kg of HCFC. This results in annual incremental operating costs of 59,625 USD, or a two year incremental cost of 103,151 (rounded to 105,000 USD). The total project costs become then (260,000 + 105,000) * 0.51 = 186,150 USD.

The cost to remove 1 ton of ODP is 8,125 USD.
It is suggested to ask the [illegible] partner to support the initiative.

8. IMPLEMENTATION : One year is OK.

9. RECOMMENDATION : to be accepted as corrected herein.

PREPARED BY : Dr.Hubert Creyf
UNDP Foam Sector Project Reviewer
DATE : 25 October 1994

PROJECT COVER SHEET

COUNTRY:	**Malaysia**
PROJECT TITLE:	**RIGID FOAM INDUSTRIES (M) SDN BHD - Elimination of CFC in the manufacture of Rigid Foam Panels**
SECTOR COVERED:	**Foamed Plastics**
ODS USE IN SECTOR:	**600 M Tonnes of CFC(=ODS)base 1991**
PROJECT IMPACT:	**Phaseout of 19 M Tonnes of CFC annually**
PROJECT DURATION:	**One year**
PROJECT ECONOMIC LIFE:	**10 years**
TOTAL PROJECT COST:	**USD 315,00 Incremental Capital Costs USD 20,000 Incremental Recurrent Costs**
PROPOSED MLF GRANT:	**USD 335,000**
COST EFFECTIVENESS:	**US$ 3.32/Kg/Yr. (unit abatement cost)**
NATIONAL COORDINATING AGENCY:	**Department of Environment (DOE)**
IMPLEMENTING AGENCY:	**UNDP**
APPRAISAL DATES:	**September/October 1994**

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PROJECT SUMMARY

Rigid Foam Industries (M) SDW BHD "RIGID FOAM" is a 100% Malaysian-owned company of 15 years standing. Its products include modular insulated panels for cold rooms, walk-in cool chambers, refrigerated trucks, chillers, freezers etc. Under the project, the company will switch to the use of HCFC-141b as an alternate blowing agent. The two existing low pressure machines will be replaced with high pressure series and a blender unit will be provided. Project cost will also include incremental recurrent cost, technology transfer and training.

Prepared by: Mr. M. Sarangapani
Reviewed by: Dr. Hubert Creyf

PROJECT FOR THE GOVERNMENT OF MALAYSIA

"RIGID FOAM": SELANGOR - ELIMINATION OF CFC-11 IN THE MANUFACTURE OF P.U. RIGID FOAM PANELS

1. PROJECT OBJECTIVE

The objective of this project is to phase out the use of CFCs in the manufacture of rigid foam panels.

2. SECTOR BACKGROUND:

CFC consumption in Malaysia as per 1991 figures was 600 Metric Tonnes. CFC-11 in PU foams. CFC-12 for Polystyrene and Polyethylene foams, with smaller quantities of MC, CFC-114, CFC-115. Refrigerant Industry consumes nearly 1500 Metric Tonnes of CFC.

3. ENTERPRISE BACKGROUND

"RIGID FOAM" was established over 15 years ago for the manufacture of panels. The company has a paid-up capital of RM. 500,000/- and has a turnover of RM 6.5 Million. The range of products are modular insulated panels for cold rooms, walk in cool chambers, clean rooms employing a novel suspension and jointing profiles, refrigerated racks, chillers freezers etc. The company has two low pressure Cannon machines, model C-80 and C-100. The company is well controlled with good house-keeping and effectively control the CFC-11 losses. Five presses for panel preparation are being used. The two foaming machines are mounted on rails and moved to different filling points. About 150,000 sq. meters of panels are produced annually, including polystyrene based insulated ones, and about 19 M Tonnes of CFC-11 are used per year. Like other companies in Malaysia, the company has its own sheet profiling facility for captive use.

4. PROJECT DESCRIPTION

Under the project, RIGID FOAM will phase out completely the use of CFC-11 with alternate methods of blowing. In view of the restricted plant layout and conditions, the use of cyclopentane as the definitive replacement is not feasible; instead, HCFC-141b will be used. This will involve the replacement of the two low pressure machines with two high pressure systems, a pre-blender and additional incremental recurrent cost arising from the increased use of MDI and higher price of 141b.

5. TECHNOLOGY

5.1 OVERVIEW

There are several routes to replace CFCs in production of rigid PUF (R-PUF)

- o CFC-11 > Partial water/HCFC-141B >?
- O CFC-11 > Partial water/HCFC-22 >HFC-134a, 152a
- o CFC-11 > (cyclo) pentane

In addition, compounds such as Methylene Chloride, HCFC-123, and water blown technologies have been suggested, but these are immature in technology, limited available or limited applicable.

The first solution -- also called the "liquid" solution -- employs technology that is closely related to the existing one. The final step in this process is not yet decided. One potential solution is HCFC-356, but full water blown foam with improved skin formation remains an option, specifically in "lesser demanding" systems.

The second one -- also called the "gas" solution -- utilizes a gaseous mixture of physical blowing agents, requires high pressure equipment, and process adjustments. The final step in this process is seen as the introduction of (gaseous) HFCs. The high diffusion rate of HCFC-22 limits its use to encapsulated systems. (Cyclo-) pentane technology is lately commercially introduced on several occasions, but its flammable nature requires safety conditions and limits its use to enterprises that can cope with such substances. Cyclopentane is also regionally restricted in availability, but this is likely to change soon.

5.2 IMPACT IN PRODUCTION PROCESS

The use of 141b will require two High Pressure Foam Dispensers and a preblender for the Polyol - 141b mix. 141b is moderately flammable, but in the intended usage as a blend, it should not cause any risk. Less 141b will be additionally required for the same insulation value, though the material itself is more expensive.

6. PROJECT COST

6.1 INCREMENTAL CAPITAL COSTS

1.	Two H.P. foaming plant @ USD 110,000/- +125,000/-	USD 205,000
2.	Pre Blending unit	USD 65,000
3.	Technology transfer - safety training	USD 10,000
4.	Tials on 2 machines	USD 10,000
	TOTAL	USD 285,000
	CONTINGENCY	35,000
TOTAL INCREMENTAL CAPITAL COSTS		USD 315,000

6.2 OPERATING COSTS:

The proposed operating cost will result in high recurrent costs from the introduction of 141b.

OLD 19,000 Kg of CFC-11 @ 1.65	(USD 31,350/-)
NEW 6,000 Kg of 141b @ 3.80	USD 22,800/-
EXTRA 11,000 Kg of MDI @ 1.85	USD 20,350/-
ANNUAL INCREMENTAL RECURRENT COSTS	USD 11,800/-
Net Incremental recurrent costs for 2 years discounted @ 10%	USD 20,060/-
SAY	**USD 20,000/-**

6.3 UNIT ABATEMENT COST:

a)	Capital cost of project	: USD 315,000
b)	Life time of investment	: 10 years
c)	Incremental recurring costs	: USD 11,800
d)	CFC consumption in 1993	: 19,000 Kg
e)	Capital recovery factor	: 0.16275
Unit abatement cost = [(a(e)+c)/d]		: USD 3.32/Kg/Yr

7. FINANCIAL PLAN:

The company requests financing of the total project cost estimated at **USD 335,000**

8. PROJECT IMPLEMENTATION

8.1 Project Management

UNDP will oversee completion of this project and provide technical assistance. UNDP/OPS will oversee the procurement activities.

8.2 Schedule

TASK	TIME FOR COMPLETION Q1	Q2	Q3	Q4	Q5	Q6
1. Preparation						
MLF approval	X					
pre audit	X					
order confirmation		X				
2. Installation						
arrivals			X			
clearance			X			
3. Startup, training					XX	
4. Post audit/commissioning					X	

9. PROJECT IMPACT

This project will eliminate at least 19 tonnes of CFC-11 in the first year of implementation. The project employs commercially viable and environmentally acceptable technology.

