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

Twelfth Meeting
Montreal, 28-30 March 1994

1994 UNDP WORK PROGRAMME

This document includes:

a) Comments and Recommendations from the Fund Secretariat;

b) 1994 UNDP Work Programme.

COMMENTS AND RECOMMENDATIONS FROM THE FUND SECRETARIAT ON 1994 UNDP WORK PROGRAMME

COMMENTS

1. The UNDP is requesting approval from the Executive Committee for its Work Programme for the 1994 calendar year.

2. The activities in the Work Programme submitted for funding were discussed at the inter-agency planning meeting convened by the Fund Secretariat on 7 January 1994, and their costs agreed to following necessary clarifications and additional information provided by UNDP representatives as necessary. Where necessary and feasible the Secretariat also liaised with governments concerned for further clarification. The proposed projects are summarized in the Consolidated 1994 Work Programmes (UNEP/OzL.Pro/ExCom/12/12).

3. The Work Programme includes:

Request for approval (at 12th Meeting)	
Projects under US $500,000	6,703,500
Projects over US $500,000	8,485,173
Project Support Costs (13 per cent)	1,974,527
1994 Project Pipeline	44,700,000

4. The amount of US $7,574,955 (including project support costs of US $871,455) is being requested as funding for projects under US $500,000 to undertake activities in 13 countries. These activities include project preparation, survey, technical assistance and investment as indicated in paragraph 5 below.

ACTIVITIES SUBMITTED FOR FUNDING REQUEST

5. The activities for which funds are being requested and amounts recommended by the Secretariat for approval are indicated in the Table below.

BUDGET OF 12TH EXECUTIVE COMMITTEE MEETING

Country/Company Name/Project Description	Amount Requested (US $)	Amount Recommended (US $)
I. Work Programme		
UNDP		
BRAZIL 1) Conversion to CFC-free technology in the manufacture of rigid polyurethane foam (spray)	370,000	370,000
CHINA 2) Survey of production and consumption of methyl bromide in China	87,000	87,000
3) Acquisition of local air compressors for halon recycling machines	155,000	155,000
4) Cleaning applications deployment centre for replication of ODS-free processes across China	489,400	489,400
COLOMBIA 5) Project preparation assistance	100,000	100,000
EGYPT 6) Technical assistance to prepare a National Halons Action Plan and project development	25,000	25,000
GHANA 7) Umbrella project for continuation of CFC-free technology in the manufacture of flexible polyurethane foam	345,000	345,000
INDIA 8) Phase-out of the use of CFCs in the manufacture of rigid PUF for thermoware **Eagle Flask Industries Ltd.**	365,000	273,000

Country/Company Name/Project Description	Amount Requested (US $)	Amount Recommended (US $)
9) Phase-out of the use of CFCs in the manufacture of extruded polyethylene foam sheet **Camphor & Allied's Products Ltd.**	280,000	280,000
10) Phase-out of the use of CFCs in the manufacture of rigid PUF panels **Sunpra Ltd.**	444,000	312,530
11) Project preparation assistance	100,000	100,000
MALAYSIA 12) Elimination of the use of 111-TCA in the metal cleaning process **Kein Hing Industry Sdn Bhd**	306,000	306,000
13) Elimination of the use of CFC-113 in the integrated circuit (IC) lead frame cleaning process **San Matech Sdn Bhd**	141,100	141,100
14) Elimination of CFCs in the manufacture of the polyurethane insulated panel **Cycle World Sdn Bhd**	353,000	353,000
15) Elimination of CFC-11 in the manufacture of integral skin, spoiler and moulded flexible foam **P.U. Tech Sdn Bhd**	198,000	198,000
16) Elimination of CFC-11 in the manufacture of flexible polyurethane foam (slabstock) **Pexafoam Sdn Bhd**	195,000	195,000
17) Elimination of CFC-12 in the manufacture of extruded polystyrene and polyethylene foam sheet **Pulai Lami Pak Sdn Bhd**	355,000	355,000
18) Elimination of CFCs in the manufacture of integral skin polyurethane foam **P.U. Mate Sdn Bhd**	113,000	113,000
19) Elimination of CFC-11 in the manufacture of flexible polyurethane foam (slabstock) **N.Y.L. Sdn Bhd**	130,000	130,000

Country/Company Name/Project Description	Amount Requested (US $)	Amount Recommended (US $)
20) Safety and technical programme to aid manufacturers of aerosol products	235,700	235,700
21) Project preparation assistance	100,000	100,000
MAURITIUS 22) Aerosol conversion project **Compagnie manufacturière de produits cosmetiques Ltée (COMANU)**	124,300	124,300
23) Project preparation assistance	25,000	25,000
PHILIPPINES 24) Phase-out of the use of CFCs in the manufacture of rigid PUF for thermoware **Nikon Industrial Corporation**	315,000	315,000
THAILAND 25) Elimination of CFC-12 and CFC-114 **MIC-CELL Co. Ltd.**	339,500	339,500
26) Elimination of the use of CFCs in the manufacture of laminated rigid polyurethane foam insulation panels **Henger M.F.R. Co., Ltd.**	257,500	257,500
27) Elimination of the use of CFCs in the manufacture of extruded polystyrene foam sheet in Thailand	455,000	455,000
URUGUAY 28) Technical assistance to the Conservation and Demonstration Programme for Domestic and Commercial Refrigeration, and installation of equipment for recovery/recycling of CFC-12	175,000	175,000
VENEZUELA 29) Pilot programme in recovery and recycling of CFC-12 in mobile airconditioning[1]	(13,400)	(13,400)
VIETNAM 30) Project preparation assistance	100,000	100,000

Country/Company Name/Project Description	Amount Requested (US $)	Amount Recommended (US $)
GLOBAL 31) Safety pre-assessment and post-assessment of foam and solvent sector projects implemented by UNDP	25,000	25,000
PROJECT TOTAL	6,703,500	6,480,030
PROJECT SUPPORT COSTS (13%)	871,455	842,404
TOTAL	7,574,955	7,322,434

NOTES:

1. This project constitutes a request for transfer of funds from another project previously approved.

General Comments

6. Following the joint reviews at the Planning Meeting of the preliminary 1994 UNDP Work Programme, and subsequent discussions with UNDP Consultants, any possible overlaps with or duplication of activities of other implementing agencies or ongoing activities would have been avoided. The types of activities and funding levels appropriate for their implementation have been discussed and agreed.

7. The total amount of US $7,322,434 including project support costs of US $842,404 was agreed for 31 activities in 13 countries and 1 global project.

Specific Comments on Activities Listed in Table 1

8. The following relate to activities listed in Table 1:

Project No. 2: China: Survey of production and consumption of methyl bromide in China (US $87,000)

1. The objective of this project is to investigate the production, producers, applications, consumption of methyl bromide to aid in the development of a programme for controlling this substance in China.

2. The project had been submitted for approval to the 9th Executive Committee Meeting, but was not approved at that time. However, the Fifth Meeting of the Parties has authorized the Executive Committee to provide funding for a limited number of methyl bromide projects for data collection and information exchange within the scope of country programmes.

3. An amount of US $87,000 is recommended for approval.

Project No. 3: China: Acquisition of local air compressors for halon recycling machines (US $155,000)

1. This project is a part of US bilateral assistance project: Halon 1211 recovery/recharge machines and training. USEPA requested UNDP to fund the local procurement of the 127 air compressors since local procurement is cheaper than importing from the outside.

2. An amount of US $155,000 is recommended for approval.

Project No. 4: China: Cleaning applications deployment centre for replication of ODS-free processes across China (US $489,400)

1. The objective of this project is to establish a centre to speed up replication of the chosen cleaning process options in the solvent sector. The centre will be established at the Research Institute No. 46 of the Ministry of Electronics Industry, which is currently engaged in the quality control and testing operations.

2. About 3,500 tonnes of ODS will be phased out with completion of replication in 800 firms by 1996. This project is a part of the strategy of the Government of China in the solvent sector. The investment costs of US $226,200 will be borne by the Government of China.

3. Capital costs requested from the Multilateral Fund are US $489,400.

4. An amount of US $489,400 is recommended for approval.

Project No. 8: India: Phase-out of the use of CFCs in the manufacture of rigid PUF for thermoware. Eagle Flask Industries Ltd. (US $365,000)

1. The objective of this project is to phase out 20 tonnes of CFC-11 in the manufacture of thermoware though conversion to HCFC-22 based technology. The HCFC-22 blowing agent will be provided by local raw material-making factories.

2. Capital costs related to equipment modification are US $225,000.

3. Operating costs are calculated at US $154,000 for four years using a 10 per cent discount rate. These calculations are based on an assumption of 10 per cent increase in company production annually,due to projected market growth.

4. The technology selected is mature and immediately available for transfer with a minimum trial period required. Therefore, incremental operating costs for the project should be applied for a two-year period only.

5. The average price of HCFC-22 in the region is US $3.50 per kg including freight charges. This price should be applied in calculating the operating incremental costs.

6. Operating incremental costs cannot be calculated on the basis of projected growth demand because of significant uncertainty in this approach.

7. The operating incremental costs will be US $48,000 calculated for the two year transitional period at a constant level of CFC-11 consumption, applying the HCFC-22 price of US $3.50.

8. The cost effectiveness of the project is US $13.6 per kg ODP phase out.

9. An amount of US $273,000 representing the total incremental costs is recommended for approval.

Project No. 10: India: Phase-out of the use of CFCs in the manufacture of rigid PUF panels. Sunpra Ltd. (US $444,000)

1. Under this project, the company will phase-out 20 tonnes of CFC-11 annually through conversion to a water/HCFC-22 blown system in the manufacturing of foam insulating panels. The project will require replacement of the existing low pressure foam unit, acquisition of one blending unit and modification to the existing equipment.

2. Costs for technology transfer at US$ 20,000 and costs for validation testing of new formulation are requested. It is envisaged that new technology and foam formulation will be provided by the local branch of a well-established company from an industrialized country. However, the Indian government submitted separate projects for funding engineering development and testing of similar foam formulations at locally based polyol production companies. As a result of the project, new formulation will be made available in the Indian market. Approval of funding for technology transfer and testing for Sunpra Ltd. and projects for three Indian polyol production companies will constitute double counting.

3. Operating costs have been calculated for a four-year transitional period with a 10 per cent growth rate and a price for HCFC-22 of US $4.20/kg.

4. It is recommended to approve funding of US $260,000 to cover capital costs.

5. It is recommended to approve funding of US $52,530 to cover operating costs calculated for two years of the transitional period at a constant level of CFC-11 consumption, applying the HCFC-22 price of US $3.50/kg (similar to the calculation scheme applied for the Eagle Flasks Industry Ltd. project).

6. The request for technology transfer and testing of new formulations is not recommended for approval.

7. The cost effectiveness of the project is US $15.6 per kg ODP phase out.

8. An amount of US $312,530 covering incremental capital costs and incremental operating costs is recommended for approval.

Solvent Projects

Project No. 12: Malaysia: Elimination of the use of 111-TCA in the metal cleaning process. Kein Hing Industry Sdn Bhd. (US $306,000)

Project No. 13: Malaysia: Elimination of the use of CFC-113 in the integrated circuit (IC) lead frame cleaning process. San Matech Sdn Bhd. (US $141,100)

1. These two projects will eliminate 11 metric tonnes of methyl chloroform/year and 5 metric tonnes of CFC-113/year.

2. The project at Kein Hing will use an aqueous process to remove metal stamping oils.

3. The project at San Matech will use a hydrocarbon-based process to clean integrated circuit lead frames.

4. Incremental capital costs of Kein Hing costing US $292,000 cover aqueous cleaning system, water treatment/filtration system and training, and the costs of San Matech costing US $142,200 cover hydrocarbon cleaning system, ventilation improvement and safety training.

5. The incremental recurrent costs/savings of both companies are relatively small, because savings are offset by the high energy costs at Kein Hing and the high hydrocarbon cleaning agent costs at San Matech.

6. The cost-effectiveness of the two projects are US $27.8 per kg. ODS phase-out and US $28.2 per kg. ODS phase-out, respectively.

7. The waste from the aqueous cleaning process at Kein Hing will be treated in conformance with the government regulations. The waste from the hydrocarbon-based cleaning process at San Matech will be collected and sent out for incineration.

8. It is recommended that the amounts of US $306,000 for Kein Hing Industry Sdn Bhd. and US $141,100 for San Matech Sdn Bhd. be approved.

Polyurethane Foam Projects (replacing HCFCs)

Project No. 14: Malaysia: Elimination of CFCs in the manufacture of the polyurethane insulated panel. Cycle World Sdn Bhd. (US $353,000)

Project No. 26: Thailand: Elimination of the use of CFCs in the manufacture of laminated rigid polyurethane foam insulation panels. Henger M.F.R. Co., Ltd. (US $257,500)

1. Under these projects, the companies will eliminate the use of 45 tonnes of CFC-11 at Cycle World and 15 tonnes of CFC-11 at Henger in its production process through conversion to CFC reduced foam blowing technology combined with replacement of the residual CFC by HCFC-141b.

2. Incremental capital costs of US $233,000 at Cycle World and US $210,000 at Henger cover the trials and the replacement of equipment that will be capable of employing emerging ODS free technology as they mature.

3. Incremental recurrent costs of US $120,000 and US $47,500 reflect the increase for the new formulations which will be partially offset by lower losses of blowing agent in the preparation of blends.

4. The cost-effectiveness of the project is US $7.8 per kg. ODP and US $17.1 per kg. ODP, respectively.

5. It is recommended that the requested amounts of US $353,000 for Cycle World Sdn. Bhd. and US $257,500 for Henger M.F.R. Co., Ltd. be approved.

Project No. 24: Philippines: Phase-out of the use of CFCs in the manufacture of rigid PUF for thermoware. Nikon Industrial Corporation. (US $315,000)

1. Under this project, the company will convert from CFC-11 to carbon dioxide and HCFC-141b. Two existing low pressure foaming units will be replaced by high pressure systems.

2. The project will result in the phase-out of 15 tonnes of CFC-11 annually.

3. Capital costs of US $230,000 include 2 high pressure foam dispensing units since the company is operating two thermoware production lines. The incremental recurring costs of US $85,000 are calculated based on the higher material cost from formulation changes.

4. The cost-effectiveness of the project based on annual elimination of CFC-11 is US $21 per kg. ODP phased out.

5. An amount of US $315,000 is recommended for approval.

Project No. 15: Malaysia: Elimination of CFC-11 in the manufacture of integral skin, spoiler and moulded flexible foam. P.U. Tech Sdn Bhd. (US $198,000)

Project No. 18: Malaysia: Elimination of CFCs in the manufacture of integral skin polyurethane foam. P.U. Mate Sdn Bhd. (US $113,000)

1. P.U. Tech Sdn. Bhd. produces spoiler (rigid foam), moulded flexible foam, and integral skin foam. P.U. Tech will eliminate the use of CFC-11 (24 metric tonnes) by converting to a combination of reduced CFC technology combined with replacement of the residual CFCs by HCFC-141b. P.U. Mate produces integral skin foam and will substitute CFC-11 (10 metric tonnes) with HCFC-22.

2. Both companies realize that the use of HCFCs constitutes an interim solution. However, the existing high pressure equipment is able to employ emerging ODS-free technologies as they mature.

3. Incremental capital costs of US $120,000 and US $105,000 cover pre-mix station, trials and training. Incremental recurring costs of US $78,00 and US $8,000 reflect the increase for the new formulations and the high costs of HCFC-141b and HCFC-22.

4. The cost-effectiveness of the project is US $8.3 per kg. ODP for PU Tech, and US $11.3 per kg. ODP for P.U. Mate.

5. The Secretariat recommends final approval in the amount requested, i.e. US $198,000 for P.U. Tech Sdn.Bhd. and US $113,000 for P.U. Mate Sdn.Bhd.

Project No. 1: Brazil: Conversion to CFC-free technology in the manufacture of rigid polyurethane foam (spray) (US $370,000)

1. This project covers three companies involved in the phase out of 72 tonnes of CFC-11 or 70 per cent of ODS consumption in the polyurethane spray foam industry in Brazil. The chosen ODS replacement procedure will be that reduced CFC foams will be used from the onset, with the remaining CFC being gradually replaced through conversion to fully water-blown foams.

2. Locally developed and produced feedstock systems and equipment will be utilized in the implementation of this project.

3. Capital costs include high pressure dispensing units and technology transfer costs. No incremental recurrent costs are requested.

4. The cost-effectiveness of the project is US $5.1 per kg. ODS phase-out.

5. An amount of US $370,000 is recommended for approval.

Polyurethane Foam Projects (replacing methylene chloride)

Project No. 16: Malaysia: Elimination of CFC-11 in the manufacture of flexible polyurethane foam (slabstock). Pexafoam Sdn Bhd. (US $195,000)

Project No. 19: Malaysia: Elimination of CFC-11 in the manufacture of flexible polyurethane foam (slabstock). N.Y.L. Sdn Bhd. (US $130,000)

1. Under these projects, the companies will phase out the use of 120 tonnes of CFC-11 at Pexafoam and 55 tonnes of CFC-11 at N.Y.L. through conversion to methylene chloride.

2. Capital costs of US $195,000 at Pexafoam and US $130,000 at N.Y.L. involve procurement of production and safety related equipment, trials and training. No operational costs were requested.

3. The cost-effectiveness of the project based on the elimination of CFC-11 is US $1.4 per kg. ODP and US $2.4 per Kg. ODP, respectively.

4. The amounts of US $195,000 for Pexafoam Sdn. Bhd. and US $130,000 for N.Y.L. Sdn. Bhd. are recommended for approval.

Project No. 7: Ghana: Umbrella project for continuation of CFC-free technology in the manufacture of flexible polyurethane foam (US $345,000)

1. This project covers four companies in Ghana which, as a result of strong encouragement from the Government over the past three years, have achieved total phase out of CFCs (since the end of 1993).

2. A total of 316 tonnes of CFC-11 have been phased out through conversion to methylene chloride. While methylene chloride costs less than CFC-11, this saving is offset by the higher costs of catalysis and polyol, operating costs of the forced cooling apparatus, maintenance, and higher rate of unusable products as a result of the conversion. The project proposal is directed at the procurement of safety related equipment and training needed following the phase out.

3. The cost-effectiveness of the project based on the elimination of CFC-11 is US $1.1 per kg. ODP.

4. The amount of US $345,000 is recommended for approval.

Polyolefine Foam Projects (replacing hydrocarbons)

Project No. 9: India: Phase-out of the use of CFCs in the manufacture of extruded polyethylene foam sheet. Camphor & Allied's Products Ltd. (US $280,000)

1. Under this project, the company will phase-out the current use of about 120 tonnes of CFC-12 annually through conversion to technology based on the isobutane blowing agent. Isobutane is a flammable material. Safety related modifications in the production environment, including some construction work, additional equipment and safety training, will be covered by capital costs.