10. ANNEXES

Annex 1: Technical Review

TECHNICAL REVIEW

1. COUNTRY :	Malaysia
2. PROJECT TITLE :	**Rigid Foam Industries (M) SDN BHD** Elimination of CFC in the manufacture of Rigid Foam Panels
3. (SUB) SECTOR :	Foamed Plastics
4. CP RELATIONSHIP :	Unknown
5. TECHNOLOGY :	The suggestion to avoid the use of pentane when metal covered panels are sawn is correct in view of fire safety. The solution to change to HCFC 141 is hence agreed with . HCFC 141b can be used without important precautions.
6. ENVIRONMENTAL IMPACT :	HCFC 141 has a low ODP (0,1) and a low GWP
7. PROJECT COST :	The proposed capital costs of 375.000 USD + 20.000 USD incremental costs are justified. The price to reduce 1t of ODS is 21,583 USD.

8. **IMPLEMENTATION :** One year is a reasonable time for implementation.

9. **RECOMMENDATION :** It is recommended to [illegible] proposed.

PREPARED BY : Dr.Hubert Creyf
UNDP Foam Sector Project Reviewer
DATE : 25 October 1994

PROJECT COVER SHEET

COUNTRY:	**Malaysia**
PROJECT TITLE:	**LEADING REFRIGERATION AND ENGINEERING SDN BHD - Elimination of CFC in the manufacture of Rigid Foam Panels and Shipyard Insulation Works**
SECTOR COVERED:	**Foamed Plastics**
ODS USE IN SECTOR:	**600 M Tonnes of CFC (=ODS) BASE 1991**
PROJECT IMPACT:	**10 M Tonnes of CFC**
PROJECT DURATION:	**One year**
PROJECT ECONOMIC LIFE:	**10 years**
TOTAL PROJECT COST:	**USD 200,000 Incremental Capital Costs USD 14,000 Incremental Recurrent Costs**
PROPOSED MLF GRANT:	**USD 214,000**
COST EFFECTIVENESS:	**US$4.06/kg/Yr. (unit abatement cost)**
NATIONAL COORDINATING AGENCY:	**Department of Environment**
IMPLEMENTING AGENCY:	**UNDP**
APPRAISAL DATES:	**September/October 1994**

PROJECT SUMMARY

"LEADING" is a 100% Malaysian-owned enterprise established in 1985. It manufactures insulated PU panels with a post mounted electric stirrer and shipyard insulation with a Cannon C-60 low-pressure machine. Under the project, the company will phase out the use of CFC-11 and go for alternative technology and blowing agent such as HCFC 141b. The use of this blowing agent will require a blender unit and a high pressure foam dispensing machine for panel filling. For the shipyard insulation, it is suggested that the company takes blended 141b polyol from the main plant, and relocate the existing Cannon C-60 machine for the Shipyard insulation work. The use of 141b will result in higher recurrent costs.

Prepared by: Mr. M. Sarangapani
Reviewed by: Dr. Hubert Creyf

PROJECT FOR THE GOVERNMENT OF MALAYSIA

LEADING REFRIGERATION AND ENGINEERING SND BHD
ELIMINATION OF CFC-11 IN THE MANUFACTURE OF INSULATED PANELS
AND SHIPYARD INSULATION WORKS

1. PROJECT OBJECTIVE

The project will eliminate the use of CFC in the manufacture of rigid foam panels and in shipyard insulation.

2. SECTOR BACKGROUND

CFC consumption in Malaysia as per 1991 figures was 600 Metric Tonnes CFC-11 in PU foams. CFC-12 for Polystyrene and Polyethylene foams, with smaller quantities of MC, CFC-114, CFC-115. Refrigerant Industry consumes nearly 1500 Metric Tonnes of CFC.

3. ENTERPRISE BACKGROUND

"LEADING" is a 100% Malaysian-owned enterprise established in 1985/87, has a paid up capital of RM. 350,000, and with an annual turnover of about RM 6 Million. The company is a well managed enterprise with a good number of technical and field staff under the leadership of Mr. S.M. Yong as Managing Director. The company manufactures insulated PU panels and carries out shipyard insulation works. It has a post-mounted electric stirrer for the panel work and a Cannon C-60 low pressure machine for shipyard insulation. Annual CFC-11 consumption is about 10 MT.

4. PROJECT DESCRIPTION

Under the project, "LEADING" will phase out the use of CFC-11 and go for alternative technology and blowing agent such as HCFC 141b. The use of this blowing agent will require a blender unit and a high pressure foam dispensing machine for panel filling. For shipyard insulation, to make the project viable, it is suggested that the company takes blended 141b Polyol from the main plant, and uses the existing low pressure Cannon C-60 machine. Technology transfer and process trials will also be provided. In addition, the use of 141b will involve incremental recurrent costs.

5. TECHNOLOGY

5.1 OVERVIEW

There are several routes to replace CFCs in production of rigid PUF (R-PUF)

- CFC-11 Partial water/HCFC 141b
- CFC-11> Partial water/HCFC-22>HFC-134a, 152a
- CFC-11>(cyclo) pentane

In addition, compounds such as Methylene Chloride, HCFC-123, and water-blown technologies have been suggested, but these are immature in technology, limited available or limited applicable.

The first solution-- also called the "liquid" solution -- employs technology that is closely related to the existing one. The final step in this process is not yet decided. One potential solution is HCFC-356, but full water blown foam with improved skin formation remains an option, specifically in "lesser demanding" systems.

The second one -- also called the "gas" solution -- utilizes a gaseous mixture of physical blowing agents, requires high pressure equipment, and process adjustments. The final step in this process is seen as the introduction of (gaseous) HFCs. The high diffusion rate of HCFC-22 limits its use to encapsulated systems.

(Cyclo-)pentane technology is lately commercially introduced on several occasions, but its flammable nature requires safety conditions and limits its use to enterprises that can cope with such substances.
Cyclopentane is also regionally restricted in availability, but this changes quickly.

Even though Cyclopentane technology, given the necessary safety aspects in work, experience and space requirement with zero ODP, yet I would recommend 141b in this company. Similarly HCFC-22 could also be a replacement to CFC-11 usage, but even this has to be imported and not relevant as HCFC-22 is not produced locally.

5.2 IMPACT ON PRODUCTION PROCESS

"LEADING" will totally phase out CFC-11 usage and change over to 141b. The use of 141b will require a High Pressure Foam Dispensers and a pre-blender for the Polyol - 141b mix. 141b is moderately flammable, but in the intended usage as a blend it should not cause any risk. Less 141b will be additionally required for the same insulation value, though the material itself is more expensive.

6. PROJECT COST

6.1 INCREMENTAL CAPITAL COSTS

The following are the Incremental capital costs that will be incurred for the proposed change over the Rigid Foam Section

1.	H.P. Foaming plant for 100 Lts/min. capacity	USD 112,500
2.	Pre-blending unit	USD 60,000
3.	Trials/Technology transfer/training	USD 10,000
	Sub-total:	USD 112,500
5.	Contingency	17,500
TOTAL INCREMENTAL CAPITAL COSTS:		**200,000**

6.2 OPERATING COSTS

The use of alternative blowing agent HCFC-141b would involve incremental recurrent cost:

OLD	10,000 Kg of CFC-11 @ USD 1.65	USD 16,500/-
NEW	3,500 Kg of 141b @ USD 3.80	USD 13,300/-
EXTRA	6,000 Kg of MDI @ 1.85	USD 11,100/-
Annual incremental recurrent costs:		USD 7,900/-
Total incremental recurrent costs for two years (discounted, 10%)		USD 13,746/-
	SAY	**USD 14,000/-**

6.3 UNIT ABATEMENT COST

a)	Capital cost of project	:	USD 200,000
b)	Life Time of investment	:	10 years
c)	Incremental recurring costs	:	7,900
d)	CFC consumption in 1993	:	10,000 Kg
e)	Capital recovery factor	:	0.16275
Unit abatement cost=[a(e)+c)/d]		:	USD 4.06/Kg/Yr.

7. FINANCIAL PLAN

The company requests financing of the total project cost estimated at **USD 214,000.**

8. PROJECT IMPLEMENTATION

8.1 Project Management

UNDP will oversee completion of this project and provide technical assistance. UNDP/OPS will oversee the procurement activities.

8.2 Schedule

T A S K	TIME FOR COMPLETION Q1	Q2	Q3	Q4	Q5	Q6
1. Preparation						
MLF approval	X					
pre audit	X					
order confirmation	X					
2. Installation						
arrivals			X			
clearance			X			
3. Start-up, training				XX		
4. Post audit/Commissioning					X	

9. PROJECT IMPACT

This project will eliminate at least 10 Metric Tonnes of CFC in the first year of implementation. The project employs commercially viable and environmentally acceptable technology

10. ANNEXES

Annex 1: Technical Review

TECHNICAL REVIEW

1. COUNTRY :	Malaysia
2. PROJECT TITLE :	**Leading Refrigeration and Engineering SDN BHD** Elimination of CFC in the manufacture of rigid foam.
3. (SUB) SECTOR :	Foamed Plastics
4. CP RELATIONSHIP :	Unknown
5. TECHNOLOGY :	The projects aims at substituting CFC11 by HCFC 141b. Since the PU panels have a thermal insulating function, this change can be agreed with. The weak chain, which should be well taken care of, is the transport of polyol-HCFC mixture from the plant to the shipyard. Under tropical circumstances the HCFC 141b might evaporate, if no proper care is taken to prevent this.
6. ENVIRONMENTAL IMPACT :	HCFC 141b has a small ODP (0,1) and a low GWP (0,11) versus CFC11.

7. PROJECT COST :	**The proposed incremental capital cost of 240.000 USD is acceptable as is the incremental recurrent cost of 10.000 USD.** The cost to eliminate 1 t of ODS is 24,56[illegible] USD.
8. IMPLEMENTATION :	**Agreed as proposed.**
9. RECOMMENDATION :	**It is recommended to accept the project as proposed. Polyol/HCFC mixture transport technology must be checked.**

PREPARED BY : **Dr.Hubert Creyf**
UNDP Foam Sector Project Reviewer

DATE : **25 October 1994**

PROJECT COVER SHEET

COUNTRY:	Malaysia
PROJECT TITLE:	DREAM PRODUCTS SND BHD - Elimination of CFCs in the Manufacture of Moulded and Flexible PU Foams
SECTOR COVERED:	Foams
ODS USE IN SECTOR:	600 M Tonnes of CFC(=ODS)base 1991
PROJECT IMPACT:	15 M Tonnes of CFC in 1993
PROJECT DURATION:	One year
PROJECT ECONOMIC LIFE:	10 years
TOTAL PROJECT COST:	USD 95,000/-Incremental Capital Costs
PROPOSED MLF GRANT:	USD 66,500/-(70% local ownership)
COST EFFECTIVENESS:	US$ 1.03 /Kg/Yr.(unit abatement cost)
NATIONAL COORDINATING AGENCY:	Department of Environment
IMPLEMENTING AGENCY:	UNDP
APPRAISAL DATES:	May, August and October 1994

PROJECT SUMMARY

"DREAM PRODUCTS" is a joint venture enterprise with 70% Malaysian and 30% Australian holdings. The company manufactures flexible polyurethane foams for cushions, pillows and mattresses. It has a high pressure machine for the molded cold-cure flexible foam line and two single-block machines (one Spuhl and one locally fabricated) for slabstock. The company intends to phase out CFCs totally from its cold-cure section by a water-blown system, and by the use of Methylene Chloride for the slabstock line. Under the project, the use of methylene chloride for the slabstock line will necessitate the installation of improved exhaust/ventilation and safety systems, an accelerated block-cooling system and a stand-by generator. Extensive technical assistance and process trials will be required for the switch over to a full water-blown system in the cold-cure molding section.

Prepared by: Mr. M. Sarangapani
Reviewed by: Dr. Hubert Creyf

PROJECT FOR THE GOVERNMENT OF MALAYSIA

DREAM PRODUCTS SND BHD - ELIMINATION OF CFC IN THE MANUFACTURE OF MOULDED AND FLEXIBLE PU FOAMS

1. PROJECT OBJECTIVE

The project will phase out 15 MT of CFC-11 used in the manufacture of flexible and cold-cure moulded foams in the enterprise.

2. SECTOR BACKGROUND

CFC consumption in Malaysia as per 1991 figures was 600 Metric Tonnes CFC-11 in PU foams; CFC-12 for Polystyrene and Polyethylene foams, with smaller quantities of MC, CFC-114, CFC-115. Refrigerant Industry consumes nearly 1500 Metric Tonnes of CFC.

3. ENTERPRISE BACKGROUND

"DREAM PRODUCTS" is a joint venture enterprise with 70% Malaysian and a 30% Australian holdings. A Spuhl and a second single block molding machines for flexible foam have been in operation for 15 years, and the molding line was established with a Cannon high pressure machine for producing moulded cold cure foams. The company produces 750 Tonnes of moulded foams and 450 Tonnes of flexible foam blocks annually and utilizes annually about 15 MT of CFC-11. It has a complete furnishing section and markets finished mattresses, cushions and quilted material coverings also.

4. PROJECT DESCRIPTION

Under the project, the company will phase out the use of CFCs by switching to an all water blown system for the cold-cure moulded line, and to the use of methylene chloride in the slabstock line. Extensive technical inputs and process trials in the cold-cure foam formulations will be provided for the switch over to water-blown system. In addition, improved exhaust and metering systems will be installed, as well as block-cooling systems to prevent scorching in the case of low density foams. A high pressure water lance will also be required. It is expected that the higher recurrent cost that will arise from the change over to an all water-blown system will be offset by the expected savings that will result from the methylene chloride system.

5. TECHNOLOGY

5.1 OVERVIEW AND SELECTION

The technology of choice for the replacement of CFCs in cold-cure polyurethane molded foams is the switch to all water-blown systems. In flexible slabstock foams, the use of methylene chloride is the prevailing replacement technology for CFCs. In addition, the use of accelerated curing systems can augment MC in formulations where high amount of auxiliary blowing agents would de-stabilize formulations. Another approach that can augment the use of MC is the addition of softeners in low density super soft formulations. Companies with complicated manufacturing programmes may need a combination of all three. Dream Products has selected all water-blown systems for its cold-cure operation. For the two flexible slabstock production stations, the company will select a combination of the three mentioned technologies. This can be done in a cost-effective way because the discontinuous nature of Dream Products operation that allows to install very low cost accelerated curing.

5.2 IMPACT ON PRODUCTION PROCESS

The company already operates a high pressure Cannon machine which only requires minimum modifications to make it suitable for the modified formulations. Extensive process trials under the supervision of an external expert, however, will have to be carried out to adjust the new formulations to the rather stringent specifications of Dream Products customers.

The flexible foam lines require overhaul of the exhaust system and the addition of methylene chloride metering systems. In addition, accelerated cooling tables will have to be provided and workers have to be trained in the safe operation of modified production system to avoid exposure hazards.

6. PROJECT COST

6.1 INCREMENTAL CAPITAL COSTS:

Following investments are proposed:

A) For cold-cure molding: no capital investments required

B) Spuhl single-block foam machine:

1)	Accelerated cooling/curing table	20,000/-
2)	Exhaust fan	5,000/-
3)	Methylene Chloride-Metering pump	5,000/-
4)	Water Lance system	5,000/-

C)	Second single-block machine:	
	1) Accelerated cooling/curing table	20,000/-
	2) Exhaust fan encapsulation	5,000/-
	3) Methylene Chloride metering	5,000/-
D)	Technology transfer and training: (for both lines)	10,000/-
E)	Trials and start-up: $5,000 per line	10,000/-
F)	Contingency:	10,000/-
TOTAL INCREMENTAL CAPITAL COSTS:		USD 95,000/-

6.2 OPERATING COSTS

The incremental recurrent costs, as a result of the change over from CFC-11 to water-blown system in Cold-cure molding and from CFC-11 to MC in flexible foams, are expected to be negligible and are therefore not be claimed by the company.