2. Operational costs have been calculated taking into account savings related to the lower price of isobutane and the higher cost of maintenance, energy, safety monitoring and insurance.

3. The company requests retroactive reimbursement of project costs for an amount of US $280,000.

4. The cost effectiveness of the project is US $2.33 per kg ODP phase out. This compares with other similar projects approved earlier.

5. The requested funding of US $280,000 is recommended for approval.

Project No. 17: Malaysia: Elimination of CFC-12 in the manufacture of extruded polystyrene and polyethylene foam sheet. Pulai Lami Pak Sdn Bhd. (US $355,000)

Project No. 25: Thailand: Elimination of CFC-12 and CFC-114. MIC-CELL Co. Ltd. (US $339,500)

6. These two projects will phase out 50 tonnes of CFC-12 annually at Pulai Lami Pak and 44 tonnes of CFC-12/114 annually at MIC-CELL through conversion to butane and alcohol as a blowing agent. Butane and alcohol are flammable materials. Safety related modifications in the production environment including additional equipment, safety training and technology transfer will be covered by capital costs of US $410,000 and US $365,500 respectively at Pulai Lami Pak and MIC-CELL.

7. Operational costs have been calculated taking into account savings related to lower price of butane and higher costs in maintenance, ongoing safety monitoring and training and insurance. These are US $55,000 and US $26,000 in savings, respectively.

8. The cost-effectiveness of the project based on annual elimination of CFCs is US $7.1 per kg. ODP phased out at Pulai and US $7.7 per kg. at MIC-CELL.

9. Funding levels of US $355,000 and US $339,500 respectively are recommended for approval for Pulai Lami Pak Industries and MIC-CELL Co. Ltd.

Project No. 27: Thailand: Elimination of the use of CFCs in the manufacture of extruded polystyrene foam sheet in Thailand (US $455,000)

1. The objective of this project is to phase out the use of 60 tonnes of CFC-12 at Food Box Co. Ltd. and 30 tonnes of CFC-12 at Thai Polyseal Materials Co. Ltd. through conversion to butane-based technology and establish safe production conditions.

2. Capital costs related to the equipment modifications, including safety-related measures, are US $610,000.

3. Operating savings are calculated at US $155,000 for four years, using 10 per cent discount rate.

4. The cost-effectiveness of the project based on annual elimination of CFCs is US $5.1 per kg. ODP phased out at Food Box Co. Ltd.

5. The Secretariat recommends final approval in the amount requested, i.e. US $455,000.

Aerosol Projects

Project No. 20: Malaysia: Safety and technical programme to aid manufacturers of aerosol products (US $235,700)

1. This project is intended to provide a safety and technical assistance programme that includes plant safety audits, a training programme, safety equipment, and information awareness.

2. The project is identical to one which was approved at the 11th Meeting of the Executive Committee (Safety and technical programme to assist manufacturers of hydrocarbon propelled aerosol products; Indonesia).

3. A number of companies have already converted from CFC to hydrocarbon use in the aerosols sector. However, these companies do not have adequate flammability safeguards in place to prevent a major accident. To date, there have been two major fires in plants. This project will address this remaining safety aspect of conversion to LPG based technology in the aerosols sector, and serves as a model for other aerosol-producing companies in the country.

4. The Secretariat suggests that UNDP should coordinate with the World Bank, which is an implementing agency of Indonesia projects, and UNEP, which is currently producing a manual on safe conversion to LPG in the aerosol sector. Such coordination would result in the reduction of costs for training materials and travel of international aerosol consultants.

5. The Secretariat recommends final approval for the requested funding amount, US $235,700 and recommends that the concerns of the Secretariat should be addressed during detailed planning. It further recommends that the manual under development by UNEP should be used during the execution of the projects, and further refined for possible use in other Article 5 countries.

Project No. 22: Mauritius: Aerosol conversion project. Compagnie manufacturière de produits cosmetiques Ltée (COMANU) (US $124,300)

1. This project involves the conversion from CO_2 to hydrocarbon as aerosol propellent.

2. In 1992, the company converted aerosol propellant of cosmetic products from CFC-12 to CO_2 with their own financing. However, CO_2 propellent is not accepted by the market, and the company is faced with the situation on whether to halt their present activities or convert back to CFC propellent.

3. This project was listed in the country programme which was submitted and approved at the 10th Meeting of the Executive Committee. At that time, the Secretariat commented "The project is ineligible for funding, since no controlled substances will be eliminated."

4. The project cost consists of safety equipment; explosion proof filling room and conveyor, an additional transformer, and lot safety equipment. It does not include production facilities.

5. The incremental recurrent savings are not calculated. The project document stated that since the company is a contract filler, it receives no savings in conversion from one propellent to another. Immediate savings will go the marketer, who is the owner of the brands packaged.

6. The Secretariat considers that the above-stated argument is against the Fund's mechanism, since the economic cost to the country (rather than the financial cost to the company) would be borne by the Fund (see Incremental Cost Policies and Operational Interpretation, UNEP/OzL.Pro/ExCom/10/39).

7. The Fund Secretariat recommends, on an incentive basis and to encourage other companies who are currently in a "wait and see" mode, to approve this project, provided that savings are calculated based on the current market price of CFC-12 and aerosol grade hydrocarbons and additional safety costs. These savings must be returned to the Fund through UNDP at a future meeting of the Executive Committee.

Project No. 28: Uruguay: Technical assistance to the Conservation and Demonstration Programme for Domestic and Commercial Refrigeration, and installation of equipment for recovery/recycling of CFC-12 (US $175,000)

1. This project consists of 2 components, one is for training of technicians in the refrigeration maintenance sector, and the other for the installation of 100 sets of recovery equipment and 10 for recycling.

2. The correction to 22.5 metric tonnes of CFC-12 per year will be made.

3. It is recommended that the amount of US $175,000 be approved, and further recommended that "Manual/Guidelines on Good Maintenance and Service Practices including Recovery and Recycling from Small and Medium Sized Refrigerator Systems", which is being prepared by UNEP, should be utilized when this project is implemented.

Project No. 29: Venezuela: Pilot programme in recovery and recycling of CFC-12 in mobile airconditioning (US $13,400)

1. Through US bilateral assistance, the above-mentioned programme has been developed. The programme is implemented in cooperation with UNDP's Global MAC project, through which recovery and recycling equipment units have been procured and sent to Venezuela.

2. For the following phases of the programme, the assistance of a local expert is required. The amount of US $13,400 will be used for that reason.

3. It is proposed to transfer funds from a previously approved UNDP project: "Recovery and Recycling in the Domestic Refrigeration Sector". Therefore, no additional funds are required.

4. A transfer in the amount of US $13,400 is recommended for approval.

RECOMMENDATIONS

The Secretariat recommends as follows:

1. To approve US $7,322,434 for funding of activities under the 1994 UNDP Work Programme, including project suppost cost of US $842,404. Savings from Project No. 22 for Mauritius, should be taken into account in the next UNDP Work Programme Ammendment.

2. To take note of the UNDP Calender Year 1994 Project Pipeline estimated at US $44,700,000.

EXECUTIVE COMMITTEE OF THE MULTILATERAL FUND FOR THE IMPLEMENTATION OF THE MONTREAL PROTOCOL

(Twelfth Meeting, 28-30 March 1994, Montreal)

1994 WORK PROGRAMME

OF THE

UNITED NATIONS DEVELOPMENT PROGRAMME

CONTENTS

18 February 1994

1994 UNDP WORK PROGRAMME

A. OVERVIEW

1. UNDP's speed of project implementation continues to increase. At the 11th Executive Committee Meeting (10-12 November 1993, Bangkok), it was reported that of project allocations of $18.18 million, $6.77 had been disbursed/obligated for a delivery rate of 37.2%. We are pleased to report to the 12th Executive Committee Meeting that of project allocations of $23.15 million to date, $9.57 million has been disbursed/obligated translating to a delivery rate of 41.4%. This has helped determine the scale of UNDP's 1994 Work Programme.

2. Figure 1 shows the development of UNDP's work programme over the 1991-1993 period. Approved project activities (excluding support costs) rose from $660,902 in 1991 to $8,974,212 in 1992 to $13,517,741 in 1993. Thus, during 1991-1993, UNDP received a cumulative total of $23,152,855 from the Executive Committee for direct project and programme activities (excluding support costs).

3. Figure 1 also shows that the technical assistance requests coming into UNDP have evolved significantly over the 1991-1993 period:
   - training has fallen from 65% to 1%
   - country programme preparation has fallen from 20% to 2%
   - institutional strengthening has risen from zero to 20%
   - technical assistance has risen from 6% to 14%
   - investment projects have risen from zero to 58%.

4. Based on these trends, we estimate UNDP's 1994 work programme could amount to $44.7 million (excluding support costs) disaggregated as follows:

Aerosols	$ 0.4	million
Foams	25.2	"
Refrigeration	6.6	"
Solvents	5.5	"
Halons	3.2	"
Other	3.8	"
Total	$44.7	"

5. The "Other" category includes technical assistance and training, institutional strengthening and similar activities.

6. Table 1 is the overall estimated 1994 UNDP Work Programme by country and sector. We feel we have taken a realistic estimate of our potential work programme activities, since $15.2 million in project proposals have already been submitted to the 12th Executive Committee Meeting. The programme is quite balanced in the number of countries we expect to be active in. Work programmes of over $2 million each are visualized in Brazil, China, Colombia, Egypt, India, Indonesia, Malaysia, Philippines and Thailand. The India work programme, for instance, is estimated at $7 million even though projects over that amount have already been identified and project proposals prepared. The speed of project submission will depend to a large extent on internal project approval processes. Slow approval processes could cut the UNDP work programme by one-quarter.

FIGURE 1

UNDP Project Activity
Total Budget = $23.2 Million
(As of Dec. 1993)

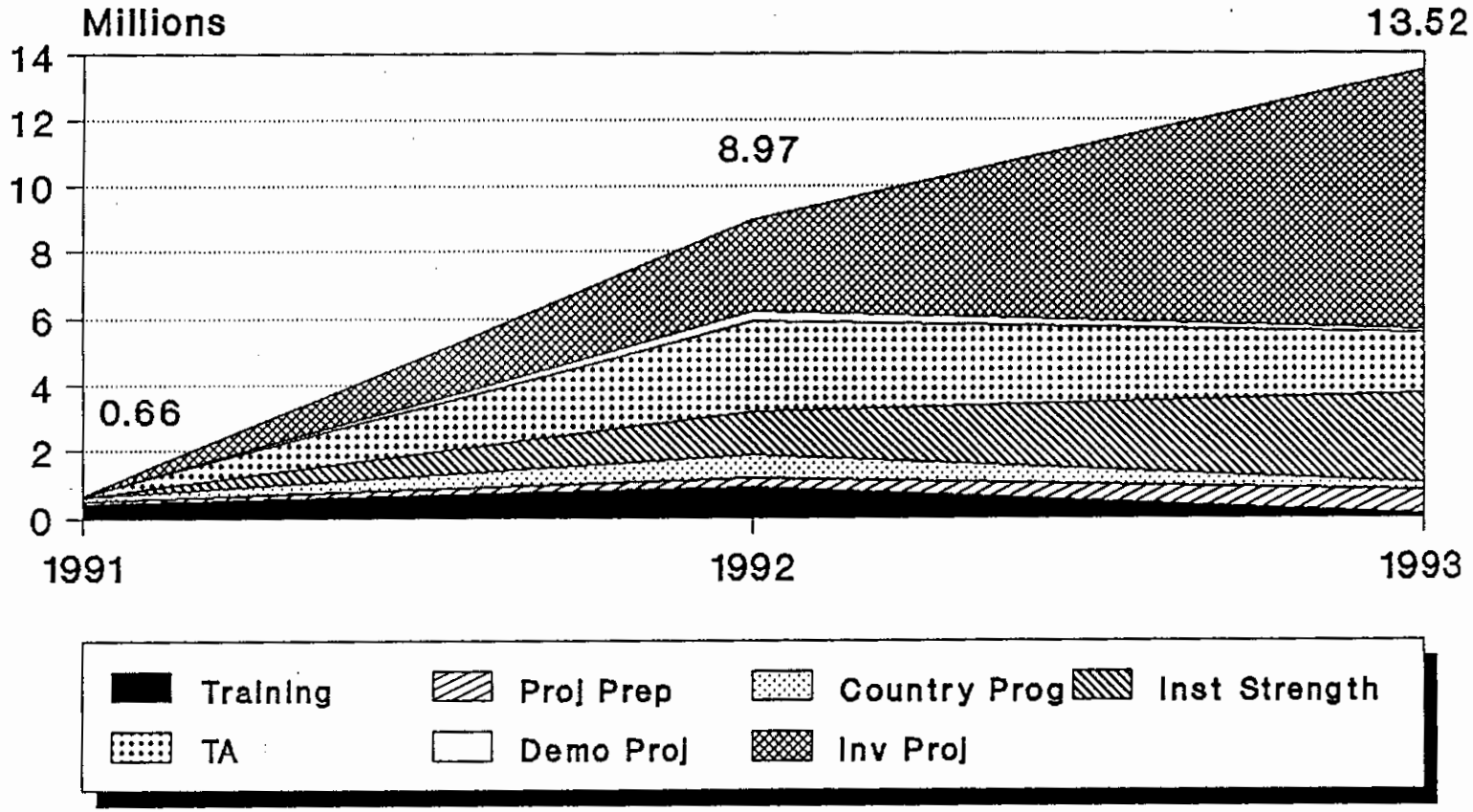

TABLE 1 : 1994 UNDP WORKPLAN UNDER THE MONTREAL PROTOCOL
(as of 11 February 1994)

(all figures in 1000 US$)

	Total	Aerosols	Foams	Refri-geration	Solvents	Halons	Others
Argentina	1,300	-	700	-	-	300	300
Bangladesh	200	-	-	-	-	-	200
Brazil	2,900	-	1,400	500	500	500	-
China	3,700	-	500	500	1,500	500	700
Colombia	4,000	-	1,000	2,700	-	-	300
Cuba	400	-	-	400	-	-	-
Egypt	3,800	-	3,400	-	-	200	200
Ghana	400	-	400	-	-	-	-
India	7,000	-	6,200	-	-	400	400
Indonesia	2,500	-	800	800	500	400	-
Iran	500	-	500	-	-	-	-
Malaysia	8,000	-	3,500	1,000	3,000	200	300
Mauritius	500	200	-	-	-	-	300
Mexico	1,400	-	500	500	-	200	200
Nigeria	200	-	-	-	-	-	200
Philippines	2,200	-	2,000	-	-	200	-
Sri Lanka	200	-	-	-	-	-	200
Thailand	4,800	200	4,300	-	-	300	-
Uruguay	200	-	-	200	-	-	-
Venezuela	400	-	-	-	-	-	400
Vietnam	100	-	-	-	-	-	100
TOTAL	44,700	400	25,200	6,600	5,500	3,200	3,800

B. 1994 UNDP WORK PROGRAMME SUBMISSION TO THE TWELFTH EXECUTIVE COMMITTEE MEETING

The following project proposals under $500,000 have been submitted for Executive Committee approval as part of the UNDP's 1994 Work Programme:

		US $
1.	BRAZIL: Conversion to CFC-free technology in the manufacture of rigid polyurethane foam (spray)	370,000
2.	CHINA: Survey of production and consumption of methyl bromide in China	87,000
3.	CHINA: Acquisition of local air compressors for halons recycling machines	155,000
4.	CHINA: Cleaning applications deployment center for replication of ODS-free process across China	489,400
5.	COLOMBIA: Project preparation assistance	100,000
6.	EGYPT: Technical assistance to prepare a national halons action plan and project development	25,000
7.	GHANA: Umbrella project for continuation of conversion to CFC-free technology in the manufacture of flexible polyurethane foam	345,000
8.	INDIA: Eagle Flasks Industries Ltd. phaseout of the use of CFCs in the manufacture of rigid polyurethane foam for thermoware	365,000
9.	INDIA: Camphor & Allied Products Ltd. phaseout of the use of CFCs in the manufacture of extruded polyethylene foam sheet	280,000
10.	INDIA: Sunpra Ltd. phaseout of the use of CFCs in the manufacture of rigid PUF panels	444,000
11.	INDIA: Project preparation assistance	100,000
12.	MALAYSIA: Elimination of the use of 1-1-1 TCA in the metal cleaning processes at Kein Hing Industry Sdn Bhd	306,000
13.	MALAYSIA: Elimination of the use of CFC-113 in the integrated circuits lead frame cleaning processes at San Matech Sdn Bhd	141,100
14.	MALAYSIA: Cycle World Sdn Bhd elimination of CFCs in the manufacture of polyurethane insulated panels	353,000
15.	MALAYSIA: Elimination of CFC-11 in the manufacture of integral skin, spoiler and moulded flexible foam at P.U. Tech Sdn Bhd	198,000

	US $
16. MALAYSIA: Pexafoam Sdb Bhd elimination of CFC-11 in the manufacture of flexible PUF (slabstock)	195,000
17. MALAYSIA: Pulai Lamipak Industries Sdn. Bhd. elimination of CFC-12 in the manufacture of extruded polyethylene foam sheet	355,000
18. MALAYSIA: PU Mate Sdn Bhd elimination of CFCs in the manufacture of integral skin polyurethane foam	113,000
19. MALAYSIA: N.Y.L. Sdn Bhd elimination of CFC-11 in the manufacture of flexible polyurethane foam (slabstock)	130,000
20. MALAYSIA: Safety and technical program to aid manufacturers of aerosol products	235,700
21. MALAYSIA: Project preparation assistance	100,000
22. MAURITIUS: COMANU aerosols conversion project	124,300
23. MAURITIUS: Project preparation assistance	25,000
24. PHILIPPINES: Nikon Industrial Corporation phaseout of the use of CFCs in the manufacture of rigid PUF for thermoware	315,000
25. THAILAND: Mic-Cell Company Ltd. elimination of CFC-12 and CFC-114 in the manufacture of extruded polyethylene foam sheet and profiles	339,500
26. THAILAND: Henger Panel Company elimination of the use of CFCs in the manufacture of laminated rigid polyurethane foam insulation panels	257,500
27. THAILAND: Elimination of the use of CFCs in the manufacture of extruded polystyrene foam sheet in Thailand (Phase I: 2 companies)	455,000
28. URUGUAY: Technical assistance for the conservation and demonstration programme for domestic and commercial refrigeration and installation of equipment for recovery/recycling of CFC-12	175,000
29. VENEZUELA: Pilot programme in recovery and recycling of CFC-12 in Mobile Air Conditioning ($13,400 transfer)	-
30. VIETNAM: Project preparation assistance	100,000
31. GLOBAL: Safety pre-assessment and post-assessment of foam and solvent sector projects implemented by UNDP	25,000
TOTAL	6,703,500

The following project proposals over $500,000 have been submitted by Governments for Executive Committee approval with UNDP as implementing agency:

		US $
1.	CHINA: ODS-free cleaning equipment manufacturing center for phasing out ODS consuming solvents across China	524,734
2.	EGYPT: Conversion to CFC-free technology in the manufacture of rigid molded and miscellaneous PUF in five enterprises	870,000
3.	EGYPT: Conversion to CFC-free technology in the manufacture of flexible PUF in two companies	525,000
4.	EGYPT: Conversion to CFC-free technology in the commercial refrigeration sector comprising five enterprises	2,100,000
5.	MALAYSIA: Elimination of the use of 1-1-1 TCA in the automobile bumper cleaning processes at Perusahaan Otomobilo National Bhd (PROTON)	700,439
6.	MALAYSIA: Phaseout of the use of CFCs in the manufacture of flexible polyurethane foam (slabstock) at small scale producers	1,045,000
7.	MALAYSIA: Elimination of CFC-11 and CFC-12 in the manufacture of home refrigerators at Sharp Roxy	962,000
8.	PHILIPPINES: Elimination of the residual use of CFCs in the manufacture of extruded polystyrene foam sheet in the Philippines (3 companies)	505,000
9.	PHILIPPINES: Technical assistance program for the elimination of CFC-use at small manufacturers of flexible foam	745,000
10.	THAILAND: Modular Compound Company elimination of the use of CFCs in the manufacture of laminated rigid PUF insulation panels	508,000
	TOTAL	8,485,173

The documentation for all the above project proposals is attached.

Institutional strengthening projects for Colombia and Sri Lanka that have been submitted directly to the Fund Secretariat for UNDP implementation have not been included in the above project listing.

Project support costs (13%) would be added to each of the approved project proposals above.

(12ECWP1)

PROJECT COVER SHEET

COUNTRY:	Brazil
PROJECT TITLE:	Conversion to CFC-free Technology in the Manufacture of Rigid Polyurethane Foam (Spray)
SECTOR COVERED:	Foamed Plastics
ODS USE IN SECTOR:	4,041t (1991)
PROJECT ECONOMIC LIFE:	10 Years
PROJECT IMPACT:	Phaseout of the use of 72 t/y CFC-11 (1992) in the manufacture of rigid polyurethane foam (spray)
PROPOSED BUDGET:	USD 370,000
COST EFFECTIVENESS:	USD 0.83/kg/y
IMPLEMENTING AGENCY:	UNDP
COORDINATING NATIONAL BODY:	Interministerial Working Group (GTO)

PROJECT SUMMARY

Under this project about 70% of the Brazilian PUF spray industry will convert to CFC-free systems utilizing locally developed and produced feedstock systems and equipment. Three insulation contractors and one system/equipment manufacturer will cooperate in this conversion project that is environmentally friendly and cost effective in investment as well as in operating costs.

It is significant to note that equipment and chemical system are locally developed and that the resin in the system is based on locally produced castor oil.

TECHNICAL ASSESMENT:

The project is reviewed and supported by Jerry S. Pool from UNDP's technical review panel. His comments are attached.

PROJECT OF THE GOVERNMENT OF BRAZIL

CONVERSION TO CFC-FREE TECHNOLOGY IN THE MANUFACTURE OF RIGID POLYURETHANE FOAM (SPRAY)

1. PROJECT OBJECTIVE

The objective of this project is (i) to phaseout the use of CFCs in the manufacture of R-PUF spray foams at selected Brazilian insulation contractors, (ii) to demonstrate the technology employed to other manufacturers and (iii) to aid these manufacturers in their efforts to phaseout the use of CFCs in rigid PUF spray.

2. SECTOR BACKGROUND

The Brazilian foam industry consumed in 1991 4,041 tons CFCs[1]. CFC-11 was the dominant substance, followed by CFC-12. During 1992 and 1993 several sub-sectors replaced substantial amounts of CFCs by non-ODP substances (flexible foam slabstock; thermoplastic foams). Figure 1 shows the breakdown of CFC-use per foam category.

CATEGORY	CFC-11	CFC-12	CFC-114
Flexible and Semi-Rigid Polyurethane Foam	1,000		
Rigid Polyurethane Foam			
Domestic Refrigeration	1,700		
Other Applications	100		
Thermoplastic Foams		1,200	41
TOTAL	**2,800**	**1,200**	**41**

Figure 1: CFC-Consumption in the Brazilian Foam Industry (t; 1991)

Brazil is currently in the process of formulating its Country Programme hat will address the strategy of the phaseout of ozone depleting substances in the country.

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[1] Source: "The Costs to Brazil of Complying with the Montreal Protocol," Brasilia, 1992.

3. BACKGROUND OF THE SPRAY FOAM INDUSTRY AND ENTERPRISES INVOLVED

The PUF-spray insulating contractors industry in Brazil consumes annually about 100t CFC-11[2]. Three manufacturers with a joint market share of about 70% dominate the market. The largest company, Therm-jet employs currently five dispersion units and three field teams. Number two, Zenimont three units and two teams and number three, Lavale, two units and one team. Profiles of the enterprises are provided in annex-A. Most companies are located in the Sao Paulo area. The industry employs generally high/medium pressure fixed ratio dispensing equipment and buys pre-blended systems. The CFC content of the A-component is about 20-25%.

4. PROJECT DESCRIPTION

It is intended to convert the following insulation contractors, representing about 70% of the sector, to CFC-free systems:

- Therm-Jet, Belo Horizonte
- Zenimont, Sao Paulo
- Lavale, Sao Paulo

The system of choice is developed by Poly-Urethane Industria Comercio LTDA ("Poly-Urethani") utilizing a castor oil based ester resin as a co-polyol. Poly-Urethani has also developed equipment that supports the new systems.

Poly-Urethani specialists will support the companies during the conversion and demonstrate subsequently the technology to smaller companies representing the remaining 30% of the market. It is intended to follow up with a residual phaseout project for this sector of he polyurethane industry.

5. TECHNOLOGY

5.1 OVERVIEW

There are currently three main directions in the development of CFC-free systems for thermoset insulation foams:

- CFC-11 > partial water/HCFC-141b > ?
- CFC-11 > partial water/ HCFC-22 and/or 142b > HFC-134a, 152a
- CFC-11 > Pentane, Cyclopentane

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[2] This does not include a relatively small and inconsistent application, the insulation of beer tanks. No reliable figures of this activity could be obtained.

In addition, compounds such as perfluoroalkanes, HCFC 123, fluorinated ethers and 2-chloropropane have been suggested, but are immature in technology, limited available or toxicologically contested.

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 HFC-356, but full water blown foam with improved cell structure remains an option.

The second one--also called the "gas" solution--utilizes a gaseous mixture of physical blowing agents, requires high pressure equipment, and sometimes extensive adjustments. The final step in this process is seen as the introduction of (gaseous) HFC's.

Cyclopentane technology is lately commercial introduced in Germany. Its flammable character requires safety conditions and limits its use.

5.2 SELECTION

Generally, the following standards of acceptance are applied to proposed replacement technologies:

- Proven, matured technology,
- Commercially available,
- Acceptable processing
- Sufficient safe,
- Environmentally acceptable,
- Economically viable.

One of the major factors pertaining the selection of an ODS replacement technology in the production of insulation foams is the "K-factor requirement. In sprayed insulation foams this requirement is less stringent than in , for instance, domestic refrigeration.

This allows a larger degree of freedom in the choice of technology and more focus on other requirements such as processability, safety, cost effectiveness and, particularly,residual ODP value.

It is in light of the above that the choice in this project is made for an all water blown system that combines environmental superiority with acceptable processing and cost effectiveness. The system is locally developed.

5.3 IMPACT ON THE PRODUCTION PROCESS

The system of choice requires high pressure foam dispensing units with variable gear ratio's to cope with higher viscosity and different (relative) quantities to be metered.

Trials and product testing will be needed under supervision of process experts from the company that provides the technology, to assure suitable product quality.

6. PROJECT COSTS

6.1 CAPITAL COSTS

The following incremental capital costs are expected, related to this project:

Therm-Jet:

o	4 medium output HP dispensing units @ 30,000 incl. freight, installation, start-up	USD 120,000
o	Trials, training, testing	USD 6,500
	Total Therm-Jet	USD 126,500

Zenimont:

o	3 medium output HP dispensing units @ 30,000 incl. freight, installation, start-up	USD 90,000
o	Trials, training, testing	USD 5,500
	Total Zenimont	USD 95,500

Lavale:

o	2 medium output HP dispensing units @ 30,000 incl. freight, installation, start-up	USD 60,000
o	Trials, training, testing	USD 4,500
	Total Lavale	USD 64,500

All Companies	USD 286,500
Technology Transfer	USD 45,000
Pre-/Post-Industrial Hygienic Auditing	USD 20,000
Contingency & Rounding	USD 18,500
Total Capital Cost	**USD 370,000**

Information on the equipment selected was provided by Poly-Urethane Industria E Comercio LDTA, Brazil (annex-B).

6.2 OPERATING COSTS

The chosen ODS replacement procedure will be that reduced CFC foams will be used from the onset. The remaining CFC will be gradually replaced through conversion to fully water-blown foams.

The provider of the fully water blown system expects to be able to maintain by enlarge the current cost level. Therefore no incremental recurrent costs or benefits are included. Cost comparisons between the different systems are shown in Annex-C.

6.3 UNIT ABATEMENT COSTS

a)	Incremental Capital Costs.....USD	370,000
b)	Project Life Time.....10	years
c)	Annual Incremental Recurrent Costs/Savings.....USD	-,-
d)	CFC Consumption .....kg	72,000
f)	Capital Recovery Factor.....0.16275	

UNIT ABATEMENT COSTS [{a(f)+ c}/d].....USD/kg/y 0,83

7. FINANCING PLAN

The companies request a grant in the amount of

USD 370,000

representing the incremental capital costs.

8 PROJECT IMPLEMENTATION

8.1 MANAGEMENT

UNDP will oversee the implementation of this project.

8.2 PROCUREMENT

It is proposed that UNDP will arrange the project procurement in close cooperation with the Brazilian Government.

8.3 SCHEDULE

TASK	TIME FOR COMPLETION					
	Q1	Q2	Q3	Q4	Q5	Q6
1. Preparation						
MLF Approval	x					
Procurement preparation	xx					
2. Installation						
Arrival		x				
Machine Installation		x				
3. Start-up,						
Machine Start-up		x				
Trials, Training		x	xx			
Certification			x			

9. REQUIRED REGULATORY ACTION

The project requires no regulatory action.

10. PROJECT IMPACT

This project will eliminate the use of at least 72 tons of CFC-11 in the first year after implementation. It will, in addition, be the base for a follow-up project for an additional 28 tons CFC-11 to be phased out. The project employs commercially developed and environmentally acceptable technology.

11 ANNEXES

Annex-A: Company profiles
Annex-B: Equipment Information
Annex-C: System Cost Information

RESOURCE POOL

Consulting In: Environmental and OSHA Compliance. Urethanes Process and Machinery Technology.

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SPRAY FOAM INSULATION
BRAZIL

SCOPE

The project is concerned with the replacement of CFC-11 in the manufacturing of rigid polyurethane foam.

RECOMMENDATION

The project is supported.

RELEVANCY AND ADEQUACY OF INFORMATION

The document provides adequate information.

TECHNICAL SOUNDNESS

It must be assumed that the Brazilian chemical and machinery supplier has developed adequate performance for the local industry. In fact, the industry is to be commended for their aggressive approach to CFC elimination. The choice is supported.

LESSON FROM EXPERIENCE

With this type program, Technology Transfer costs should probably be by "site" rather than by number of machines. However, it will not affect the cost on this one for they "average" $15,000.

ENVIRONMENTAL ISSUES

No particular issues need to be addressed.

SAFETY ISSUES

There are no particular safety issues to be addressed.

COST EFFECTIVENESS

The cost is very good for the quantity of ODP eliminated.

Jerry Pool
10/Feb/94

PROJECT OUTLINE

COUNTRY	:	CHINA
SECTOR COVERED	:	Methyl Bromide
SECTORAL ODS CONSUMPTION	:	Unknown
NATIONAL ODS CONSUMPTION	:	48,239 metric tonnes in 1991
PROJECT TITLE	:	Survey of production and consumption of Methyl Bromide in China
PROJECT DURATION	:	One year
PROJECT IMPACT	:	Collection and analysis of basic information on production and consumption of methyl bromide to facilitate planning of a future phaseout programme.
PROPOSED BUDGET	:	US$87,000
IMPLEMENTING AGENCY	:	UNDP
NATIONAL IMPLEMENTING AGENCIES	:	Ministry of Chemical Industry and Ministry of Agriculture
NATIONAL COORDINATING AGENCY	:	National Environmental Protection Agency (NEPA)

PROJECT DESCRIPTION

Detailed statistical information on the production and consumption of methyl bromide in China is not available though its use is expanding rapidly. A survey is essential to help develop a successful programme for controlling this ODS.

This project will investigate the actual production, capacity, number of producers, inventory of applications, consumers and total consumption. The action plan is as follows: A survey team will be formed consisting of experts involved in methyl bromide production and applications. This team will design and implement the survey and will provide a detailed report including proposals on alternatives to methyl bromide use. Following the survey, MCI and MOA will organize regional meetings of producers and consumers to discuss the problems in phaseout of methyl bromide. The final survey report and phaseout meeting will be jointly organized by MCI and MOA. The schedule consists of the survey during May-October 1994, meetings and workshops during November 1994-February 1995, and a final report in May 1995.

The budget of $87,000 includes the fees and internal travel expenses of the survey team/investigators ($30,000), development of the data reporting system ($12,000), costs of organizing the regional and national meetings/workshops ($35,000), communications, operational expenses and miscellaneous expenses ($10,000).

This project had originally been submitted for approval to the 9th ExCom in March 1993 but was not approved at that time. Based on the decision on methyl bromide taken at the Fifth Meeting of the Parties to the Montreal Protocol in November 1993 in Bangkok, this project proposal is resubmitted by the Government of China for approval at the 12th ExCom Meeting.

PROJECT OUTLINE

COUNTRY	:	CHINA
SECTOR COVERED	:	Halons
PROJECT TITLE	:	Acquisition of local air compressors for halons recycling machines
PROJECT DURATION	:	One year
PROJECT IMPACT	:	Local procurement of air compressors is less expensive than international procurement for equipment of the same specifications.
PROPOSED BUDGET	:	US$ 155,000
IMPLEMENTING AGENCY	:	UNDP

PROJECT DESCRIPTION

Under a halons sector project proposal being presented by the United States to the Executive Committee for approval at the 12th Executive Committee meeting, USEPA has proposed that it will procure 127 Halon-1211 recovery/recharge machines for China. The proposal also requests that UNDP fund the local procurement of the 127 air compressors for these machines from the Global Halons Project implemented by UNDP.

Funding of the local procurement of the air compressors under the Global Halons Project is not feasible for two reasons:

a) the terms of reference for the Global Halons Project are quite specific and do not really cover equipment procurement in any large way.
b) The funds under the project have been fully allocated to participating countries for other activities.

It is therefore proposed that, in conjunction with Executive Committee approval of the bilateral assistance request from the United States for their Halon-1211 recovery/recharge machines, that UNDP be given an additional allocation, completely separate from the Global Halons Project, to fund the local procurement in China of 127 air compressors for this purpose.

The estimated budget is $155,000. This comprises $152,400 as the cost of 127 compressors at $1,200 each. In addition, $2,600 has been requested to cover miscellaneous/contingency expenses.

Executive Committee approval is requested.

PROJECT COVER SHEET

COUNTRY OR REGION:	China
SECTOR COVERED:	Primary Sector: Solvents
ODS CONSUMPTION IN AFFECTED SECTORS	4311 tonnes of ODP in 1991
PROJECT TITLE:	CLEANING APPLICATIONS DEPLOYMENT CENTER FOR REPLICATION OF ODS-FREE PROCESSES ACROSS CHINA
PROJECT DURATION:	One year from funding availability
PROJECT IMPACT:	Rapid and accurate replication and placement of non-ODS technologies as they are transferred from developed countries to China.
PROPOSED BUDGET:	Total Project Expense: US $715,600 Requested funding US$ 489,400
IMPLEMENTING AGENCY:	UNDP
NATIONAL COORDINATING AGENCY:	NEPA THROUGH MEI

PROJECT SUMMARY

The China Country Programme addresses the rapidly growing solvent sector by employing a strategy of subsectoral demonstration projects, followed by replication. With an estimated 3000 lines consuming ODS in cleaning processes throughout China, there is a need to coordinate and facilitate the conversions of enterprises to the various cleaning process options. This will assure high conversion success and cost effective replication of the chosen technology alternatives. The site chosen for this task is in Tienjin City, at No. 46 Institute. Small scale cleaning process systems will be installed at the Institute so that, ,just as in developed countries, enterprises can evaluate the cleaning effectiveness of proposed technologies applied to their specific parts, to assure that their project investments will actually meet their soil removal needs and their quality requirements. The appraisal of progress for the solvent sector will also be coordinated from the institute, as well as confirming that the enterprises have completed their projects and have phased out of ODS. Additionally, the Institute will periodically run training programmes for the enterprises who are in the process of evaluating the various options for ODS elimination. In total, the combined activities resulting from this project will accelerate, coordinate, and confirm the complete phaseout of ODS from the solvents sector.

PROJECT OF THE GOVERNMENT OF CHINA

CLEANING APPLICATIONS DEPLOYMENT CENTER FOR REPLICATION OF ODS-FREE PROCESSES ACROSS CHINA

1.Project Objective

The objective of this project is to speed up the replication of demonstration lines by offering applicable and practical non-ODS cleaning processes to Chinese firms, and by offering training to those firms, as well as confirming that their projects are complete. If UNDP grant could be available on schedule, 3,518t ODS would be reduced, with completion of replication in 800 firms in 1996. The project will use technology and equipment that can serve to demonstrate successful application of ODS-free technology to the numerous and varied manufacturers in this subsector

2.Sector Data

Total ODS consumption in China in 1991 was 48,239 tonnes with an ODP (ozone-depleting potential) value of 60,352 tonnes. China has forecast that unconstrained ODS consumption would by the year 2010 result in ODS consumption of 229,318 tonnes with a ODP value of 292,714 tonnes with a resulting severe damage to the global ozone layer.