6.3 UNIT ABATEMENT COST:

a)	Capital cost of project	:USD 95,000/-
b)	Life time of investment	:10 Years
c)	Incremental recurring costs	:USD 0/-
d)	CFC consumption in 1993	:15,000 Kg
e)	Capital recovery factor	:0.16275
Unit abatement cost = [(a(e)+c)/d]		:USD 1.03/Kg/Yr.

7. FINANCIAL PLAN:

The company requests financing of 70% of the total project cost ($105,000) amounting to **USD 66,500**.

8. PROJECT IMPLEMENTATION

8.1 UNDP will oversee completion of this project and provide technical assistance. UNDP/OPS will oversee the procurement activities.

8.2 Schedule

TASK	TIME FOR COMPLETION Q1	Q2	Q3	Q4	Q5	Q6
1. Preparation						
MLF approval	X					
pre audit	X					
order confirmation		X				
2. Installation						
arrivals			X			
clearance			X			
3. Start-up, training			XX			
4. Post audit/Commissioning				X		

9. PROJECT IMPACT

This project will eliminate at least 15 Tonnes of CFC in the first year of implementation. The project employs commercially viable and environmentally acceptable technology.

10. ANNEXES

Annex 1: Technical Review

TECHNICAL REVIEW

1.	**COUNTRY :**	**Malaysia**
2.	**PROJECT TITLE :**	**Dream products SDN BHD**
3.	**(SUB) SECTOR :**	**Foamed Plastics**
4.	**CP RELATIONSHIP :**	**Unknown**
5.	**TECHNOLOGY :**	***5.1. Discontinuous flexible block production :*** **The change from CFC11 to MC as a blowing agent is considered as acceptable. It should be noticed that the TLV of MC is 50 ppm in many countries. The local TLV must not be exceeded, and the ventilation adapted if necessary.** **Active fire training must be part of the training nf the people.** ***5.2. Moulding :*** **The change to all water-blown foam is the best technology which can be recommended.**
6.	**ENVIRONMENTAL IMPACT :**	**Methylenechloride has no ODP. The local emission standards must be consulted.**

7. PROJECT COST :	**All capital costs proposed are essential and acceptable. The cost for reduction of 1 t of ODS is 4900 USD. It is suggested to ask the Australian partner whether he will join the project.**
8. IMPLEMENTATION :	**Agreed with the proposed one year period.**
9. RECOMMENDATION :	**It is proposed to accept the project, provided the safety aspect is considered.**

PREPARED BY : **Dr.Hubert Creyf**
UNDP Foam Sector Project Reviewer
DATE : **25 October 1994**

PROJECT COVER SHEET
(PROJECT 1)

4th Revision
19-9-1994

COUNTRY	MALAYSIA
PROJECT TITLE	Substitution of CFC-12 and CFC-11 with HFC-134a and HCFC-141b respectively and elimination the use of 1,1,1 TCA in Household refrigerator manufacturing
SECTOR COVERED	Household Refrigerator
ODS CONSUMPTION (IN 1992 FISCAL YEAR)	18.0 Tonnes of CFC-12 (Refrigerant) 80.6 Tonnes of CFC-11 (Blowing Agent) 11.3 Tonnes of 1,1,1 TCA (Cleaning Solvent)
PROJECT IMPLEMENTATION	The project will lead to the elimination of 109.9 Tonnes of Ozone Depleting Substances (ODS) annually under the project impact.
PROJECT DURATION	3 Years
PROJECT ECONOMIC LIFE	10 Years
TOTAL PROJECT COST	PHASE 1 (Capital Cost) US$ 1,055,841.21 PHASE 2 (Incremental Operating Cost) US$ 838,008.00 Total Project cost US$ 1,893,849.21
PROPOSED FOR FINANCING	US$ 1,276,500[a] (based on 56.9% of local public listed share, which exclude the ownership of transnational corporation, Matsushita Electric Industrial Co. Ltd., Japan 43.1%)
IMPLEMENTING ENTERPRISE	MATSUSHITA ELECTRIC CO.,(M) BHD.- BANGI PLANT (Hereinafter called MELCOM)
PLANT LOCATION	Lot No.7, Jalan P/2A, Bandar Baru Bangi, Bangi Industrial Site, 43650 Kajang, Selangor Darul Ehsan.
NATIONAL COORDINATING AGENCY	Department of Environment
IMPLEMENTING AGENCY	World Bank

a) Grant request includes 3% financial administration fee.

PROJECT SUMMARY

The duration of the project is 3 years (1993 to 1995). With the successful completion of the project Melcom will be able to substitute the use of ODS in the manufacturing of refrigerators. The substitution will be made of the CFC12 to HFC134a, blowing agent CFC 11 to HFC 141b, and solvent 1.1.1 TCA to water soluble oil.

In doing so major changes must be carried out on the materials, components and processing methods. Melcom is callobrating with Matsushita Electric Industrial Japan (Hereinafter called MEI) to produce the ODS free refrigerators. MEI will be responsible for the materials and components research whilst Melcom is responsible to verify these results and develop a total product, including manufacturing changes.

Melcom currently produces 13 (thirteen) refrigerator models on a single assembly line. The company has made a decision to begin its conversion to CFC-free models by initially converting 7 (seven) models by the end of 1995; the remaining 6 (six) models will be converted later. Melcom believes that the imminent production phaseout of CFCs requires it to move quickly as supplies will become increasingly uncertain.

The total project is divided into two phases. In phase 1, Melcom will request technical assistance from its technology suppliers and investigate the changes needed to produce reliable CFC-free refrigerators. Limited production of refrigerators will be carried out for testing purposes. Testing will verify the reliability of the new models and answer questions about changes needed in the manufacturing process. Given the results of the phase 1 investigations, certain costs described below may not, in fact, be realized. In phase two, mass production of CFC-free refrigerators would begin.

Initially Melcom will be using HCFC 141b polyurethane foam tentatively by March 1995 onward for mass production. Melcom will introduce cyclopentane system upon receiving the technological knowhow and experience from MEI by early 1997. By beginning of 1995, a second project proposal will be submitted on the cyclopentane system.

PROJECT OBJECTIVE

1. Being the biggest refrigerator manufacturer in Malaysia, Melcom feels it is its duty to respond early in the phasing out of ODS, even though Malaysia is given a grace period in the phasing out of ODS.

2. Melcom must take more responsibility in the engineering conversion to ODS-free refrigerators compared to the other Matsushita sister companies in the Asean region due to limited manpower, time, and facilities at MEI to accommodate both their domestic requirements and requirements from the overseas plants.
   MEI believes that Melcom's technical capabilities are at present greater than those in sister plants throughout the region, so Melcom will have to take a stronger role in its phase out efforts.

3. This is an opportunity to grasp the technical knowledge and skill from MEI for Melcom's continuing manpower development.

SECTOR BACKGROUND

In the 1992 fiscal year, MELCOM-Bangi Plant produced 147,667 units of household refrigerators comprising 13 models. In producing the refrigerators, MELCOM-Bangi Plant consumed approximately 18.0 Tonnes of CFC-12, 80.6 Tonnes of CFC-11 and 11.3 Tonnes of 1,1,1 TCA. Hence, the total consumption of ODS was 109.9 Tonnes in that particular year. This figure represented 2.7 % of Malaysia's consumption of ODS, which in 1992, was approximately 4087 Tonnes of ODS.

ENTERPRISE BACKGROUND

MATSUSHITA ELECTRIC CO., (M) BHD. (MELCOM) was officially opened on 11th May 1967. MELCOM is public listed company. The major share holder (43.1%) is the parent company MATSUSHITA ELECTRIC INDUSTRIAL CO. LTD JAPAN (MEI) and the rest of the share is held by the public.