ODS consumption in the solvents sector in 1991 amounted to 4,947 tonnes with a combined ODP value of 4,311 tonnes. This combination reflects the weighted average of a 1.07 ODP value for CFC-113 (91%) and a 0.12 ODP value for methyl chloroform (9%). There are 3,200 middle and small-sized enterprises using ODS-based cleaning processes in China at present. With unconstrained consumption, ODS consumption in this sector by the year 2010 would reach 53,571 tonnes growing at over 14% per annum over the period 1991-2010. It is thus critical that ODS consumption in this sector be reduced as soon as possible. This is technologically feasible since alternative processes exist. The main issue is to determine, and then deploy, the cleaning processes, or alternative technologies, most feasible for the many different factory applications throughout China.

3. Background

3.1 Sectoral Needs and Strategy

A major, high growth area in China is the solvents sector, as described above. China has defined its strategy in its Country Programme, and is in the process of implementation of each of the elements of that strategy. Key demonstration projects in each of several major applications, or subsectors, followed by rapid deployment and replication of the demonstrated technology, is deemed necessary for successful completion of the solvents sector overall strategy. For rapid deployment and replication to be successful, i.e.,a cost effective phase out, two additional elements are deemed essential, both of which have also been described as part of the CP solvent sector strategy:

a) An equipment manufacturing line to produce cleaning equipment for the replication in an economical, expeditious manner.

b) An Applications Deployment Center (ADC) for evaluating the cleaning process options for the replication plants, where samples from the factories will be cleaned in various processes, and the appropriate process and equipment specified for those applications.

In China, with such a significant, geographically spread user base, and such a large variety of parts and industries consuming ODS for cleaning, it will be of great benefit to use a centralized applications deployment facility. This should allow replication faster, due to the ability to rapidly define process settings based on all the experience being gained, and the large, developing data base of applications -some of which could be replicated without testing, once the process has been defined the first time. It is the intent of this project to establish the Applications Deployment Center.

This element will establish a centralized means of following the normal ODS cleaning conversion steps that have been established in the developed countries. There, sample parts from enterprises are evaluated in various cleaning technologies and processes, and cleaning effectiveness is determined before a final decision is made to invest money in the selected process, cleaning agents, and equipment.

3.2 Enterprise Background

No. 46 institute of the Ministry of Electronics Industry (MEI) is the quality control and test centre for special materials used in the electronics industry. It has a strong technical staff, is already equipped with advanced instrumentation, and possesses rich testing experience as well as capacity to handle the

instrumental requirements of an applications deployment center. It is, therefore, believed to be the correct choice as the Applications Deployment Center.

The Electronic Material Testing Centre of No.46 Institute is located in the new technical development area, Tienjin City, which is within the scientific planning zone, adjacent to Nankai and Tienjin Universities. Tienjin City has ready access to air , ocean, rail and highway facilities, and has convenient use of telecommunication means.

The centre now has:

-staff	100
in which technical personnel number	45
-site ground area	26,100m2
-building area	12,054m2
-instrument inventory of	309pcs
-fixed assets	RMB 30,000,000

No. 46 Institute also has the advantage of being able to use existing environmental control facilities, designed to meet current Chinese ambient air and water effluent national standards.

4. Project Description

4.1 Project Components and Scope of Study

An existing building will be converted to include:

1)Cleaning Process Applications -To evaluate the no-ODS cleaning and recycling processes adapted to the following products in the areas of electrovacuum, semiconductor, communication and broadcasting, computer and peripherals and nonelectronics:

a Printed Circuit Boards (through-hole and SMT)
b precision parts (including electronic components and devices)
c metal parts

2)No-clean Process Applications - To service enterprises who wish to stop using cleaning agents altogether, this section will evaluate the application of a no-clean process, including the soldering process using application of low-solids fluxes, solder paste, preheat profiles necessary to prevent splatter, solder temperatures and hold times in the reflow ovens, etc

3) Cleaning Effectiveness Measurement - To measure the cleaning effectiveness of the products cleaned for the enterprises as per relevant standards and specifications covering cleanliness, cleaning rate and related physical, chemical and electrical parameters.

4) Material Analysis and Test

a physical and chemical properties of ODS substitute materials used in the cleaning process so that the enterprises have purchasing standards opposite what actually performed well in the process evaluation runs;

b composition and analysis of effluent and solid waste;

c modifying measurement methodology and specifications for products that are submitted to be cleaned.

5) Electronics Cleaning Standard and Specifications With reference to international standards, to monitor, interact internationally, and communicate the electronics cleaning standards in line with the local electronics industrial characteristics.

a soldered PCB cleaning standard (including both through-hole and SMT);

b precision parts cleaning standard (including electronics components and devices and non-metalic materials);

c precision metal parts cleaning standard.

6) Training and Replication Assistance for no-ODS cleaning processes - to fully spread the experience of the 4 demonstration lines and the no-clean replacement process in the electronics industry, and other no-ODS cleaning technology in the other solvent subsectors,

a regularly organize training courses for operators to learn no-clean process;

b make use of publications and technical seminars to promote no-ODS cleaning technology.

7) Appraisal - to determine progress in the overall phaseout plan for the subsectors

a Draw up the acceptance test procedures for ODS phaseout in the entire solvent sector;

b Verify the firms who have eliminated ODS and issue certificate.

c Maintain data and periodically report progress to NEPA.

5. Technology Discussion

5.1 Selection of Technology

To accelerate the elimination of ODS, proven technology available abroad will be in the first place for consideration. The feasibility study and selection of processes will be conducted on the basis of overseas mature technology and the specific product requirement of the enterprises. Successful substitutes should feature equal or better cleaning effectiveness, no damage to the

solvent-sensitive components, low toxicity, environmental friendliness, relatively easy process control, and low cost. In the electronics industry, most ODS is consumed to remove flux residue on soldered PCBs to ensure electric properties, protective coating adhesiveness and integrity, corrosion resistance(through removal of the corrosive residues) and appropriate visual aesthetics. The cleaning process varies with flux used. Thus the technologies to be evaluated have been chosen for their flux compatibilities. For instance, a water cleaning process is employed for water soluble flux. Saponifier, semi-aqueous, and solvent cleaning are used for rosin and solvent activated fluxes, and no-clean processes for low solid flux. Therefore, the process - including type of flux- shall be chosen based upon PCB requirements and specifications. Processes available for electronics applications will also be available for the less critical cleaning applications such as the cleaning of metal parts.

The following replacement cleaning processes are available worldwide:

a For PCB, there are DI water cleaning, saponifier cleaning, no-clean process and alternative solvents such as hydrocarbon and surfactant,
EC-7, and alcohol,etc.;

b For precision components requiring very high surface cleanliness even up to micro level, there are alcohol, mixture of HCFC and alcohol, hydrocarbon, water and biolytic solvent;

c For metal parts, there are alkaline,emulsion, low pressure steam mixture, mixture of hydrocarbon and surfactant, naphtha, mixture of naphtha and terpene and steam, etc. available to remove organics such as grease and oil, particulate and inorganic dirt.

The available solvent recycling processes to reduce solvent loss and increase reuse are as follows:

-solvent recovery and distillation on-site;

-solvent decanting and separating with filter, molecular sieve or permeation;

-activated carbon absorption of solvent vapor;

-adequate storage and supply chain control provisions to reduce solvent loss.

In the Developed countries, historically, there were over 20 ODS processes available for enterprises to consider when preparing to invest money in a cleaning process. Thus, a practice developed where various technologies and processes were evaluated and defined first before committing funds, especially in the Electronics and the precision cleaning subsectors. With the non-ODS substitutes, as mentioned above, process options have increased, and the need in Developed countries has been felt even more to evaluate specific applications prior to committing to a process path and requesting funds from within an enterprise.

5.2 Selection of Equipment and Instruments

Small-sized cleaners for applications testing will be purchased from abroad to bring about faster outcomes based on mature technology. This project will install equipment and instruments in conformity to specified cleaning and recycling requirements. The equipment will allow no-clean, aqueous, semi-aqueous, and solvent processes to be evaluated for the enterprises prior to their committing funds for purchase. To minimize cost of the project, a semi-aqueous cleaning module will be connected in parallel to an aqueous cleaning/rinsing module and a drying module. Thus, with two cleaning feeds and a common rinse/dry, various combinations can be tested with no additional cleaning equipment or rinse/dry equipment. One small solvent cleaner will also be installed. Since many of the ODS-free solvents are flammable, appropriate safety controls will be needed in the solvent equipment design. An ionic contamination tester (omega meter) will be used to measure cleaned circuit boards (PWB) in the various processes to determine level of residual contamination. An atomic absorption meter will be used to measure the heavy metal content of the aqueous waste streams from the various flux/water cleaning/PWB choices being evaluated for an enterprise. An ionic chromatograph will be used to measure organic and ionic residues not removed in the sample parts being evaluated in the different processes. Surface insulation test equipment, cables and test chamber will be purchased to allow evaluation of the no clean processes for enterprises. These evaluations are deemed essential to determine the cleanliness that can be expected for the assigned process, and also to determine the process settings needed to achieve that standard of cleanliness.

Because the predominant cleaning applications are for the electronics industry, it will be necessary to train not only the users of the processes, whose main interest is in manufacturing, and not in cleaning the parts to be manufactured, but also those who are employed at the Number 46 Institute, who will be determining the correct processes and process settings via the cleaning equipment and the cleanliness tests of the parts. The instrumentation gives results, but the results have to be interpreted as to their meaning with respect to contaminants, subsurface bleed-through, handling contamination, etc. Thus there is a training/technology transfer component included in the project which should provide for the services of various consultants who are skilled in the use of, and interpretation of, these process evaluations.

6. Project Costs

The detail of the investment cost is described in the attached annexes. The investment cost requested of the Multilateral Fund has been determined to be US $489,500 . The investment cost of the remainder of the project, to be bourne by the Government of China has been determined to be $US 334,100.

6.1 Investment Estimate Summary

a Total investment: RMB 4,418,100
100%
(including US$ 489,400 from MLF)

in which

building construction 1.31%	RMB	50,000	
machine procurement 82.34%	RMB	3,609,700	
(including US$ 388,500 from MLF)			
installation 2.56%	RMB	96,300	
(including US$9,100 from MLF)			
other engineering cost & expenses 13.79%	RMB	971,500	
(including US$ 91,900 from MLF)			

RMB 1,917,800 to be provided locally amounts to US$ 334,100.

6.2 Some Explanations

a The building construction cost will mainly refer to that for the conversion of pipeline necessary for the new equipment. The investment is estimated at RMB 50,000.
b The imported equipment will be at CIA price and be exempted from duties and taxes on added value pursuant to certain rules. But the local supported costs in RMB such as company commission, banking charges and local transport expenses and miscellaneous expenses shall be included.
c The foreign exchange rate will be 1 US$ to RMB 8.7 as issued by the State Foreign Currency Administration.
d The locally sourced equipment will be priced with reference to ex-factory price with 6% of transport and miscellaneous expenses.
e Installation cost for imported equipment will be 2.5% of CIA price while for local equipment 3.5% of the equipment cost. The installation cost will cover the cost for debugging of both imported and local equipment and instrument.

g Expenses for necessary tools and furniture procurement (if any) will be bourne by the institute itself rather than by this project.

h The charges for feasibility study and design will be as stipulated in "The Charging Criteria for Engineering Design" issued by the State Planning Commission in 1984.

This project aims at study and selecting cleaning process appropriate to specific product so as to phase out ODS in coordination with demonstration lines, which will need additional investment and will not bring any economic benefit to the institute. Thus, it's suggested that UNDP provides grant for US$ investment while the institute be responsible for the local RMB investment. To reduce ozone layer destruction is most essential and imperative. Judging from the social and environmental point of view, this project is not only feasible but also a must.

7. Financing Plan

From the Multilateral Fund:	**$489,400**
From the Chinese Government:	**$226,190**
Total Project Cost	**$715,600**

8. Environmental and Safety

Laboratory hoods will be used to control personnel exposure to toxic concentrations of solvents. Sprinkler system and dry powder extinguisher will be installed.Appropriate equipment vapor emission controls will be maintained during the process evaluation and definition studies.

While some equipment will contain recycle capability, thereby reducing waste stream emissions, the Institute has controls already installed to assure compliance with the Environmental regulations of China.

9. Project Implementation

9.1 Management

Project management will be carried out by MEI/CEEDI under the direction of NEPA.

9.2 Schedule

	YEAR	1993	1994	1995
STEP	**DESCRIPTION**			
1	Feasibility Study report preparation and approval	**xx**	**xx**	
2	Design		**x**	
3	Construction		**x**	
4	Inquiry, negotiations, & contracts for imported eqpt.& instrumentation		xx	
5	Technology transfer and training		x	
6	Acceptance tests, installation, debugging and trial runs of imported empt		x	xxx
7	Start giving training courses for replication			xxxx
8	Full startup			**x**
9	Applications testing and replication,		xx	xxxx

10. Project Impact

This project will result in the establishment of a central applications deployment unit that will be fully capable of

- evaluating the cleaning needs of enterprises who will be phasing out of ODS.
- determining the cost effective technology and process that will meet those needs
- providing the recommended process and process settings, the equipment, and cleaning agents
- if "no-clean" is an acceptable alternative for an enterprise, providing the process recommendations (flux, paste, process settings)
- training operators, managers, and engineers in the aspects associated with the new processes that have been adopted by the enterprises
- monitoring progress in the solvents sector vs scheduled ODS to be eliminated by a project, and tracking overall progress in the sector vs a complete phase out.

EQUIPMENT REQUIREMENTS

Item no.	Item	qty	MLF $ US	MLF As RMB	CHINA RMB	TOTAL RMB
1	small batch aqueous cln module	1	15000	130500		130500
2	full semi-aq cln & rinse module	1	60000	522000		522000
3	drying module	1	13000	113100		113100
4	small solvent cleaner	1	19000	165300		165300
5	surface insulation resistance meter	1	50000	435000		435000
6	ion contaminaation tester (omega m	1	27000	234900		234900
7	atomic absorption meter	1	40000	348000		348000
8	ionic chromatograph (or HPLC)	1	60000	522000		522000
9	chemical work bench	2	10000	87000		87000
10	exhaust hood	1	5000	43500		43500
11	precision balance	1	6000	52200		52200
12	precision flux applicator	1	10000	87000		87000
13	bench wave solder machine	1	18000	156600		156600
14	bench top reflow unit	1	20000	174000		174000
15	thermal profile meter (M.O.L.E.)	1	10000	87000		87000
16	scanning electronic microscope	1		0	1200000	1200000
17	IR photometer	1		0	60000	60000
	TOTAL		363000	3158100	1260000	4418100

PROJECT CALCULATIONS
(1$US = 8.7 RMB)

	MLF $ US	MLF As RMB	CHINA RMB	TOTAL RMB
1 BUILDING CONSTRUCTION				
Building and piping construction			50000	50000
				0
subtotal		0		0
				0
2 EQUIPMENT				
imported	363000	3158100		3158100
Company commission	5445	47372		47372
banking charges	1815	15791		15791
local transport	9075	78953		78953
local		0	1260000	1260000
transport		0	75600	75600
		0		0
				0
3 INSTALLATION				
imported	9075	78953		78953
local		0	44100	44100
		0		0
4 TOOLS AND FURNITURE		0		0
		0		0
		0		0
5 OTHER				
technology transfer and training	36000	313200	243800	557000
local training		0	10000	10000
FSD preparation and design	6000	52200		52200
replication tests and development		0	100000	100000
cunstruction supervision		0	10000	10000
preparation work	15000	130500		130500
Contingency	44000	382800	174350	557150
		0		0
Grand TOTAL	489410	4257867	1967850	6225717
		$US =	226190	715600

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TO: C. J. NORRIS (UNDP) DATE: 10 FEB., 1994

FROM: W. G. KENYON

SUBJECT: PROJECT TECHNICAL REVIEW

I have reviewed the Solvent Project, "Cleaning Applications Deployment Center for Replication of ODS-Free Processes Across China" prepared by MEI, CEEDI and UNDP personnel.

Technical Soundness

This project is the keystone to rapid, successful, cost effective deployment of non-ODS technology throughout China via evaluation of the various alternatives. As in the developed countries, such a facility allows rapid selection of the optimum alternative process, thus speeding the entire solvent sector conversion process. In addition, the facility can serve as a gateway to China for more advanced technology from developed countries as it becomes available. The facility can also provide and deploy expertise and training in analytical methods, cleanliness testing, waste treatment monitoring and compliance plus specifications and standards. The facility will have equipment for both aqueous and semi-aqueous cleaning plus no cleaning soldering capability. Both cleaning technologies are now in use and have generally demonstrated at least equivalent performance vs. prior ODS cleaning processes. Once China has commercial manufacture of no clean fluxes and pastes, this technology can also be deployed.

Safety

The use of semi aqueous technology employs hydrocarbon substances which have flammability or combustibility potential. Aqueous cleaning employs either acid or alkaline additives to the cleaning bath, which can enter the workplace air during operation of the process unless the equipment is adequately vented. The use of established equipment and processes assures that the appropriate safeguards (such as ventilation) are designed into the replacement technology. Thus, chemical misting will be controlled or blanketed, depending on the equipment chosen.

Environmental

The use of aqueous technology has the potential for the detergents to complex with the heavy metal components in the removed flux residues when cleaning electronic assemblies after soldering. The use of aqueous technology in non-electronic applications has the potential for the acidic or alkaline cleaning chemistries to complex with the metals being cleaned, thus introducing metallic complexes to the waste stream. It is the evaluator's understanding that aqueous filtration/waste treatment is available at the proposed #46 Institute site.

The filtration will remove any metal particulates while the water treatment will take care of dissolved contamination, including cleaning chemicals, in the water waste prior to release to the drain. Monitoring instrumentation provided in the project will detect if metals are being dissolved in the water waste so that the process settings can be adjusted for minimum environmental impact. Equipment can have built in recycle capabilities which will minimize the size of waste streams as well. Semi-aqueous solvents are hydrocarbons and thus have VOC potential. While VOCs are not regulated in developing countries, they may be a future concern.

Cost Effectiveness

The project addresses cost effectiveness, with the stipulation that the Chinese government share the cost almost equally, to accelerate the ODS phase-out. While the leverage accruing from establishing a Center of Expertise (like the proposed #46 Institute Applications Deployment Center) does not readily appear on a balance sheet, it is an effective investment to maximize the successful process conversion success rate in China while protecting the environment.

Recommendations

It is recommended that this project be approved.

República de Colombia

Departamento Nacional de Planeación

PROJECT OUTLINE

COUNTRY:	COLOMBIA
SECTORS COVERED:	Foams, mobile refrigeration, Industrial and commercial refrigeration.
NATIONAL ODS CONSUMPTION:	2588 Tonnes ODP in 1993
PROJECT IMPACT:	Identification, preparation, and finalization of industrial conversion projects in the foams, industrial and commercial refrigeration sectors.
PROPOSED BUDGET:	US$ 100,000.oo
IMPLEMENTING AGENCY:	UNDP
NATIONAL COORDINATING AGENCY:	NOPC

PROJECT DESCRIPTION

Colombia's ODS consumption in 1993 was 2588 Tonnes ODP comprising 22.9% (594 ton.ODP) used in refrigeration, 1% (26 Ton.ODP) in air conditioning, 40.8% (1057 Ton.ODP) in maintenance, 11.4% (297 Ton.ODP) in polysthyrene and polyurethane foams, 11.3% (295 Ton.ODP) in halons, 0.7% (18 Ton.ODP) in cleansing agents and 11.6% (301 Ton.ODP) in pesticides.

Colombia's Country Program for ODS phase-out was prepared during 1993 and early 1994 thanks to a general effort of the private and public sectors of the country and thanks to financial support offered by the Colombian private sector, the National Industrial Association, and UNDP. The Colombian Country Program will be presented during the 12th Executive Committee Meeting in March 1994. At present the Country Program and the Institutional Strenghtening Project have been revised by UNDP consultants and technical staff from the Secretariat of the Executive Committee, and their comments have been included.

Given that 100% of the ODS phase-out is still to undertake, a very large number of projects will have to be designed and implemented, and others that have already been drafted will have to be quickly finalyzed. This effort requires the assistance of international consultants and an important local capacity building process, in the sectors mentioned.

The funds requested will be utilized over a one year period to recruit national and international consultants and the appropriate representatives from the sectors involved and the governmental entities. It is expected that the completed projects will be submitted for approval as soon as the month of April 1994, and during the following Executive Committee Meetings.

PROJECT COVER SHEET

COUNTRY:	**EGYPT**
PROJECT TITLE:	**Technical Assistance to prepare a National Halons Action Plan and project development.**
SECTOR COVERED:	**Halons Sector**
ODS USE IN SECTOR:	**759 tonnes ODP per year (1991 figure)**
PROJECT DURATION:	**10 months**
TOTAL COST:	**$US 25,000**
IMPLEMENTING AGENCY:	**UNDP**
COORDINATING NATIONAL BODY:	**EEAA**

PROJECT DESCRIPTION:

The Phase out activities and projects for the Halons sector have only been briefly addressed in the Egypt Country Programme. Further to the initial efforts undertaken during the Regional UNDP/EEAA Halons workshop held in Cairo from 6 to 8 November 1993, EEAA has requested UNDP's assistance to initiate the development of a National Halons Action Plan to phaseout the use of halons and for identification and preparation of the projects.

As a first step, it would be necessary to establish the Action Plan. This plan should contain detailed information on the halons sector, i.e. the quantities being imported, companies producing or installing halons fire equipment, and information on the distribution and the end users. The plan should also contain the following:

A: Setting up a time schedule to stop the use of halons for non-essential uses and produce appropriate legislation in this connection. Recommend a stop to producing or installing of halons-based fire equipment and appropriate phaseout schedule for existing installations.

B: Identify Fire Equipment Companies presently using halons for production, installation and servicing and provide project preparation assistance to those companies if so required.

C: Establish specific phaseout programmes for major and critical users in order to avoid any lack of supply of fire extinguishants and to limit the cost of change over to alternative fire protection technologies.

D: Establish a national programme for halons recycling and banking and identify the national entity responsible to implement and monitor such a system.

E: Ensure transfer of alternative technology such as Nitrogen, CO2, Powder, Water and Water Mist systems, and possible future chemicals alternatives.

F: Awareness campaigns and information programmes for end users.

The information needed to establish such a National Halons Action Plan will be obtained through the cooperation and active participation of the various concerned parties in this sector.

The plan will further establish summary project proposals or outlines which may need further elaboration in follow-up missions.

It is also proposed to hold a National Workshop in close collaboration with the Civil Defense Ministry which has expressed keen interest in hosting such a workshop as a follow-up to the regional workshop held in November 1993 and which would ensure that all parties concerned are fully involved in the formulation of the National Action Plan.

PROJECT COVER SHEET

COUNTRY:	GHANA
PROJECT TITLE:	UMBRELLA PROJECT for Continuation of CFC-free Technology in the Manufacture of Flexible Polyurethane Foam
SECTOR COVERED:	Foamed Plastics
ODS USE IN SECTOR:	316 tons/year of CFC-11
PROJECT IMPACT:	Eliminate the use of 316 tons/year CFC-11 (316 t ODP; 1993)
PROJECT DURATION:	Nine Months
PROJECT ECONOMIC LIFE:	Ten Years
TOTAL PROJECT COST:	USD 345,000
PROPOSED MLF GRANT:	USD 345,000
COST EFFECTIVENESS:	USD 0.18/kg/yr
COORDINATING NATIONAL BODY:	Ghanian Environmental Protection Council (EPC)
IMPLEMENTING AGENCY:	UNDP

PROJECT SUMMARY

The flexible slabstock industry in Ghana is concentrated in the cities of Accra (4 factories) and Kumasi (1 factory). The industry has taken a very aggressive approach toward the elimination of CFC's in the manufacturing process. Within the past three years, with Government encouragement, every company has begun the conversion to a non-ODS technology, the last one in December of 1993. The conversion to methylene chloride has been the method chosen by each company, with varying degree of success.

The factories are similar in operation and machinery with the exception of one factory, (a box foamer). The problems and solutions are also similar. The major concern is inadequate ventilation in the manufacturing and curing areas. Other concerns include the metering system for the methylene chloride and a water supply for fire protection within the proposed hoods.

A second component of this project is technical assistance in the foam manufacturing process. Each of the foam factories indicated a history of processing problems related to the conversion to methylene chloride, which continue to the present.

TECHNICAL ASSESSMENT

The project is reviewed and supported by Mr. Bert Veenendaal from UNDP's technical review panel. His comments are attached.

PROJECT OF THE GOVERNMENT OF GHANA

CONTINUATION OF CONVERSION TO CFC-FREE TECHNOLOGY IN MANUFACTURING OF FLEXIBLE POLYURETHANE FOAM AT EXISTING FOAM FACTORIES

1. PROJECT OBJECTIVE

The objective of this project is to continue the elimination of CFCs in the manufacture of flexible slabstock PUF at four factories in Ghana. The project will allow these companies which started the conversion process from CFC-11 to Methylene Chloride to ensure its continued use by installing essential metering and safety/ventilation equipment.

2. SECTOR BACKGROUND

The ODS consumption in 1991 in the Ghanian foam sector, (excluding foams for domestic and commercial appliances), has been established at 100 metric tons. From 1990 to 1991, Ghana experienced a sharp decline in CFC use when one of the largest flexible slabstock manufacturers switched to methylene chloride due to awareness of the ozone issue. However, in 1992, another large manufacturer increased his consumption of CFC's heavily. (Ghana Country Program, #7). The increase of CFC usage was temporary for he also switched to the methylene chloride technology. While by the end of 1993, all the flexible slabstock manufacturers had made the change to methylene chloride, they all are experiencing processing and safety related difficulties.

The introduction of 16 kilo density PUF foam with its significantly reduced price in the Ghanian market has caused unprecedented increase in the use of flexible foam in mattresses and furniture. The information collected on methylene chloride use indicates an equivalency of 316 metric tons of CFC-11 in the flexible slabstock manufacturing for 1993. The market is not expected to continue to grow at the past rate, but will run well above the national average. A 10% per year growth would lead to an estimated CFC consumption of 421 tons by the end of 1996.

3. ENTERPRISE BACKGROUND

The Ghanian flexible slabstock industry is made up of 5 factories, of which 4 have "continuous" production machines and 1 has a "single block" machine. One of the foamers with a continuous machine presently does not produce the low density (16 Kilo) foam and has no history of CFC usage. The companies eligible for ML Fund assistance are:

Ashanti Foam of Kumasi:	**MeCl @**	**80 tons**	**(CFC equivalency:.....**	**94 tons)**
Latex Rubber of Accra:	**MeCl @**	**156 tons**	**(CFC equivalency:.....**	**184 tons)**
Nsawam Foam of Accra:	**MeCl @**	**20 tons**	**(CFC equivalency:.....**	**24 tons)**
Prestige Foam of Accra:	**MeCl @**	**12 tons**	**(CFC equivalency:.....**	**14 tons)**
TOTALS:		**268 tons**	**(CFC equivalency:.....**	**316 tons)**

The other company, United Mattress and Foam Factory has been business since 1960 and has manufactured flexible slabstock PUF since 1972. However, they have made only higher density, firm grades on one of the "continuous" lines. They have never used an ABA for softening or lowering the density. Therefore, they fall outside the ML Fund qualification.

4. PROJECT DESCRIPTION

The qualifying companies with continuous lines need exhaust fans and hoods which will require the addition of the powered take away conveyor and water lances since access to the foam will be restricted by the hood. Exhaust fans are also needed in the curing area. In some cases, Make-up Air will have to be provided.

The metering system for methylene chloride needs to be brought up to standard. They are all experiencing processing problems due to the improper metering system for methylene chloride. A transfer pump, a pressure pump with motor, and a back pressure valve will be required for each factory.

5. TECHNOLOGY

5.1 OVERVIEW

There are numerous technologies to replace the use of CFCs in flexible foams by non ODS or low ODS options. We refer to publications by UNEP and documentation available through UNDP for summaries of these technologies. Methylene chloride is one of the most cost effective technologies and is usually applied where process, industrial hygienic and regulatory conditions will permit it.

5.2 SELECTION

All of the Ghanian flexible slabstock companies have selected to phaseout CFCs in the slabstock production through replacement by methylene chloride.

5.3 REQUIRED MODIFICATIONS

In all areas where methylene chloride and isocyanate are processed, adequate vapor containment and ventilation will have to be installed to assure safe workplace conditions. Regular checkups should be performed to assure continued compliance and are to be a part of the Ghanian Factories Inspectorate program. The production lines will need additional metering systems for the use of methylene chloride.

6. PROJECT COSTS

6.1 SUMMARY OF PROJECT COSTS

The total project incremental cost of USD 345,000 is based on the incremental capital costs at the four qualifying factories. The net incremental recurrent costs are expected to be offsetting.

6.2 CAPITAL COSTS

The following costs are expected to be incurred:

#	**Upgrading of ventilation and encapsulation systems**	**USD 199,400**
#	**Additional metering equipment**	**USD 31,500**
#	**Powered Conveyor in Hoods**	**USD 14,500**
#	**Water Lines and Lances**	**USD 15,000**
#	**Production Trials, Chemical Losses**	**USD 20,000**
#	**Technology Transfer**	**USD 35,000**
#	**Contingency and rounding**	**USD 29.600**
	TOTAL INCREMENTAL CAPITAL COSTS	**USD 345,000**

6.3 OPERATING COSTS

Methylene chloride is lower priced than CFC-11, resulting in lower material costs. Offsetting that is more difficult processing, higher costs of catalysis and polyol, operating costs of the forced cooling apparatus, annual training and maintenance. These costs are difficult to calculate in advance as individual formulation changes and operating conditions tend to be site specific. However, expected annual savings on methylene chloride will ultimately exceed the extra processing and chemical costs . Therefore, no recurrent incremental costs will be considered on this project. Annex-B provides more detailed information.

6.4 UNIT ABATEMENT COSTS

a)	Incremental Capital Costs	USD	345,000
b)	Project Life Time		10 years
c)	Incremental Recurrent Costs	USD	-,-
d)	CFC Consumption	kg	316,000
	UNIT ABATEMENT COSTS [(a*b + c)/d]	USD/kg/yr	0.18

7. FINANCING PLAN

The companies request a total MLF grant of **USD 345,000**

8. PROJECT IMPLEMENTATION

8.1 MANAGEMENT

UNDP will be the implementing agency for this project and will work with the recipient of project execution under the guidance of the Government of Ghana.

8.2 PROCUREMENT

UNDP will review and supervise the procurement process, following UNDP guidelines and regulations.

8.3 SCHEDULE

TASK	TIME TO COMPLETION					
	Q1	Q2	Q3	Q4	Q5	Q6
1. Preparation						
MLF Approval	x					
Procurement preparation	x					
Vendor selection	x					
2. Installation						
Arrival, Customs		x				
Machine installation		x	x			
3. Start-Up						
Machine start-up			x			
Trials, training			xx			
Certification			x			

9. REQUIRED REGULATORY ACTION

The project does not require regulatory action.

10. PROJECT IMPACT

This project will eliminate the use of at least 316 tons of CFC-11 in the first year of implementation. The project employs commercially available and environmentally acceptable technology.

11. ANNEXES

Annex A: Detailed information on Incremental Capital Costs.
Annex B: Detailed information on Incremental Recurrent Costs.
Annex C: Technical Assessment

ANNEX A: INCREMENTAL CAPITAL COSTS

ASHANTI FOAM:

MAIN CONVEYOR HOOD	USD	10,000
TRANSITION CONVEYOR HOOD	USD	1,400
CUT-OFF-SAW HOOD	USD	20,000
TAKE AWAY CONVEYOR HOOD	USD	1,300
POWERED TAKE-AWAY CONVEYOR	USD	7,500
EXHAUST FANS ON HOODS	USD	10,000
CURING AREA EXHAUST FANS & VENTILATION CONTROL	USD	11,500
METHYLENE CHLORIDE METERING SYSTEM	USD	15,000
SAFETY: WATER LANCES	USD	5,000
TRIALS	USD	5,000
TECHNICAL TRANSFER	USD	10,000
CONTINGENCY AND ROUNDING	USD	8,300
SUB-TOTAL	USD	105,000

LATEX FOAM FOAM RUBBER PRODUCTS:

TRANSITION CONVEYOR HOOD	USD	1,500
CUT-OFF-SAW HOOD	USD	20,000
POWERED TAKE-AWAY CONVEYOR	USD	7,000
MAKE-UP AIR, FOAM MACHINE AREA	USD	6,000
EXHAUST FANS ON HOODS	USD	10,000
CURING AREA EXHAUST FANS	USD	15,000
MAKE-UP AIR, CURING AREA	USD	15,000
METHYLENE CHLORIDE METERING SYSTEM	USD	15,000
SAFETY: WATER LANCES	USD	5,000
TRIALS	USD	5,000
TECHNICAL TRANSFER	USD	10,000
CONTINGENCY AND ROUNDING	USD	10,500
SUB-TOTAL	USD	119,000

NSAWAM FOAM:

MAIN CONVEYOR HOOD	USD	10,000
TRANSITION CONVEYOR HOOD	USD	1,700
CUT-OFF-SAW HOOD	USD	20,000
EXHAUST FANS ON HOODS	USD	10,000
CURING AREA EXHAUST FANS	USD	10,000
VENTILATION CONTROL: WINDOWS & WALL	USD	16,000
METHYLENE CHLORIDE METERING SYSTEM CONTROLS	USD	1,500
SAFETY: WATER LANCES	USD	5,000
TRIALS	USD	5,000
TECHNICAL TRANSFER	USD	10,000
CONTINGENCY AND ROUNDING	USD	8,800
SUB-TOTAL	USD	98,000

PRESTIGE FOAM, (BOX FOAMER)

HOOD	USD	5,000
EXHAUST FANS ON HOOD	USD	5,000
TRIALS	USD	5,000
TECHNICAL TRANSFER	USD	5,000
CONTINGENCY AND ROUNDING	USD	2,000
SUB-TOTAL	USD	22,000

ANNEX B
RECURRENT INCREMENTAL COSTS

Some companies began the conversion from CFC-11 to methylene chloride approximately two years ago. At least one company started the conversion in December of 1993. They have been on a learning curve throughout that period. It is normal to drop about 5% in prime yield in factories where that change in ABA is instituted. The companies that started the conversion two years ago experienced approximately that degree of loss, but have regained about half. With some process training and the proposed forced cooling, they should complete the curve. The company that has started recently is experiencing more than a 5% drop in yield.

In the process 316 tons/year of CFC-11 is replaced by 269 tons/year of methylene chloride. In addition, the catalysts and polyol have to be changed, recurrent safety training, operating costs for the extra ventilation and increased maintenance will be needed. This will impact the operating costs as follows:

ITEM	BEFORE	AFTER
316 T/Y CFC-11 @ 2500	USD 790,000	
269 T/Y Methylene Chloride @ 1500	-,-	USD 403,500
1 T/Y Extra Amine Catalyst @ 7500	-,-	USD 7,500
2 T/Y Extra Tin Catalyst @ 5600	-,-	USD 11,200
Annual electricity for forced ventilation	-,-	USD 7,500
Training, Maintenance		USD 20,000
TOTAL	USD 790,000	USD 449,700

INCURRED COSTS FROM PRIOR CONVERSION EFFORTS:

First year yield:
Incremental Gain = USD 340,300
Loss = 5% x 4500 T/Y @ 2500 = - 562,500
- 221,900 x 1.0000 = USD -221,900

Second year yield:
Incremental Gain = USD 340,300
Loss = 4% x 4500 T/Y @ 2500 = - 450,000
- 109,700 x 0.9090 = USD - 99,717

Third year yield:
Incremental Gain = USD 340,300
Loss = 2% x 4500 T/Y @ 2500 = - 225,000
+ 115,300 x 0.8260 = USD + 95,238

Fourth year yield:
Incremental Gain = USD 340,300
Loss = 1% x 4500 T/Y @ 2500 = - 112,500
+ 227,800 x 0.7513 = USD +171,146

NET FOUR YEAR TOTAL.....USD - 55,233

On balance, a slight increase in incremental recurrent cost appears to exist. Over the customary four years period for incremental cost calculations, the operational savings are growing from year to year, while costs remain constant. From the fifth year savings will significantly exceed accumulated losses, and it is therefore deemed fair not to apply for incremental recurrent costs under this project.