At present, MELCOM is the most comprehensive manufacturer of electrical and electronic home appliances in Malaysia. The list of products being produced are as follows, colour television, refrigerator, washing machine, dry cell battery, electric fan, ventilation fan, rice cooker,slow cooker, blender, electric iron, gas cooker, home shower and vacuum cleaner. In 1992, the total sales revenue was RM 577 million (US$ 277 million). The export business accounted 32.1 % of the total sales and the rest from the domestic market. These products are being produced at four (4) different sites of factories. To increase it's production of refrigerators and washing machines to meet the growing demand, these departments were moved to the newly opened BANGI PLANT in June 1983.

The refrigerator department is the biggest refrigerator producer in Malaysia. The plant is producing an average of 13,000 sets of refrigerators per month for the domestic market only. This is about 51 % of the total refrigerator production in Malaysia. There are two (2) types of refrigerator being produced, namely the direct cool and frost free type. There are 13 different type of models being produced. In the manufacturing of refrigerators, 70 % of the parts are locally produced. Currently the NATIONAL brand is holding 35 % of the total refrigerator market share. (Total sales of locally made plus imported by all brand).

To ensure a continuously supply of good quality refrigerators to our consumers, it had been the policy of MELCOM as a whole, to strongly emphasize on the development of manpower before product. MELCOM has a TECHNICAL AGREEMENT with the parent company to ensure continuous availability of technical backup and assistance. In producing the NON-CFC refrigerators, the Refrigerator department is taking the initiative to start the development together with the parent company and at the same time developing the local staff's technical capabilities.

Melcom's technical agreement with MEI is slightly different from those between other Asian refrigerator manufacturers and their Japanese parent companies. Given the technical capabilities of the Malaysian company, much of the product development and testing of new CFC refrigerator models has taken place in Malaysia, a practice that is consistent with the goverment's policy of increasing the technical capabilities of Malaysian firms. The development and testing of CFC-free models will continue this practice. Melcom's refrigerator models are distinct from those produced by MEI for the Japanese market, and although MEI will provide considerable technical support, much of the responsibility for the development of the CFC-free models is Melcom's.

As part of the existing technical agreement, Matsushita Refrigeration Company of Japan will do the following at no cost to Melcom :-

a) Design the different refrigerator models.
b) Provide production drawing for the new models.
c) Provide training on manufacturing, engineering and quality control.
d) Conduct the various approval tests for each refrigerator model.

PROJECT DESCRIPTION

This project is designed within the framework of the Montreal Protocol as an international agreement to reduce ODS consumption. Thus with the successful completion of the project, the use of CFC-12, CFC-11 and TCA 1,1,1 will be phased out in the household refrigerator manufacturing at Melcom Bangi Plant.

The total project can be classified into two different phases. The 1st phase is to verify chosen CFC-free technologies for the manufacturing of refrigerators and answer question about their reliability and manufacturability. The 2nd phase will be the mass production of CFC-free refrigerators.

Most of the incremental costs of making the conversion to CFC-free models are related to testing the reliability of the refrigerant circuit and the overall performance of the new models. Melcom anticipates relatively small costs for converting to HCFC-141b blown foam as the existing foaming machineries and equipments is only 3 years old and can be used with minor modification. It is necessary to purchase two preheating oven for the door and cabinet lines. It was confirmed after conducting 2nd trial test on HCFC 141b polyurethane foam in August 1993. The 3rd trial test is been schedule in beginning October 1994. Central ventilation was constructed in the chemical mixing room in July 1994. Similarly, the costs of eliminating the use of 1,1,1 trichloroethane in the "Plate Water Evaporator" production step are expected to be small.

Melcom currently purchase its compressors from Matsushita Refrigeration Industries (Singapore) Pte Ltd.), in short (Maris). Maris had developed the HFC 134a compressors used in our initial system test in 1993. Maris will manufacture these compressors for our monitoring and limited production sets by April 1994.

Mass production of these compressors for our refrigerator production will start towards the end of 1995. Basically the compressor manufacturer will conduct tests on compressor performance and reliability only on the compressor itself. The lifetime of a compressor used in an appliance is not only affected by the durability of the compressor itself, but also depends on the operating conditions which are related to the design of the refrigeration system.

The complete refrigeration system performance and reliability using the new compressor must be confirmed by Melcom. The HFC 134a compressor oil has high hygroscopicity compared with conventional refrigerant oils. Therefore a total product assurance based on actual manufacturing process under high humidity and high ambient temperature is necessary.

Melcom's conversion to CFC-free refrigerator production is already underway and some of the cost of activities described below have already been incurred. To aid the reader, those cost incurring before June 1994 are identified.

1. **Phase 1 components**

Training - As part of its Costing Technical Assistance Agreement with MEI, Melcom receives free of charge training in Malaysia and Japan. Melcom bears only the cost of airfare and accommodation. MEI plans to conduct training in Japan simultaneously with training of staff from other overseas locations.

To receive the knowledge through meetings, seminars and trainings at both local and overseas, these activities will be carried out throughout the project period.

a) Attending Non-CFC product development meeting in MEI (Japan) with all Matsushita Overseas Refrigerator manufacturing plant advisers and managers. This is carried out twice a year throughout the project period.

	Anticipated Cost	US$ 27,118.11
Incurred prior to	June 1994	US$ 10,627.04

(See annex 2 for detailed estimated cost and schedule)

b) Receiving refrigeration system specialist from MEI to MELCOM for Technical Assistance as required by the project.

	Anticipated Cost	US$	30,086.58
Incurred prior to	June 1994	US$	9,862.85

(See annex 2 for detailed estimated cost and schedule)

c) Sending Melcom staff (engineering, QC & ect..) to MEI for training as required by the project.

Anticipated Cost	US$	64,102.36
Incurred prior to June 1994		30,417.82

(See annex 2 for detailed estimated cost and schedule)

2. Purchase and set-up testing facilities in order to verify the performance, reliability and durability of the refrigeration system. These will be done in the factory premise with additional monitoring at actual homes (Practical usage).

a) **Trial Testing Equipment**

For each new CFC-free models, Melcom must make testing sample refrigerators to determine the correct sizing of refrigeration system. (Compressor; Condenser; Evaporator and Capillary tube). This is the initial testing requirement.

The above equipment is be use to make the NON-CFC refrigerator sample and will be continue use for future model development follow by mass production.

Detail :-	Qty
1) Halogen Leak Detector	1 set
2) Leak Standard	1 set
3) Vacuum Pump	1 set
4) Freon Gas R-134a	1 cylinder
5) Dryer	20 pcs
6) Seal Valve (PCV-630-2P)	20 pcs
7) Seal Valve (SGP-400-2F)	20 pcs

* Purchased : April 1993 Total Cost US$ 19,660.77

b) **Testing Room**

Currently Melcom has 2 testing rooms that can accommodate a maximum of 25 Units of refrigerator. However for this project, during the peak time of testing, 96 sets of refrigerator need to be tested. Additional testing room capacity is needed because of the magnitude of the change to CFC-free refrigerators. As noted above, Melcom currently produces 13 refrigerator models. Past practice had been to introduce a new model every one or two years. The testing rooms were in more or less continuous use during this period but were adequate because only one or at most two models were being intensively tested at a time.

In making the switch to CFC-free models, Melcom plans to convert seven models by the end of 1995. We need to develop a minimum of 7 models in order to meet the market demand on the various range of refrigerator. In actual case, our marketing section requested the same range of model by 1995 with 134a system, however due to our capability and cost constraint we can develop only 7 models by 1995. This requires additional test room capacity. The alternative of converting one model at a time so that the testing room constraint is not reached will take too long. At the same time the present testing room could only be controlled at 32 C and 43 C, which are the standard test method. The new testing room will be able to be controlled at 15 C and 60 C as required by the new testing methods for reliability and durability.

The newly developed NON-CFC refrigerators must be tested continuously for a minimum of 2 years for durability test.

Inview of the high cost involved in the extension of the existing main building inorder to accommodate the new testing room. On completion of the development of Non-CFC models with these testing room, it will be continuously utilise for the conversion of HCFC 141b blowing agent to cyclopentane system by early 1997.