TECHNICAL ASSESSMENT

PROJECT TITLE:	UMBRELLA PROJECT for Conversion to CFC-free Technology in the Manufacture of Flexible Polyurethane foam
CATEGORY:	Foamed Plastics; Flexible PUF Slabstock
RECOMMENDATION:	The project is supported
INFORMATION:	Adequate
TECHNOLOGY:	Methylene Chloride is an acceptable choice. The deficiencies of the technology are adequately addressed
REFERENCES:	MLF projects in China, Egypt, Indonesia and Malaysia use the same or comparable technology
ENVIRONMENTAL:	Methylene chloride is currently not restricted in Ghana, but is in some other countries. Regulatory situation to be monitored.
SAFETY:	Issues on workplace safety and fire risks are adequately addressed. Pre and post industrial hygienic survey critical
COST EFFECTIVENESS:	Exceptionally good for this category (0.50-1.50)
OTHER ISSUES:	From verbal communication it was learned that some companies were not that interested in the program. A technical, "hands-on" workshop as part of the project may be beneficial
REVIEWER:	Bert Veenendaal
DATE:	February 10, 1994

PROJECT COVER SHEET

COUNTRY:	**India**
PROJECT TITLE:	**EAGLE FLASKS INDUSTRIES LTD. phase out of the use of CFCs in the manufacture of rigid PUF for thermoware**
SECTOR COVERED:	**Foamed Plastics**
ODS USE IN SECTOR:	**1,577 tons CFCs (=ODP) in 1991**
PROJECT IMPACT:	**Phaseout of 20t CFC-11 per year (base 1993)**
PROJECT DURATION:	**One year from approval**
PROJECT ECONOMIC LIFE:	**10 years**
TOTAL PROJECT COST:	**USD 225,000 Incremental Capital Cost USD 140,000 Incremental Recurrent Costs**
PROPOSED MLF GRANT:	**USD 365,000**
COST EFFECTIVENESS:	**USD 3.17/kg/y (unit abatement cost)**
COORDINATING NATIONAL BODY:	**Ministry of Environment and Forests (MOEF)**
IMPLEMENTING AGENCY:	**UNDP**
APPRAISAL DATE	**August 22, 1993/February 8, 1994**

PROJECT SUMMARY

Under this project Eagle flasks Industries Ltd. will phaseout the use of CFCs in the manufacture of thermoware. HCFC-22 is selected as replacement of choice, based on economic considerations as well as availability from local sources. To achieve the phaseout of CFCs, replacement of the low pressure foaming equipment will be required. The company will induce recurrent incremental costs related to higher material prices. HCFCs constitute an interim solution, but the choice of equipment will allow a subsequent move to HFCs.

TECHNICAL REVIEW

The project is reviewed and supported by Dr. Mike Jeffs fron UNDP's Technical Review Panel. His comments (attached) are addressed.

PROJECT OF THE GOVERNMENT OF INDIA

EAGLE FLASK INDUSTRIES ELIMINATION OF CFC-11 IN THE MANUFACTURE OF RIGID PU FOAMS FOR THERMOWARE

1. PROJECT OBJECTIVE

The objective of this project is (i) to phaseout the use of CFCs in the production of rigid PUF for the insulation of thermoware at Eagle Flask Industries and (ii) to function as a "beacon" project in the Indian CFC phaseout program, allowing Indian system manufacturers to apply newly developed CFC free polyol systems and so to gain the necessary experience for subsequent general phaseout.

2. SECTOR BACKGROUND

The Indian foam industry consumed in 1991 1577 tons CFCs (ref.; India Country Programme). CFC-11 was the dominant substance, followed by CFC-12. More detailed information is provided in Table-1:

Table-1
ODS Consumption in Foams (1991; metric tons)

Category		CFC-11	CFC-12	CFC-113
Polyurethane Foams (PUF)				
Flexible PUF		160		
Rigid PUF		975		
Refrigerator Insulation	500			
General Insulation	250			
Thermoware	225			
Integral Skin, RIM and Misc.		62		
Phenolic Foams		15		15
Thermoplastic Foams		70	280	
Total		**1,282**	**280**	**15**

The sector experiences impressive growth, based on:

- The current low polyurethane use per capita;
- The current and expected growth in GNP;
- The substitution of the use of mineral fibers by rigid PUF in the insulation of refrigerators.

Unconstrained demand would lead to an expected ODS use of about ten times the current consumption in 2010.

The Ministry of Environment and Forest (MOEF) is leading the efforts in the phaseout of CFCs, in close cooperation with the consuming and supplying industry.

Complete phaseout for foams other than rigid PUF is targeted for the year 2000. rigid PUF are expected to be CFC-free from the year 2006.

The sector accounts for about 230 enterprises. About 20% of these companies are large or medium CFC users and have relatively sophisticated manufacturing equipment. The remaining ones operate small scale units and are technically and chemically unsophisticated. The support of the chemical suppliers and associations will be crucial in reaching and educating this group.

3. ENTERPRISE BACKGROUND

Eagle Flasks Industries Ltd. ("EAGLE") is one of the major Indian manufacturers of household wares. The company specifically is specialized in vacuum-glass bottles, in which it is the market leader in the country. Hardly any hotel room can be found without an insulated thermos-flask from EAGLE. The company is also involved in the production of other thermoware, such as casseroles, water jugs, hot pots etc. About 40% of the production is exported. The expert share is rising and may approach 50% soon. Major target countries are the USA and Germany, where well known enterprises purchase and sell EAGLE products under their own brand names. The company operates modern facilities near Pune/Maharashtra.

4. PROJECT DESCRIPTION

EAGLE will utilize in 1993 about 20 tons CFC-11 in the manufacture of thermoware. Management of the company is committed to the phaseout of this ODS to protect export markets as well as to contribute to the Indian phaseout program which needs participants that are capable and willing to evaluate the indigenous produced CFC-free PUF systems in an industrial context.

The introduction of HCFC-22 is identified as the preferred technology to CFC phaseout at the enterprise, and the phaseout program is based on this decision. However, other compounds, such as HCFC-141b, will also be evaluated.

Low pressure foaming equipment will have to be replaced by high pressure systems. In addition, existing high pressure equipment will have to be modified to allow metering at different ratio's.

Initial formulation development will be performed by system suppliers, followed by extensive production trials. Product testing will be done during the evaluation phase by suppliers, followed by outside certification testing for the purpose of independent verification of the insulation values achieved.

Although the use of HCFC-22 constitutes the most economical replacement technology, and the only one that allows the use of indigenous compounds, incremental recurrent costs will occur.

The company is aware that the use of HCFC-22 constitutes an interim replacement technology. The new as well as the modified equipment is, however, designed to allow the implementation of emerging technologies, such as morphology optimization, use of HFCs etc, without further equipment modifications, at the time these technologies appear to be industrialized and economically feasible.

5 TECHNOLOGY

5.1 OVERVIEW

There are currently three main directions in the development of CFC-free systems for thermoset insulation foams:

- CFC-11 > partial water/HCFC-141b > ?
- CFC-11 > partial water/ HCFC-22, 142b > HFC-134a, 152a
- CFC-11 > Pentane

In addition, compounds such as perfluoroalkanes, HCFC 123, fluorinated ethers and 2-chloropropane have been suggested, but are immature in technology, limited available or toxicologically contested.

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 HFC-356, but full water blown foam with improved cell structure remains an option, specifically in "lesser demanding" systems such as water heaters, were dimensional changes--although costly-- are possible.

The second one--also called the "gas" solution--utilizes a gaseous mixture of physical blowing agents, requires high pressure equipment, and sometimes extensive adjustments. The final step in this process is seen as the introduction of (gaseous) HFC's.

Cyclopentane technology is lately commercial introduced in Germany. Its flammable character requires safety conditions and limits its use. Only two companies offer currently cyclopentane packages, including equipment (Bayer/Hennecke and BASF/Elastogran), but this may change quickly.

5.2 SELECTION

EAGLE has decided for the water/HCFC-22 solution with most likely subsequent replacement of the HCFC by a fully water blown system or HFC 134a. The main reason is an economical one: HCFC-22 is produced in India and available at much more favorable pricing than HCFC-141b. Also, the local support from raw material manufacturers is a factor in favor of the use of HCFC-22. Finally, the much more lower ODP value of HCFC-22 compared to HCFC-141b was weighed in favor of HCFC-22. In EAGLE's case, the use of cyclopentane would be cost prohibitive from a safety standpoint.

5.3 IMPACT ON PRODUCTION PROCESS

The use of HCFC-22 will increase the viscosity of the Polyol blend, which cannot be well metered by the low pressure equipment. The introduction of a gaseous blowing agent requires the need of high pressure metering, which will also allow more precise metering of high viscosity blends. In addition, the ratio between the polyol blend and isocyanate will change. Equipment with fixed gear ratio's will have to be modified to the new ratio's. The blowing agent can be pre-blended by the systems supplier or blended at site, which would require a blending system. International trend is to blend at site, to avoid losses during storage and to allow continuous adjustment of the amount and type of auxiliary blowing agent to emerging technological developments.

In India, the expected initially prevailing use of HCFC-22 as well as the high amount of small scale companies that cannot afford or even operate in house blending equipment, may lead to a different situation. In the case of thermoware, formulations are rather stable and blending equipment most likely not cost effective. The use of pre-blended material is therefore selected.

Vault-free material is essential and viscosity and reactivity changes will influence the filling patterns. The higher viscosities and different reaction times of the new systems will therefore require extensive trials, initially at the suppliers site, followed by industrial evaluation.

6. PROJECT COSTS

6.1 SUMMARY OF PROJECT COSTS

Incremental Capital Costs	USD	225,000
Incremental Recurrent Costs	USD	140,000
TOTAL PROJECT COSTS	**USD**	**365,000**

6.2 CAPITAL COSTS

The following incremental capital costs are expected, related to this project:

o 2 High pressure foaming units @ USD 90,000	USD	180,000
o Modification of existing equipment 1 conversion @ USD 15,000	USD	15,000
o Trials, testing, training	USD	10,000
o Contingency/Rounding	USD	20,000
TOTAL INCREMENTAL CAPITAL COSTS	**USD**	**225,000**

Prices on equipment are derived from information from two independent equipment suppliers. Performance testing will require about USD 5,000 per unit, based on previous experience. Trials will be partly done at supplier site at no expense and at site in combination with process and safety training.

6.3 RECURRENT INCREMENTAL COSTS

The company expects recurrent incremental costs based on higher prices for polyol and HCFC-22 as well as from formulation changes. These costs are expected to amount to USD 179,000 over the four years following implementation (1995 thru 1998). Net present value of these costs at 10% discount amounts to:

USD 140,000

Annex-A provides more detailed information.

6.4 UNIT ABATEMENT COSTS

a)	Incremental Capital Costs.....USD	225,000
b)	Project Life Time.....10 years	
c)	Incremental Recurrent Costs (1995).....USD	39,000
d)	CFC Consumption (1994).....kg	24,000
f)	Capital Recovery Factor.....0.16275	
	UNIT ABATEMENT COSTS [{a(f) + c}/d].....USD/kg/y	**3.17**

7. FINANCING PLAN

The company requests reimbursement of **USD 365,000**, representing all eligible incremental costs.

8. PROJECT IMPLEMENTATION

8.1 MANAGEMENT

UNDP will oversee the this project. This project is significant for future projects in India under the Montreal Fund as it will function as a "beacon" project. An intensive observation and supervision by an Agency experienced in similar projects seems therefore logical.

8.2 PROCUREMENT

It is proposed that UNDP's Office for Project Services (OPS) will arrange the project procurement. OPS would cooperate with the local UNDP office and with MOEF, and receive technical assistance from UNDP-ENS.

8.3 SCHEDULE

TASK	TIME FOR COMPLETION					
	Q1	Q2	Q3	Q4	Q5	Q6
1. Preparation						
MLF Approval	x					
Procurement preparation	xx					
Vendor selection	x					
2. Installation						
Arrival, Customs			x			
Machine Modifications			x	x		
3. Start-up,						
Machine Start-up				x		
Trials, Training				xx		
Certification				x		

9. REQUIRED REGULATORY ACTION

The project requires no regulatory action.

10. PROJECT IMPACT

This project will eliminate the use of at least 24 tons of CFC-11 in the first year of implementation. Market growth indicates that this may increase by 10% annually in subsequent years. The company's past performance does expect even larger growth rates. The project employs commercially and environmentally acceptable technology.

11. ANNEXES

Annex-A: Detailed calculation of recurring incremental costs
Annex-B: Technical Review

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ANNEX-A

INCREMENTAL RECURRENT COSTS, EAGLE PROJECT

The use of HCFC-22 triggers price consequences, not only related to the different auxiliary blowing agent (ABA) but also to the use of a different polyol and a different foam formulation. The changes are as follows (developed and double checked with an Indian Polyol manufacturer and an Indian manufacturer of CFCs/HCFCs):

o	Polyol	Before and after price		- USD 3.17/kg
	ABA	Before:	CFC-11 price	- USD 2.40/kg
		After:	HCFC-22 price	- USD 4.20/kg
	MDI	Before and after price		- USD 3.85/kg
o	Formulation:	Before:	Polyol	- 35 %
			CFC-11	- 19 %
			MDI	- 46 %
		After:	Polyol	- 36 %
			HCFC-22	- 13 %
			MDI	- 51 %

Consequently, the price per kilogram foam mixture increases from USD 3.34 to USD 3.65, or USD 0.31.

The Indian Country Programme forecasts a growth rate for this foam category of 12% for 1992-1996 and of 9.5% for 1996-2005. These growth rates have been applied to the calculation of the incremental recurrent costs. This amounts to the following:

	1995	1996	1997	1998	TOTAL
System use (t)	125	137	150	165	577
Price difference (x 0.31; USD)	39	42	47	51	179
Discounted (10%)	35	35	35	35	140

The Net Present Value is so with

USD 140,000

TECHNICAL REVIEW BY DR. MIKE JEFFS

EAGLE FLASKS

SCOPE

The project is concerned with the replacement of CFC 11 in the manufacture of rigid polyurethane insulating foam for thermoware.

RECOMMENDATION

The project is supported but steps - see below - should be considered to reduce project costs.

RELEVANCY AND ADEQUACY OF INFORMATION

Good but no quotations for capital purchases are included.

TECHNICAL SOUNDNESS

The use of HCFC 22 is sound. In this insulation application the use of HCFC 22-based foam, which ages comparatively rapidly in terms of thermal conductivity, should not pose a problem. The shells of the thermoware should also provide reasonable protection against ageing. The pressurised addition of HCFC 22 does not appear to be addressed in the equipment section.

LESSON FROM EXPERIENCE

None

ENVIRONMENTAL ISSUES

HCFC 22 should be replaced by a zero ODP blowing agent as soon as is practicable.

SAFETY ISSUES

None

COST EFFECTIVENESS

Unit Abatement Cost is comparatively high due to the requirement for two high pressure dispensing machines for a low foam (and CFC 11) throughput. Could this be rationalised to one machine ? There is also the new standard developing country increase in polyol price for the newer technology - which is not reproduced in any developed country. This should be monitored during the first years of operation.

OTHER

None

GMFJ/kd/15/9/93

PROJECT COVER SHEET

COUNTRY:	**India**
PROJECT TITLE:	**CAMPHOR & ALLIED PRODUCTS LTD. phase out of the use of CFCs in the manufacture of extruded polyethylene foam sheet**
SECTOR COVERED:	**Foamed Plastics**
ODS USE IN SECTOR:	**1,577 tons CFCs (=ODP) in 1991**
PROJECT IMPACT:	**Phaseout of 120t CFC-11/12 per year (base 1991)**
PROJECT DURATION:	**6 months**
PROJECT ECONOMIC LIFE:	**10 years**
TOTAL PROJECT COST:	**USD 293,000 Incremental Capital Costs USD 13,000 Incremental Recurrent Savings**
PROPOSED MLF GRANT:	**USD 280,000**
COST EFFECTIVENESS:	**USD 0.29/kg/y**
COORDINATING NATIONAL BODY:	**Ministry of Environment and Forests (MOEF)**
IMPLEMENTING AGENCY:	**UNDP**
APPRAISAL DATE	**July 18, 1993/February 8, 1994**

PROJECT SUMMARY

Camphor & Allied's Profeel-Sentinel division ("Profeel") produces extruded low density polyethylene foam sheet for packaging and insulation purposes. Under this project the use of a mixture of CFC-11 and CFC-12 as a blowing agent will be replaced by liquified petroleum gas (LPG) and Isobutane. The project is designed by and will be executed under guidance of an external process expert. It includes safety provisions to deal with the hazard properties of flammable substances such as hydrocarbons.

TECHNICAL ASSESSMENT

The project is reviewed and supported by Dr. Mike Jeffs from UNDP's Technical Review Panel. All remarks from the attached comments are addressed.

PROJECT OF THE GOVERNMENT OF INDIA

CAMPHOR & ALLIED PRODUCTS LTD.
PHASEOUT OF THE USE OF CFCs
IN
THE MANUFACTURE OF EXTRUDED POLYETHYLENE FOAM SHEET

1. PROJECT OBJECTIVE

The objective of this project is to phaseout the use of CFCs in the production of polyethylene foam sheet at Camphor & Allied's Profeel-Sentinel Division.

2. SECTOR BACKGROUND

The Indian foam industry consumed in 1991 1577 tons CFCs (ref. India Country Programme). CFC-11 was the dominant substance, followed by CFC-12. More detailed information is provided in Table-1:

Table-1
ODS Consumption in Foams (1991; metric tons)

Category		CFC-11	CFC-12	CFC-113
Polyurethane Foams (PUF)				
Flexible PUF		160		
Rigid PUF		975		
Refrigerator Insulation	500			
General Insulation	250			
Thermoware	225			
Integral Skin, RIM and Misc.		62		
Phenolic Foams		15		15
Thermoplastic Foams		70	280	
Total		**1,282**	**280**	**15**

The sector experiences impressive growth, based on:

- The current low polyurethane use per capita;
- The current and expected growth in GNP;
- The substitution of the use of mineral fibers by rigid PUF in the insulation of refrigerators.

Unconstrained demand would lead to an expected ODS use of about ten times the current consumption in 2010.

The Ministry of Environment and Forest (MOEF) is leading the efforts in the phaseout of CFCs, in close cooperation with the consuming and supplying industry.

Complete phaseout for foams other than rigid PUF is targeted for the year 2000. Rigid PUFs are expected to be CFC-free from the year 2006.

The sector accounts for about 230 enterprises. About 20% of these companies are large or medium sized and have relatively sophisticated manufacturing equipment. The remaining ones operate small scale units and are technically and chemically unsophisticated. The support of the chemical suppliers will be crucial in reaching and educating this group.

3. ENTERPRISE BACKGROUND

Profeel-Sentinel ("PROFEEL") is a division of M/s. Camphor & Allied Products Ltd. and is engaged in the manufacture of extruded polyethylene foam roll stock and planks. The division was established in 1986, in technical cooperation with Sentinel Foams, USA. Production facilities are located in a Government-developed industrial estate in Nandesari/Baroda in Gujarat-State. In the facility, EPE foam roll stock and EPE foam specialties such as poly-laminated planks, static dissipative foams, fire retardant foams are produced. Products are made in a range of colors and densities to suit specific customer needs. Main applications are in specialty packaging, cold insulation, gymnastic mats etc. Profeel is the only company with this kind of production program in India and one of the very few in developing countries.