Note :- The total cost of the testing room US$ 433,070.87 is included of the construction of building (extended from main building)
Present building not enough space to make the testing room.

Melcom been a responsible enterprise proposed 50% of these cost to be fund by Melcom amounted to US 216,535.44.

Detail :-		Price
New Testing Room	Qty/unit	US$ 216,535.44
* Completion : November 1993		==========

c) **Temperature Recorder** (At testing room)
Consistent with the additional of test room capacity and the need to test more sets simultaneously, Melcom must purchase additional temperature recorders. The numbers of recording points per set of refrigerator during testing is 6 points, which means during the peak period, 96 sets of refrigerator will require 594 testing points. Currently Melcom has 4 recorders with the total capacity of 102 recording points. We will purchase 15 recorders with a total capacity of 450 recording points. With this plan we will have a total capacity of 552 recording points. We will maximize the use of these temperature recorders.

These recorders will be used in the random sampling and monitoring of refrigerator durability performance.

Detail :-	Qty	Price
Hybrid recorder	15 Units	US$ 80,626.18
(30 Channel)		==========
* Purchased : April 1993		

d) **Temperature Recorder** (for monitoring at home user - actual usage monitoring)
For the above test, Melcom will select 120 customers for monitoring at various location in Malaysia. Only 34 out of total customers will be selected where each customer will have a recorder, monitoring the performance of the refrigerator. This recorder has only 2 recording point capability as the minimum testing requirement. The above test is to check the reliability and durability of the refrigerator in actual consumer settings.

This procedure will be the standard cycle used in the development of future NON-CFC refrigerator.

Detail : -	Qty	Price
Hybrid recorder (2 Channel)	34 units	US$ 63,124.88
* Purchased : April 1993		

e) SURGE PROOF (Lightning Test)
Surge Proof is the testing done to ensure the newly developed refrigerator can withstand the high surge current and voltage (2.0 kA @ 20 μsec. & 4.4 kV @ 50 μsec). The newly developed refrigerator is susceptible to moisture; because the oil in the compressor has a very high moisture absorption rate. This in turn can result in current leakage.

Since the compressor motor is in the same casing as the compressor, the chances of current leakage is higher compared to the present type of compressor. In order to ensure the safety of the newly develop refrigerator, high current and high voltage tests must be carried out.
This equipment will be used to ensure product reliability and durability by random sampling.
This surge proof test will be conducted using Marco Japan testing facilities at no cost to Melcom.

f) VIBRATION TEST
Vibration test is carried out to ensure the endurance of the finished product at very severe vibration condition.

This testing will examine the fittings or the absorption capability of the product and it's components (eg: to test the mounting of the newly developed compressor to the refrigerator.)

This equipment will be used to ensure product reliability and durability by random sampling.

The vibration test anticipated earlier will be replaced by actual transportation test so costs of vibration tester are omitted.

g) Scope camera & Accessories
The Scope Camera is use for monitoring the level of the compressor oil in the compressor. Oil return to the compressor depends on the design of the refrigeration piping system; as such this test will determine that a good refrigeration piping system has been designed.

This equipment will be used to ensure product durability and reliability by random sampling.

Detail : -	Qty	Price
Scope & Camera	1 set	US$ 9,448.82
* Purchased : December 1993		

h) **Humidity Detector (On dry air quality for production use)**
This equipment is used for monitoring our dry air quality in our compress air that used for blowing all the NON-CFC copper part before assemble to the refrigerator.

(Part Blowing Process)
This process is to assure all the piping in the NON-CFC Refrigerator free from moisture & dust.

Detail :-	Qty	Price
Moisture Detector	1 set	US$ 5,100.02

i) **Moisture & Dust Equipment**

To analyse the oil and gas for any form of impurities and contamination. Due to the susceptibility to moisture and the possibility of dirt contamination during handling, we need to analyse the oil periodically using a random sampling method to ensure the purity of the oil.
This sampling test will be carried out even after the introduction of NON-CFC refrigerators.

We had purchased Karl Fisher moisture titrator MKC-210 with measurable range of 10 g to 100 mg H_2O of moisture content in test sample with detecting sensitivity of 1.0 g H_2O. Our present moisture titrator MKA-210 with measuring range of 1.0 - 1,000 mg H_2O which is not suitable for checking R134a refrigerator components.

Detail :-	Qty	Price
Moisture and Dust Equipment.	1 set	US$ 28,005.51

*** Purchased : Jun 1994**

J) **Thermocoupler wire (10,000 meters)**
The thermocoupler wire is for the construction of new testing room and the connection to the temperature recorders.

	Price
* Purchased : April 1993	US$ 52,533.05

k) **Halogen Leak Detector**
This equipment is to detect of freon gas leak after charging the gas to the system.(R-143a) to ensure the refrigerator system do not have any leakage. These equipment will be used for 100 % quality inspection by Q.C inspector.

	Price
Halogen leak Detector	US$ 30,708.67

*** Purchased : Jun 1994**

l) Air Leak Tester in production line.
This air leak tester is use to ensure all the copper tube welding point are perfect condition before the vacuum & gas charging process can be continue.

Present moment we use water tank to check the leakage of the brazing point. Since water is the enemy of NON-CFC refrigerator, checking leaking with water cannot be used for 134a system.

	Price
Air leak Tester	US$ 26,811.02
¥ Purchased : July 1994	==========

3. Testing of CFC-free models : As part of its technical agreement, MEI will test in Japan trial refrigerators produced by Melcom. Melcom is responsible for the cost of producing the refrigerators and for freight charges but pays no cost for the testing. As detailed below and in Annex 2, Melcom is requesting reimbursement for these costs only.

a) Refrigeration system testing (Using HFC-134a) in order to verify the above system many testing sample are required

Testing of CFC-Free models.

MODEL	TRIAL TEST	PILOT TEST	MONITOR	TOTAL QTY	TOTAL PRICE
1) NR-A13CM (366.93)	3 SETS	11 SETS (Cmpt on July 94)	50 SETS	64 SETS	23,483.52
2) NR-A16CM (395.28)	3 SETS	11 SETS	-	14 SETS	5,533.92
3) NR-A19CM (478.74)	3 SETS	11 SETS	-	14 SETS	6,702.36
4) NR-B20CDM (511.42)	3 SETS	11 SETS	-	14 SETS	7,159.88
5) NR-B25CFM (706.70)	3 SETS	11 SETS	-	14 SETS	9,893.80
6) NR-B33CFM (711.42)	3 SETS	11 SETS	-	14 SETS	9,959.88
7) NR-B43BFM (870.08)	3 SETS	11 SETS	-	14 SETS	12,181.12
TOTAL					74,914.48

Total Cost US$ 75,000.00
==========

b) POLYURETHANE FOAMING USING HCFC-141b

Melcom decide to use HCFC 141b first before change to cyclopentane inorder to phase out the ODS at earlier stage. To change to the foaming agent HCFC-141b, the material of parts that are in contact with the Polyurethane foam have to be changed so that they are compatible.

Examples of such parts are, Inner Liner (Inner refrigerator body) and cap-door sash. Currently other material are being studied, such as the wire cords.

Based on extensive preliminary study at Melcom and at its components suppliers minimum modifications are required to the foaming line. Only minor modification is needed to the foam injection equipment as this equipment is new. However a pre-heating oven for the Polyurethane foaming process is required (See 4.e below).

What is also required in this project is extensive testing and verification of the production of the polyurethane foam using HCFC-141b . The manufacturing variables will need to be watched out during this testing stage. Melcom's refrigerator are different in size and shape from refrigerator made by MEI. As such testing is required on every models. Materials and parts are required in order to carry out the testing. Local conditions such as temperature, humidity, and different production equipment affect the result and must be studied.

Total Cost	US$	77,468.30

POLYURETHANE FOAM USING CYCLOPENTANE

With regards to the safety factor in the usage of cyclopentane system for polyurethane foam, Melcom will follow the MEI policy on the application of polyurethane for refrigerator.
Initially Melcom will be using HCFC 141b polyurethane foam tentatively by March 1995 onward for mass production.
Melcom will introduce cyclopentane system upon receiving the technological knowhow and experience from MEI by early 1997.