4. PROJECT DESCRIPTION

Under this proposed project PROFEEL will phaseout the current use of about 120t/y CFC-12 through replacement by Isobutane. The company will work closely together with "Enviro-Tek" (USA), a company that is specialized in this area. The project will include the installation of storage capacity for Hydrocarbons, modification

of the extruder and safety related investments to cope with the use of an extremely flammable substance.

The company is preparing this project for some time and has essentially finalized all preparations. Implementation is crucial to regain exports, specifically to Singapore, that collapsed in 1992 after the import of products made with or/and containing CFCs was not anymore allowed. The company has already engaged in some contracts and intends to proceed immediately and swiftly with this project. It is therefore assumed that retroactive reimbursement of the costs induced will be applied.

5 TECHNOLOGY

5.1 OVERVIEW OF ALTERNATIVES

There are several options to replace CFCs in the production of EPS/EPE foam sheet, such as:

- Nitrogen,
- Carbon dioxide,
- Hydrocarbons (butane, pentane, LPG),
- "Berstorff" technology (nitrogen and alcohol),
- HCFCs (-22, -142b),
- HFCs (-134a, -152a).

A summary of these technologies, their potentials and their limitations is provided in annex-A.

5.2 SELECTION

PROFEEL has engaged an internationally recognized process expert to advise on the replacement of CFC-12. His recommendation is to use isobutane--which has to be imported. The company is, however, also considering LPG, for economic reasons. As this is not supported by the Multilateral Fund consultant, the assumption of a change to pentane is made.

5.3 IMPACT ON PRODUCTION PROCESS

The use of Hydrocarbons will require substantial changes in the production process and storage facilities.

Required equipment modifications and additions may include:

- **Storage**
  - Separate, explosion proof storage of the butane tank.

- **Feeding systems**
  - More injection systems for additives,
  - Replacement of the foamant metering pump and injection system,
  - New gaskets and seals.
  - New pressure gauges

- **Extrusion system**
  - Replacement or modification of the screw,
  - Replacement or modification of the extrusion die.

- **Electrical systems**
  - Installation of spark arresters,
  - Sealing of electrical control cabinets,
  - Explosion proof motors and switches.

- **Auxiliary safety devices**
  - A ventilation system to prevent the accumulation of hydrocarbon vapors,
  - Monitoring and alarm systems for hydrocarbon vapors,
  - Extra fire extinguishers.

Production and aging areas are to be separated from other working areas and to be sprinklered or otherwise protected against fire hazards.

Production and maintenance personnel has to be trained in the safe handling of hydrocarbons, in addition to production training.

Start-up trials will be necessary to adjust for foamant volume and permeability.

6. PROJECT COSTS

6.1 SUMMARY OF PROJECT COSTS

Incremental capital Costs	USD 293,000
Incremental Recurrent Savings (NPV @10%)	USD 13,000
TOTAL PROJECT COSTS	**USD 280,000**

6.2 CAPITAL COSTS

The costs related to equipment modifications, safety measures, start-up and trials are specified in annex-C (handwritten notes are from the UNDP consultant and concern proposed modifications that are accepted by the company). The total incremental capital costs amount to:

USD 293,000

6.3 RECURRENT COSTS

The use of Isobutane leads in this specific context to slightly lower operating costs. These costs are calculated in annex-D and amount to USD 4,000 per year (exchange rate USD = Rs 31.0). The net present value for four years, assuming a 10% discount factor amounts to:

USD 13,000

6.3 UNIT ABATEMENT COSTS

a)	Capital Costs	USD 293,000
b)	Lifetime of the investment	10 years
c)	Incremental recurrent savings/year	USD 4,000
d)	CFC-12 consumption in 1993	kg 120,000
f)	Capital Recovery Factor (10% interest)	0.16275
UNIT ABATEMENT COSTS		**USD/kg/y 0.29**

7. FINANCING PLAN

The enterprise requests retroactive reimbursement of the incremental project costs in the amount of **USD 280,000.**

8 PROJECT IMPLEMENTATION

8.1 MANAGEMENT

The project is already substantially implemented by the company. UNDP-OPS will oversee the completion of this project, UNDP-ENR will provide technical assistance.

8.2 SCHEDULE

Annex-E provides the original scheduling details pertaining to the project. It was expected to essentially complete the project before November 1993. An about 6 month delay has moved the expected completion to about June 1994.

8.3 PROCUREMENT

The company has procured the project. UNDP's Office for Project Services (OPS) will review this procurement with technical assistance from UNDP-ENS.

9. REQUIRED REGULATORY ACTION

The company has applied for and received all necessary permits (Annex-F).

10. PROJECT IMPACT

This project will eliminate the use of at least 120 tons of CFC-12 in the first year of implementation. Market and company growth indicates that this may increase by 10% annually in subsequent years. The project employs commercially and environmentally acceptable technology.

11. ANNEXES

Annex-A: Information on Camphor & Allied, Profeel-Sentinel Division
Annex-B: Overview of CFC Phaseout Technologies in the Manufacture of Polystyrene and Polyolefine Foams
Annex-C: Detailed budget proposals
Annex-D: Detailed calculation of recurrent incremental costs
Annex-E: Implementation Schedule
Annex-F: LPG storage approval under SMPV (U) Rules, 1981
Annex-G: Technical Review

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ANNEX-C
Detailed Budget Proposals

COST OF PROJECT:

Project costing		Rs. in Lakhs.	
1.	Consultants fees	12.00	
2.	Civil work on building walls, pump room, tanks foundations.	7.00	
3.	Ventilation system for extruder room, ageing room including motors	7.00	
4.	Ducting work for ventilation system	8.00	
5.	LPG bulk storage tanks, supplied		
6.	LPG pump, unloading	11.00	
7.	LPG Boaster pump		
8.	LPG Monitors	5.00	
9.	Air Ionisers	7.10	
10.	Electrical work on change over to FLP fittings	4.00	
11.	Extruder static mixer	8.00	
12.	Pneumatic handling system for resin	3.00	
13.	D.G. Set modification for quick start	0.70	
14.	D.G. Set for extruder exhaust system	0.70	
15.	Cast band heaters for extruder	1.20	
16.	Miscellaneous items.	6.00	
		---	81.60
17.	Contingencies @ 5% of direct project costs		4.40

		TOTAL	86.00
			=====

Sub-Total	USD 273,000
Training	10,000
Pre/Post Audit	10,000

Total (Exchange rate 31.0 Rs = USD)	USD 293,000

COMPHOR & ALLIED

SCOPE

The project is concerned with the replacement of CFC 12 in the production of extruded polyethylene foam sheet.

RECOMMENDATION

The project is supported.

RELEVANCY AND ADEQUACY OF INFORMATION

Generally good. Capital cost sheet should be repeated without hand-written numbers !

TECHNICAL SOUNDNESS

The chosen routes of CFC 12 replacement by LPG and isobutane are the recommended options for non-insulating foams provided that adequate safety precautions are taken - see below.

LESSON FROM EXPERIENCE

Well drawn up project.

ENVIRONMENTAL ISSUES

Zero ODP option chosen. The route will have a volatile organic compound (VOC) impact.

SAFETY ISSUES

A key issue in view of the technology chosen. The safety-related modifications and training appear to be adequately addressed. The implementing agency should monitor these during the completion of the project.

COST EFFECTIVENESS

Overall cost effectiveness is good. See cover note on Unit Abatement cost calculation.

OTHERS

None

ANNEX - D

CAMPHOR & ALLIED
RECURRENT INCREMENTAL COSTS CALCULATION

ASSUMPTIONS

- Prices: CFC-12 USD 2,400/t
  Isobutane USD 1,950/t
- Isobutane use identical to CFC-12[1]
- Required extra additives: USD 50/t of resin
- Preventive maintenance: 5% of equipment related project costs (199,000): US$ 10,000.
- 1 USD = 31 Rupies
- resin use: 480t/y

1) MATERIAL

- Before: 120t CFC-12 @ 2,400 .....USD 288,000
- Future: 120t isobutane @ 1,950 = 234,000
  additives .....24,000...USD 258,000

2) OTHER RECURRING INCREMENTAL COSTS

- Recurrent training/monitoring costs..... 10,000
- Extra maintenance & utility... 10,000
- Extra insurance ..... 6,000.....USD 26,000

3) TOTAL ANNUAL RECURRING INCREMENTAL COSTS

- Annual Savings of.....USD 4,000

4) Net Present Value of the Recurrent Incremental Costs.....USD 13,000
(4y/10% Discount) ==========

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[1] The company submitted in its feasibility study lower use of blowing agent, but a higher density. It is more cost-effective to raise the amount of blowing agent to avoid the cost penalty related to the higher density. Calculation is made with isobutane as no information is available on the ratio between LPG and isobutane. The process consultant expressed its doubths if LPG would work at all in the subject applications .

PROJECT COVER SHEET

COUNTRY:	**India**
PROJECT TITLE:	**SUNPRA Ltd phase out of the use of CFCs in the manufacture of rigid PUF panels**
SECTOR COVERED:	**Foamed Plastics**
ODS USE IN SECTOR:	**1,577 tons CFCs (=ODP) in 1991**
PROJECT IMPACT:	**Phaseout of 20 t CFC-11 per year (base 1993)**
PROJECT DURATION:	**one year**
PROJECT ECONOMIC LIFE:	**10 years**
TOTAL PROJECT COSTS:	**USD 290,000 Incremental Capital Cost USD 154,000 Incremental Recurrent Cost**
PROPOSED OTF GRANT:	**USD 444,000**
COST EFFECTIVENESS:	**USD 3.47/kg/y (unit abatement cost)**
COORDINATING NATIONAL BODY:	**Ministry of Environment and Forests (MOEF)**
IMPLEMENTING AGENCY:	**UNDP**
APPRAISAL DATE	**August 21, 1993/February 8, 1994**

PROJECT SUMMARY

Under this project, SUNPRA will phaseout the use of CFC in its production of cold storage panels through the application of reduced CFC technology, followed by the replacement of the residual CFC consumption by HCFC-22. The project will require the replacement of the existing low pressure foaming unit by a high pressure one that will include a pre-blender. Extended trials followed by testing will be performed to achieve proper processing and to assure maintenance of the existing K-values. Outside process support will be used. While being the most economic phaseout solution, the use of HCFC-22 will lead to higher operating costs. HCFC technology constitutes an interim technology, but the new equipment will allow implementation of emerging technologies at no additional capital investment.

TECHNICAL REVIEW

The project is reviewed and supported by Dr. Mike Jeffs from UNDP's Technical review Panel. His Comments (attached) are addressed.

PROJECT OF THE GOVERNMENT OF INDIA

SUNPRA ENERGY & RECOVERY ENGINEERING PVT LTD ELIMINATION OF CFC-11 IN THE MANUFACTURE OF PRE-ENGINEERED RIGID PUF PANELS.

1. PROJECT OBJECTIVE

The objective of this project is to phaseout the use of CFCs in the production of rigid PUF sandwich panels for cold storage rooms at SUNPRA.

2. SECTOR BACKGROUND

The Indian foam industry consumed in 1991 1577 tons CFCs (ref.; India Country Programme). CFC-11 was the dominant substance, followed by CFC-12. Some incidental use of CFC-113 and MCF (reported under the solvents sector) completes the consumption pattern. More detailed information is provided in Table-1:

Table-1
ODS Consumption in Foams (1991; metric tons)

Category		CFC-11	CFC-12	CFC-113
Polyurethane Foams (PUF)				
Flexible PUF		160		
Rigid PUF		975		
Refrigerator Insulation	500			
General Insulation	250			
Thermoware	225			
Integral Skin, RIM and Misc.		62		
Phenolic Foams		15		15
Thermoplastic Foams		70	280	
Total		**1,282**	**280**	**15**

The sector experiences impressive growth, based on:

- The current low polyurethane use per capita;
- The current and expected growth in GNP;
- The substitution of the use of mineral fibers by rigid PUF in the insulation of refrigerators.

Unconstrained demand would lead to an expected ODS use of about ten times the current consumption in 2010.

The Ministry of Environment and Forest (MOEF) is leading the efforts in the phaseout of CFCs, in close cooperation with the consuming and supplying industry.

Complete phaseout for foams other than rigid PUF is targeted for the year 2000. rigid PUF are expected to be CFC-free from the year 2006.

The sector accounts for about 230 enterprises. About 20% of these companies are large or medium CFC users and have relatively sophisticated manufacturing equipment. The remaining ones operate small scale units and are technically and chemically unsophisticated. The support of the chemical suppliers and associations will be crucial in reaching and educating this group.

3. ENTERPRISE BACKGROUND

SUNPRA Energy Recovery Engineering Pvt.Ltd. ("SUNPRA") was founded in 1984 to service the food preservation industry in India and abroad. The company commenced production of pre-engineered rigid polyurethane sandwich panels in early 1986 as the first company in India in this field.

The current product include panels, refrigeration units,insulated doors, other assessories, engineering and construction services for the purpose of cold storage and weather sheltering.

The company operates a production plant in Pune and sales/services offices in Delhi, Bombay, Bangalore and Shrinigar. A total of about 50 are employed. More information is supplied in annex-1.

4. PROJECT DESCRIPTION

SUNPRA utilized in 1993 about 20 tons CFC-11 in the manufacture of rigid PUF sandwich panels. Management of the company is committed to the phaseout of this ODS and eager to participate in an early phaseout program developed as part of the Indian Country Programme, as the highly sophisticated, international oriented, market that is served requires now already the use of CFC-free technologies. Reduced CFC technology, followed by the introduction of HCFC-22 is identified as the preferred pathway to achieve this goal. The low pressure foaming equipment in use has to be replaced by high pressure equipment for this purpose. A closed system pre-blender will also be required. Initial formulation development will be done at the system supplier, followed by production trials.

Product testing will be done at an outside institute for cost reasons as well as for the purpose of independent verification of the insulation values achieved.

Although the use of HCFC-22 constitutes the most economical replacement technology, incremental recurring costs will occur.

The company is aware that HCFC-22 constitutes an interim replacement technology based on its ODP value. The new equipment is however designed in such a way that future developments in ODS-free technologies, such as morphology changes, use of HFCs etc. can be introduced without equipment modifications.

5 TECHNOLOGY

5.1 OVERVIEW

There are currently three main directions in the development of CFC-free systems for thermoset insulation foams:

- CFC-11 > partial water/HCFC-141b > ?
- CFC-11 > partial water/ HCFC-22, 142b > HFC-134a, 152a
- CFC-11 > Pentane

In addition, compounds such as perfluoroalkanes, HCFC 123, fluorinated ethers and 2-chloropropane have been suggested, but are immature in technology, limited available or toxicologically contested.

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 HFC-356, but full water blown foam with improved cell structure remains an option, specifically in "lesser demanding" systems such as water heaters, were dimensional changes--although costly-- are possible.

The second one--also called the "gas" solution--utilizes a gaseous mixture of physical blowing agents, requires high pressure equipment, and sometimes extensive adjustments. The final step in this process is seen as the introduction of (gaseous) HFC's.

Cyclopentane technology is lately commercial introduced in Germany. Its flammable character requires safety conditions and limits its use. Only two companies offer currently cyclopentane packages, including equipment (Bayer/Hennecke and BASF/Elastogran), but this may change quickly.

5.2 SELECTION

SUNPRA has decided for the water/HCFC-22 solution with most likely subsequent replacement of the HCFC by a fully water blown system or HFC 134a. The main reason is an economical one: HCFC-22 is produced in India and available at much more favorable pricing than HCFC-141b. Also, the local support from raw material manufacturers is a factor in favor of the use of HCFC-22. Finally, the much more lower ODP value of HCFC-22 compared to HCFC-141b was weighed in favor of HCFC-22.

In SUNPRA's case, the use of cyclopentane would be cost prohibitive from a safety standpoint.

5.3 IMPACT ON PRODUCTION PROCESS

The reduced use of a different polyol as well as the use of HCFC-22 will increase the viscosity of the A-component (polyol blend), and cannot be metered by the current equipment. The introduction of a gaseous blowing agent requires the need of high pressure metering, which will also allow more precise metering of the higher viscosity blends.

The blowing agent can be pre-blended by the systems supplier or blended at site, requiring a blending system. International trend is to blend at site, to avoid losses during storage and to allow continuous adjustment of the amount and type of auxiliary blowing agent to emerging technological developments. The latter solution is preferred in SUNPRA's case as it will allow adjustments on site and will therefore constitute the more economical solution.

6. PROJECT COSTS

6.1 SUMMARY OF PROJECT COSTS

Incremental Capital Costs	USD	290,000
Incremental Recurrent Costs	USD	154,000
TOTAL PROJECT COSTS	**USD**	**444,000**

6.2 CAPITAL COSTS

The following incremental capital costs are expected, related to this project:

One high pressure dispensing unit	USD	150,000
One blending unit	USD	75,000
Technology transfer	USD	20,000
Ancillary modifications	USD	10,000
Validation testing	USD	10,000
Contingency	USD	25,000
TOTAL INCREMENTAL CAPITAL COSTS	**USD**	**290,000**

The costs for equipment are derived from inquiries at two independent manufacturers. Cost for validation testing are based on past experience. The cost of technology transfer includes those for an outside expert and chemicals used for trials.

6.3 OPERATING COSTS

The company expects recurrent incremental costs based on higher prices for polyol and HCFC-22 as well as from formulation changes. These costs are expected to amount to USD 197,000 over the four years following implementation (1995 thru 1998). Net present value of these costs at 10% discount amounts to:

USD 154,000

Annex-B provides more detailed information.

6.4 UNIT ABATEMENT COSTS

a)	Incremental Capital Costs	USD	290,000
b)	Project Life Time		10 years
c)	Incremental Recurrent Costs (1995)	USD	43,000
d)	CFC Consumption (1995)	kg	26,000
f)	Capital Recovery Factor (@ 10 % intrest)		0.16275
	UNIT ABATEMENT COSTS [(a/b + c)/d]	**USD/kg/y**	**3.47**

7. FINANCING PLAN

The company requests reimbursement of **USD 444,000**, representing all eligible incremental costs.

8 PROJECT IMPLEMENTATION

8.1 MANAGEMENT

It is proposed that UNDP-OPS will oversee the this project. This project is significant for future projects in India under the Montreal Fund as it will function as a "beacon" project. An intensive observation and supervision by an Agency experienced in similar projects seems therefore logical.