By beginning of 1995 a second project proposal will be submitted on the cyclopentane system. The demand for protection whole areas of plant from explosion cannot be realistically be enforced in industrial practice in most cases. This often mean that existing production areas (chemical mixing room, metering machines, conveyor system and urethane jigs) would have to be modified or even totally replaced at enormous capital expenditure.

In 1996, related machineries and facilities will be installed for this system. In early 1997, expected to start production with cyclopentane system for polyurethane foam.

c) ELIMINATE THE USE OF 1,1,1 TRICHLOROETHANE

The 1,1,1 TCA was used as a cleaning solvent for our refrigerator parts (condensor oil, plate water evaporator).

These items after cleaning were coated with blue paint and black paint by an auto dipping process. They were then dried in an oven. These process was done through the conveyor system. This equipment was fabricated in 1983. With the elimination of 1,1,1 TCA tank the whole structure was totally dismantled and a smaller oven was fabricated for the purpose of drying.

Evaporator Coil

Melcom had decided that since Marcot (Matsushita Thailand) is being identified as the base for manufacturing of evaporator coil in this region, Melcom will stop its evaporator coil line. However Melcom is required to conduct the suitability study and testing to match to the evaporator coils made by Marcot. Costs involved are the refrigerator sample to be made.

Total Cost	US$	19,861.20

Evaporator Coil Oven

Upon receiving the Marcot evaporator coil, we carry out the various joints pipes brazing and leak inspection in water tank, follow by drying process in the oven. After that the layer of lacquer paint is apply to the brazing area. It is than dried in the oven at a temperature of 160 C for 30 minutes.

Details:-
Evaporator Coil Oven

	Price
* Purchased : January 1994	US$ 12,141.73

Plate Water Evaporator

This is a pressed metal part with steel tubing attached to it. This is part of the condenser use as a mean to vapourise the defrosted water collected in the collector pan. This part requires black painting process before which cleaning using 1,1,1 TCA is necessary. Melcom had decided to shift the production of this item to outside supplier. The supplier will be using degreasing pre-treatment process (parco cleaner & zinc phosphating) followed by black paint dipping process.
Melcom had dismantle the 1,1,1 TCA and black paint dipping tank, thereby omitting the usage of 1,1,1 TCA. It was completed on 16 November 1993

Dismantled the 1,1,1 TCA and black dipping tank	US$	4,940.94

* Completion : November 1993

4) Production facilities

These are the actual machines or equipment that will be used in the mass production of CFC-free refrigerators.

a) Gas Charging Machine

This machine is used in the production line for the charging of refrigerant gas into the refrigerator's system.

Present machine cannot be used for the new refrigerant because the latter is already contaminated with R-12 that is impossible to be purged out completely (the new refrigerant is R-134a).

The new machine will be used for pilot production of NR-A13 model by end July 1994, subsequently follow up with monitoring and limited production.

The introduction of R134a refrigerator will be carry out in stages beginning from mid 1995 until completion in end 1995. Due to the above reason mix production of R12 and R134a refrigerator will be carry out as from mid 1995, which mean both machines will still be required for production

This machine will be used 100% on the production line during the mass production.
Note : Total cost of Gas charging machine is US127,255.46 Melcom been a responsible enterprise proposed cost to be reduced to US$85,000.00

Detail :-	Qty	Price
Gas Charging Machine	1 set	US$ 85,000.00
* Purchased : June 1994		==========

b) Vacuum Pump

To create a vacuum condition before refrigerant is charged into the refrigeration system.

Present vacuum pumps are already contaminated with R-12 and mineral oil which cannot be purged totally from the system, so we must purchase new sets of vacuum pumps in order to carry out the vacuuming process.

This is an unavoidable purchase whereby the usage of these pumps will be 100% during mass production.

Detail :-	Qty	Price
Vacuum pumps	35 units	US$ 93,742.81
		==========

Note :- Base on the Master Plan schedule (ANNEX 1) there will be an overlapping period (1995) when both CFC and NON-CFC models will be produced. Our study had showed that no change to our production conveyor system is required. Currently we use a mixed production system and the same will be applied during this overlapping period. Only our production planning and control has to be strengthened.

c) Seal valve & socket
It serves as a "coupling" from the joint between the refrigerator pipes and the vacuum pump. Currently the total number of these parts used in the production is 350 Units.

These present couplings are already contaminated with R-12, so we need to replace them with new ones.

The new couplers will be used fully during mass production.

Detail :-	Qty	Price
Seal valve & Sockets	350 pcs	US$ 14,960.63

d) Assembly Process Room (To omit)
This room is to house the assembly process of compressor to the refrigeration piping and to keep dryers and joint pipes. Moistures is identified as the main source of problems with HFC-134a refrigeration systems. In the Melcom-Bangi Plant, humidity is found to reach to a maximum of 95%. The room will have controlled humidity features and operate at all times during production days.

e) Oven For Door And Cabinet
(Urethane Line)
To increase the temperature of the Refrigerator Doors and the Cabinets to 40 C.

The present R-11 has a boiling temperature of 23 C but the new R-141b boiling temperature is 32 C. Realizing this condition we need to pre-heat the Doors and Cabinets to a temperature of at least 40 C prior to Urethane charging in order to get a good reaction time and avoid the possibilities of defectives.

Detail :-	Qty	Price
Oven for Door And Cabinet	1 Each	US$ 6,104.34

f) Ventilation system for Urethane Foam Chemical Mixing Room.
To install ventilation system in the chemical mixing room. This is due to the high flammability of HCFC 141b. HCFC 141b vapour is heavier than air and tends to stay in low places. Therefore these places will be adequately ventilated to prevent excessive exposure or build-up of vapour.

Detail :-	Qty	Price
Ventilation system for Urethane Foam Mixing Room	1 Each	US$ 10,409.45

g) **Dryer and Accumulator storage container in production line.**
To ensure the refrigerator components are free from moisture and dust, the refrigerator dryer and suction accumulator need to be store in a special design container with pipe in compress dry air. These container will be placed in the production line during the refrigerator system assembly for 134a

Details :-

Dryer and Accumulator Container	US$ 2,350.40
	==========

Phase 2

1) Mass Production
The incremental operating cost will be calculated after the mass production begins in 1995.
The estimation incremental cost as below:-

Model	EST. PROD. QTY (6 MTHS)	INCREMENTAL COST PER SET	PROPOSED INC CLAIM / SET	TOTAL
NR-A13CM	24,444	34.93	12.00	293,328.00
NR-A16CM	21,120	32.67	12.00	253,440.00
NR-A19CM	1,920	35.97	12.00	23,040.00
NR-B20CDM	10,800	50.87	14.00	151,200.00
NR-B25CFM	4,500	36.60	12.00	54,000.00
NR-B33BFM	2,400	43.33	14.00	33,600.00
NR-B43BFM	2,100	49.13	14.00	29,400.00
TOTAL				838,008.00

Total production incremental cost for 6 months	US 838,008.00
	==========

Our estimated incremental cost per set is much higher, however been a responsible enterprise our final propose claim will be in in the region of US$12.00 to US$14.00 per set.

2) Next Development of new NON-CFC Refrigerator.
Cost on this subject is not included in this proposal.

JUSTIFICATION FOR SELECTION OF ALTERNATIVE TECHNOLOGY AND EQUIPMENT INVESTMENT

Present ODS - CFC 12

Alternative - HFC 134a

Justification - HFC 134a has no ODP and is the alternative refrigerant of choice of refrigerator manufacturers worldwide, including Matsushita. Its use is recognized and approved by the UNEP Technical Committee on Refrigeration and Air Conditioning and the World Bank's OORG.

Present - CFC 11
- Cyclopentane (To be submitted as a second project proposal)

Alternative - HCFC 141b

Justification - HCFC 141b is an interim alternative to CFC 11 blown PU foams. It has lower ODP than CFC 11 and can be used by Melcom with relatively minor equipment modifications and testing.

HCFC 141b is also the substitute chosen by Matsushita in Japan. A eventual transition to other alternatives such as cyclopentane, will be required but Melcom believes that to convert its facilities now would be premature, particularly since little cost will be incurred in adopting HCFC 141b technology as an interim measure.

Present ODS -1,1,1 TCA

Alternative - water soluble oil

Justification - The conversion to a water soluble oil by Melcom's parts suppliers will eliminate the need to use chlorinated solvents for cleaning metal parts at Melcom. There will be minimal environmental effects of converting to a water soluble oil as the wash effluent will be sent to treatment facilities inspected by Department of Environment.

PROJECT COST

Total Project Cost

The total project cost is

Phase 1	US$ 1,055,841.21
Phase 2	US$ 838,008.00
Total project Cost	US$ 1,893,849.21

This is the accumulation of Phase 1 and Phase 2 cost.

INVESTMENT COST

Total investment cost

The total investment cost is US$ 1,055,841.21

This is the accumulation of Phase 1

OPERATING COST

Not Determined
(No request is made here for operating costs.)

UNIT ABATEMENT COST (UAC)

Not Determined

PROPOSED OTF GRANT

The propose OTF GRANT is US$ 1,276,417.44 and was calculated as follows :-
The incremental investment cost were added to the incremental operating costs to give the total project costs. A 15% contingency was added to the total project costs based on only those cost not yet incurred. This figure was multiplied by 3% to account for the local financial intermediary fees. The resulting total was multiplied by the percentage of Malaysian ownership (56.9% to give the grant amount.

FINANCIAL AND ECONOMIC ANALYSIS

Economic internal rate of return (ERR)
To be completed by DOE or the World Bank

Financial internal rate of return (FRR)
To be completed by DOE or the World Bank

FINANCIAL STATUS OF ENTERPRISE

To be completed by DOE or the World Bank

FINANCIAL PLAN

To be completed by DOE or the World Bank

PROJECT IMPLEMENTATION

Management

The Malaysian DOE will oversee the successful implementation of this project.

Schedule

Refer to ANNEX 1

Procurement

To be completed by DOE or the World Bank

Disbursements

To be completed by DOE or the World Bank

Audits

To be completed by DOE or the World Bank

REQUIRED REGULATORY ACTIONS

No regulatory actions, other than routine permitting, are required to implement this project.

Results

Direct Project Impacts

The project will eliminate 18.0 Tonnes of CFC-12, 80.6 Tonnes of CFC-11 and 11.3 Tonnes of 1,1,1 TCA each year based on 1992 production.

Indirect Project Impacts

Technology transfer from MEI to Melcom, thereby increasing the technical capabilities of Melcom staff.

ENTERPRISE COMMITMENT

DOE has confirmed with executives of Melcom that the enterprise is committed to undertaking the project described above that funds are approved and available as scheduled.

Oct 20, 1994
Dr. Mike Jeffs

MALAYSIA - MELCOM

NOTE

An earlier version of this project was reviewed on 28/8/94.

TECHNOLOGY

The foam technology changes proposed are in two steps. The first step is to replace CFC 11 by HCFC 141b. This is a proven technology and is operated in Japan by Melcom's parent company Matsushita.

This will be operated for two years from 1995 to 1997 and then a change will be made to cyclopentane. This is in line with Matsushita's own strategy. Cyclopentane-based technology is also now well proven.

The main questions relate to the cost effectiveness of the intermediate stage and on the degree of redundancy of measures proposed in this stage.

ENVIRONMENTAL ISSUES

The enterprise clearly recognises that HCFC 141b is an intermediate technology because of its residual ODP. The final technology choice, cyclopentane, has zero ODP and, hence, constitutes a long term solution. The slightly flammable nature of cyclopentane is taken into account by the request for improved ventilation equipment.

PROJECT COSTS

There should be further breakdown of the items in 3(b).

Analysis of the foam elements alone, without costs shared with the refrigeration system changes for training and transport; indicate a UAC of about 0.18 $/kg/yr. This is apparently very cost effective and replaces 80.6 te of CFC 11 by a HCFC of considerably lower ODP.

It is noted that no request is made for operating costs - which could have been significant taking into account possible costs associated with plastic liners. The degree of redundancy of equipment when the cyclopentane-based technology is installed should be measured - however, this may not be significant relative to the cost of conversion to cyclopentane.

IMPLEMENTATION TIMEFRAME

This is in Annex 1 and was not included for review.

RECOMMENDATION

Approved subject to the comments above under "project costs" and the implementation timeframe being satisfactory.

GMFJ/kd/20/10/94

Malaysia

REVIEW OF A HFC-134a CONVERSION PROJECT

Manufacture of HFC-134a Appliances at Matsushita Bangi MELCOM Plant

Modified Project Proposal by The World Bank, September 1994

RTU-UNWB-LK-94496 -lk

Scope

The project under review covers the conversion from CFC-12 to HFC-134a in circuits of refrigerators and the conversion from CFC-11 to HCFC-141b (cyclopentane). Only the HFC-134a part is reviewed here.

Technology

The HFC-134a technology selected is environmentally sound and safe. It is the most cost effective option that can be used at present.

The 134a technology is implemented in two phases, according to guidelines from the World Bank's OORG. There is a technology transfer or licensing agreement in the conversion from CFC-12 to HFC-134a from Matsushita; costs for this transfer are incorporated in the project via training and testing costs. In principle, the proposal has a very sound character where it concerns reliability, i.e. testing of a large number of models for reliability in the factory and, at a later stage, at customers.

Environmental impact

The refrigerant proposed has a no ODP. Health and safety impacts are minimized.

Project costs

All cost components are to a certain degree essential for the conversion. Where, in earlier Melcom proposals, the equipment proposed would lead to a questionable increase of existing capacity, the number of equipment proposed in this proposal now seems acceptable (however, probably not necessary).

This September 1994 proposal does contain a good description of the training required; it is questionable whether this high amount of training would be necessary, however, it can be seen as a form of technology transfer for which no extra fee is imposed.

The testing room financial requirements are huge, however, this is also related to the fact that the testing room space has to be adapted. If it is stated, as in accompanying correspondence, that it concerns testing of redesigned models that are not produced elsewhere which would have a spin off to other operations in South East Asia, costs claimed could be acceptable. This also applies to extra costs for the temperature recorders and the thermocouple wire (USD 130,000,-). Costs for other, additional components are reasonable; it is acceptable that the costs for surge and vibration testing are taken out (compared to earlier).

The number of models tested is large; it would certainly be acceptable for reliability if the number would be reduced. It is not clear in how far the testing in Japan takes away the need for additional testing at Melcom (via the extra installed testing rooms). Taking into account that Melcom only requests financing for one of the rooms installed, it emphasises that the company is of the opinion that a large number of additional tests are necessary.

In summary, it must be stated that this proposal is impressive given the attention given to the reliability testing of refrigerators; it is not certain whether the HFC-134a conversion would need such an emphasis on reliability testing, given the amount of general experience available at the Matsushita company.

Costs for the gas charging machine as claimed are acceptable. Costs for vacuum pumps are high; in how far this is an early replacement of vacuum pumps or in how far a certain amount of the costs claimed would also apply to the normal replacement of equipment is not clear. It is proposed to accept the costs for the vacuum pumps at this stage, if there is no residual value in the existing pumps and it concerns an early replacement.

Operating costs
Incremental operating costs are mentioned to be 30-50 USD; this is in contrast with the incremental costs claimed in other proposals which are often substantially lower. However, the fact that a lower amount is claimed (which is in the range of other proposals) seems acceptable.
In a final claim for operational costs, a breakdown into the different components would be desirable.

Implementation timeframe
The implementation timeframe seems reasonable.

Recommendations
The HFC-134a conversion itself, as proposed in the project proposal dated 19 September 1994, is recommended.

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