8.2 PROCUREMENT

It is proposed that UNDP's Office for Project Services (OPS) will arrange the project procurement. OPS would cooperate with the local UNDP office and with MOEF, and receive technical assistance from UNDP-ENS.

8.3 SCHEDULE

TASK	TIME FOR COMPLETION					
	Q1	Q2	Q3	Q4	Q5	Q6
1. Preparation						
MLF Approval	x					
Procurement preparation	xx					
Vendor selection	x					
2. Installation						
Arrival, Customs			x			
Machine Installation			x	x		
3. Start-up,						
Machine Start-up				x		
Trials, Training				xx		
Certification				x		

9. REQUIRED REGULATORY ACTION

The project requires no regulatory action.

10. PROJECT IMPACT

This project will eliminate the use of at least 26 tons of CFC-11 in the first year of implementation. Market growth indicates that this may increase by about 10% annually in subsequent years. The project employs commercially and environmentally acceptable technology.

11. ANNEXES

Annex-A: Company Information
Annex-B: Detailed calculation of recurring incremental costs
Annex-C: Technical Review

SUNPRA2.UNP
93-08-21/2

ANNEX-A
COMPANY PROFILE

SUNPRA

Energy & Recovery Engineering Pvt. Ltd.

SUNPRA ENERGY & RECOVERY ENGINEERING (PVT) LTD, for the first time in the country started the production of pre-engineered sandwich PU panels and this fulfiled a long standing need of the Food Preservation Industry in particular but, in no small measure, of the Special Construction Industry in general.

Neat, clean and hygienically constructed cold rooms with the highest degree of insulation became a reality. Another advantage accruing to the user was the enormous saving of time, elimination of heavy civil structures and saving in power.

No wonder that in a short span of first four years a discerning clientelle has been built up which continues to grow in a wide variety of users. Be it in manned station in Antarctica or in a large ice-cream hardening and storage rooms or a large food processing plant or even a retailers ice-cream walk-in-cooler, SUNPRA panels are increasingly becoming the first choice of the client.

SUNPRA is a registered S.S.I. Unit. The factory is situated in Ambervet, P.O. Paud, Taluka Mulshi, Dist. Pune, a notified backward area about 22 kms from proper PUNE. The factory was set up in 1984-85, plant and machinery installed by February 1986 and trial production of pre-engineered sandwich polyurethane panels commenced early 1986 using machinery imported from Italy.

The addition of aircooled compact ZANOTTI Refrigeration Units, a world leader of Italian make whose exclusive franchisee SUNPRA are, has fulfiled yet another need in that a most reliable refrigeration unit ensures the preservation of costly perishables at the desired conditions.

SUNPRA is a Company totally manned and managed by Technocrats and Professionals highly experienced and qualified, some of them having over 25 years of experience in Refrigeration and Airconditioning in National and International field, as can be seen from the accompanying Executive Profile.

SUNPRA has also extensive Network of Sales & Service Offices in major cities all over India such as Bombay, Delhi, Bangalore and Srinigar.

SUNPRA

Energy & Recovery Engineering Pvt. Ltd.

ACHIEVEMENTS OF SUNPRA -

Over a period, SUNPRA has achieved excellence in its product and project qualities.

Some of the remarkable projects are :

1) Very large cold room and ripening chambers for a 100% Export Oriented Unit set up under collaboration with M/s Henschel Exports GMBH, Germany for Banana Processing Plant. The quality was tested by M/s Alfa Laval and stagewise inspection was carried out.

2) Large cold room for fish processing for M/s Abad Fisheries, Cochin, where the panel quality and cold room installation was appreciated by British clients of M/s Abad Fisheries.

3) M/s Engineers India Ltd and M/s Rhone Paulenc, France have approved SUNPRA panels for their Vaccine project coming up in Haryana. Several mockups to illustrate new design concepts were prepared and the efforts were appreciated by consultants and clients who modified the tender specifications as per SUNPRA suggestions.

4) A large chicken processing plant near Pune was completed for a public limited company M/s Agritech Hatcheries & Foods Ltd, in record time including Zanotti units. The client has placed one more order for new expansion.

5) An order for cold storage for storing explosive chemicals (organic peroxide), has been received, for which M/s Uhde India Ltd are consultants.

6) Recently we have exported our panels to Samarkand for constructing cold rooms for a five star hotel. Even Zanotti units are supplied by us.

7) Frigoscandia Winner Teknology, a company formed by M/s Frigoscandia, Sweeden has been regularly placing orders on Sunpra for their blast freezer room for Sea food processing.

SUNPRA name is now synonymus with trustworthiness and the company os recognised in domestic market for its professional approach & timely completion of projects. Major industrial houses & leading companies have shown their faith in SUNPRA by giving repeat orders all along.

SUNPRA

Energy & Recovery Engineering Pvt. Ltd.

EXPORT FRONT

SUNPRA has successfully completed following export / deemed export (for 100% export oriented units) orders.

Deemed Export -

1. Government of India, Permanent manned station at ANTARCTICA, named "MAITRI".

2. Supply of 16 numbers ripening chambers & large cold storage for M/s Enkay Texofood Industries Ltd,Bhilad.

3. Supply of three numbers of large sea food cold storages for M/s Abad Fisheries Ltd, Cochin.

4. Supply of one large cold storage for M/s Innovative Marine Foods Ltd, Cochin.

Export -

Supply of walk-in coolers & freezers for a Five Star hotel in Samarkand, Uzbekistan (CIS).

To explore export markets, actively and efficiently recently we have entered into an agreement with M/s Isol Homes Impex of Belgium, who are experts in cold rooms for marketing SUNPRA products, at present, in the Asian & Middle East countries.

The enquiries can also be directed to them for direct prices and other details by you,

Their address & contact numbers are...

M/s Isol-Homes Consult Ltd,
Wagenbruggelaan -20,
B-8200, Bruges,
BELGIUM.

Tel : (0032) - 50384298 / Fax : (0032) - 50381988.
Contact : Mr. Noel Debaere - Manager.

M/s Isol-Homes Consult (Pvt) Ltd,
C-T 1/12, Ambika, S.P. Nagar,
Nahur Road,
Mulund (West)
Bombay - 400 080. (India)

Tel : (0091) - 222611443 / Fax : (0091) - 225649940
Contact : Ms. Varsha Kalnawat - Managing Director.

SUNPRA

Energy & Recovery Engineering Pvt. Ltd.

KEY PERSONNEL OF SUNPRA

S. S. GHATAGE
MANAGING DIRECTOR

Graduate in Mechanical Engineering and experience of over 25 years in the field of Air Conditioning & Refrigeration, covering areas such as Designing, Planning & Execution of large AC & R projects.

He has worked in India in companies like Voltas Ltd, Kirloskar Pneumatic Ltd, who had tie-ups with M/s Carrier, Accel-Sabroe & Hitachi.

He has worked in Kuwait for 9 years in the same field, with exposure to cold storages using Pre-Fab rigid PUF panels.

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L. N. JOSHI
DIRECTOR - MARKETING

A Graduate in Mechanical Engineering, he has over 40 years of experience in the field of AC & R. He has worked with M/s Kirloskar Pneumatic Ltd for over 15 years and was Senior Vice-president of the same company.

He has pioneered the Railway air conditioning in India by comissioning the first fully airconditioned Rajdhani Express in 1951, when working with Indian Railways.

He had negotiated the technical collaborations with M/s Stone-Carrrier UK, Grasso Holland, Hitachi Japan & Sutrak Germany for M/s Kirloskar Pneumatic Ltd.

++

C. Y. WAGH
EXECUTIVE - MATERIALS

He is a graduate in Mechanical engineering & has a total of about 25 years of experience in food processing equipment manufacturing industry, out of which about 8 years in M/s Alfa Laval (India) Ltd as Manager-Planning in PPC Department. He also has experience in Marketing & production of ISO Shipping Containers, with a company having tie-up with Sea Lord Containers, U.K.

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S. M. PANDIT
EXECUTIVE - DEVELOPMENT

He has done his graduation in Mechanical Engineering & has completed his Masters degree in Heat Power & Refrigeration (MTech) from the Indian Institute of Technology, Bombay.

In India, he has worked with M/s Blue Star Ltd, M/s Kirloskar Pneumatic Ltd in India having tie-ups with York USA & Hitachi Japan.

He has extensive exposure to international refrigeration companies through his job in Saudi Arabia with M/s Al-Zamil Refrigeration Industries. There he has worked on technology transfer & adaptation of M/s Dunham-Bush & M/s Trane. He also has experience on mainframe & dedicated type computer systems. Programming knowledge in FORTRAN, BASIC, dBASE etc.

++

D. V. VAIDYA
EXECUTIVE - DESIGN & ESTIMATIONS

A Graduate in Mechanical Engineering with specialisation in the field of Refrigeration & Air Conditioning, he has over 7 years of experience in this field.

He has worked with M/s Blue Star Ltd, has experience in Sales & Erection of AC & R projects. He has extensive knowledge of Computer programming in FORTRAN, COBOL, dBASE, BASIC languages both on Minicomputers & dedicated computer systems. He also conducts Computer language classes in a Technical institute. He is a Member of The Institution of Engineers India (MIE) in the Computer discipline.

++

N. M. KANGO
EXECUTIVE - OPERATIONS

He is a Graduate in Mechanical engineering & looks after the co-ordination between the Marketing-Sales & Production departments. He has a good experience in developing the insulated truck bodies with Rigid Polyurethane sandwich panels. He has acquired extensive knowledge in Precooling of fruits & transport refrigeration segments.

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C. S. CHIRMULAY
CONTROLLER - NORTHEN REGION

He has done his post graduation in Heat Power & Refrigeration (MTech) from the Indian Institute of Technology, Bombay.

He worked with M/s Kirloskar Pneumatic Ltd, for about 3 years as Section Manager.

He has experience in designing, estimation, sales & planning of Central AC plants, Ventilation systems, for Hotels, Underground railway stations etc. He also has wide experience in computer programming in FORTRAN & BASIC languages.

At present he is handling the New Delhi office of SUNPRA.

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A. A. GHATAGE
EXECUTIVE - PRODUCTS

He is a Graduate in Physics discipline and is an expert in Electrical & refrigeration systems, having worked on the Zanotti packaged refrigeration units.

In SUNPRA, he looks after the management of the Installation & Comissioning of the Pre-fab cold rooms with SUNPRA PUF panels & Zanotti refrigeration units.

He is also an incharge of the Service Department of this company looking after the Zanotti refrigeration units all over India.

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ANNEX - B

INCREMENTAL RECURRENT COSTS

The use of HCFC-22 triggers price consequences, not only related to the different auxiliary blowing agent (ABA) but also to the use of different foam formulations. The changes are as follow (developed and double checked with an Indian Polyol manufacturer and an Indian manufacturer of CFCs/HCFCs):

o	Polyol	Before and after price		- USD 3.17/kg
	ABA	Before:	CFC-11 price	- USD 2.40/kg
		After:	HCFC-22 price	- USD 4.20/kg
	MDI	Before and after price		- USD 3.85/kg
o	Formulation:	Before:	Polyol	- 37 %
			CFC-11	- 13 %
			MDI	- 50 %
		After:	Polyol	- 38 %
			HCFC-22	- 9 %
			MDI	- 53 %

Consequently, the price per kilogram foam mixture increases from USD 3.41 to USD 3.62, or USD 0.21.

The Indian Country Programme forecasts a growth rate for this foam category of 12% for 1992-1996 and of 9.5% for 1996-2005. These growth rates have been applied to the calculation of the incremental recurrent costs. This amounts to the following:

	1995	1996	1997	1998	TOTAL
System use (t)	203	222	243	266	934
Price difference (x 0.21; USD)	43	47	51	56	197
Discounted (10%)	39	39	38	38	**154**

The Net Present Value is so with

USD 154,000

TECHNICAL REVIEW BY DR. MIKE JEFFS

SUNPRA

SCOPE

The project is concerned with the replacement of CFC 11 in manufacture of polyurethane rigid foam-cored sandwich panels.

RECOMMENDATION

The project is supported.

RELEVANCY AND ADEQUACY OF INFORMATION

Adequate. Quotations from prospective equipment suppliers are not included.

TECHNICAL SOUNDNESS

The choice of HCFC 22 is sound for this application where the steel panel facings should provide adequate protection against ageing of thermal conductivity.

LESSON FROM EXPERIENCE

None

ENVIRONMENTAL ISSUES

The use of HCFC 22 is recognised as a transitional blowing agent to be eventually replaced by HFC 134a. The reviewer, however, doubts that this route will be cost effective.

SAFETY ISSUES

None

COST EFFECTIVENESS

The Unit Abatement Costs are high because of the low CFC 11 usage coupled with comparatively high equipment and recurrent costs - again with a contribution from supposed higher polyol costs.

OTHERS

None

GMFJ/kd/15/9/93

PROJECT OUTLINE

COUNTRY:	INDIA
SECTORS COVERED:	Foams and halons
NATIONAL ODS CONSUMPTION:	10,370 metric tonnes in 1991
PROJECT TITLE:	Project preparation assistance
DURATION:	One year
PROJECT IMPACT:	Preparation of ODS phaseout projects in the foams and halons sectors
PROPOSED BUDGET:	US$ 100,000
IMPLEMENTING AGENCY:	UNDP
NATIONAL COORDINATING AGENCY:	Ministry of Environment & Forests (MOEF)

PROJECT DESCRIPTION

The India Country Programme was presented and approved at the 11th Executive Committee Meeting in November 1993 in Bangkok. India's ODS consumption in 1991 was 10,370 tonnes distributed as follows: solvents (47.7%), refrigeration/AC (19.2%), foams (15.2%), aerosols (10.6%) and halons (7.2%) respectively.

At Government request, the Executive Committee at its 8th Meeting in October 1992 had approved $100,000 for UNDP project preparation assistance. Of this amount, $79,000 has been spent. Some of the funds during 1993 went towards assisting project identification in all sectors in support of country programme preparation. The main emphasis was on the foams sector since the Government of India has determined that UNDP will design and implement all projects in this sector with the exception of the polyol producer projects.

The results of UNDP's project preparation activities in India have been the following:

a) 14 projects have been identified and prepared to date.
b) One project for the small-scale sector ($120,000) was approved for UNDP implementation during the 11th ExCom Meeting.
c) Three foam sector projects amounting to $1.2 million have been submitted for approval at the 12th ExCom Meeting.
d) Eight foam sector projects (around $4.3 million) and upto 2 halons projects are awaiting internal Government review and clearance for submission to the 13th ExCom Meeting.

The additional funding will be used during 1994 for preparation of projects in the foams and halons sectors. $40,000 will be allocated to MOEF to support the recruitment of national experts who will be responsible for the first stage of project identification. International experts will contribute during the second stage. The completed project proposals, following Government approval, will be submitted for Executive Committee approval.

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:	Total capital investment cost: USD 292,000 NPV of incremental operating cost: USD 14,000
PROPOSED MLF GRANT:	USD 306,000
COST EFFECTIVENESS:	USD 3.07 $/kg Unit Abatement (ODS 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 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 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	$185,000	
Freight and Installation	15,000	
		$200,000
· Water treatment/filtration system		18,000
· Water piping	10,000	
· Electrical wiring	10,000	
· Ventilation improvement	9,000	
		29,000
· Salvage		(1,000)
· Training & engineering		6,000
· Process & material compatibility testing		4,000
· Equipment training & testing at supplier site		6,000
· Contingency & rounding		30,000
		$292,000

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 292,000
- Annual incremental cost.....USD 4,600
- Project useful life..... 10 years
- ODS reduction..... 11,000Kg

. Unit Abatement Cost [(a/c + b) /d] US/kg/ (ODS Basis) 3.07

7. FINANCING PLAN

The company requests reimbursement of the complete project costs, which are estimated to be: USD 292000+14000=306,000

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	
Competition (routing, monitoring shows parts are meeting customer needs							X	X

Phaseout actually begins here (1995)

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 stringent 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.

GLOBAL CENTRE FOR PROCESS CHANGE

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Fax: 302-652-5701

TO: C. J. NORRIS (UNDP) DATE: 10 FEB., 1994

SUBJECT: PROJECT TECHNICAL REVIEW

I have reviewed the Solvent Project, "Elimination of the Use of 111 TCA in the Metal Cleaning Processes at Kein Hing Industry Sdn Bhd" prepared by factory and UNDP personnel.

Technical Soundness

This project substitutes accepted, effective non-ODS aqueous detergent technology for the current solvent cleaning systems. 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.

Environmental

The use of aqueous technology has the potential for the acidic or alkaline cleaning chemistries to complex with the metals being cleaned, thus introducing metallic complexes to the waste stream. The project addresses the waste treatment issue by incorporating filtration and treatment capability in the capital investment portion. 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.

Cost Effectiveness

The project addresses cost effectiveness, using data that is felt to be reasonably accurate, since aqueous cleaning of stamping oils is a standard process world-wide. However, as a contract manufacturer, the factory realizes compatibility testing is essential to ensure clean, damage-free parts in view of the wide range of metals and soils encountered. The calculated unit abatement costs for solvents at $3.8/kg, falls in the acceptable range for non-ODS replacement technology.

Recommendations

It is recommended that this project be approved with the stipulation the factory carry out the compatibility testing and waste stream monitoring needed to fully realize the capability of the new process.

PROJECT COVER SHEET

COUNTRY:	Malaysia
PROJECT TITLE:	Elimination of the use of CFC-113 in the integrated circuit (IC) lead frame cleaning processes at San Matech Sdn Bhd.
SECTOR COVERED:	Solvent
ODS USE IN SECTOR:	1308 MT of CFC-113 in 1991 2029 MT of 111 TCA in 1991
PROJECT IMPACT:	5 MT of CFC-113 per year
PROJECT DURATION:	18 months
PROJECT USEFUL LIFE:	10 years
TOTAL PROJECT COSTS:	Total capital investment cost: USD 142,200 Total operating cost: USD (1,100)
PROPOSED MLF GRANT:	USD 141,100
COST EFFECTIVENESS:	USD 2.75 $/kg Unit Abatement Cost
NATIONAL COORDINATING AGENCY:	Malaysia Department of Environment (DOE)
IMPLEMENTING AGENCY:	UNDP

PROJECT SUMMARY

San Matech Sdn Bhd is a sub-contractor to a multinational electronics company in Malaysia. At present, CFC-113 is used to clean lead frames in the San Matech Sdn Bhd factory. Under this project San Matech will eliminate the use of CFC-113 by converting to a hydrocarbon cleaning agent, resulting in an annual reduction of 5MT of ODS. The existing cleaning equipment is to be replaced with a new machine, complete with a drier and safety features. A grant covering all project related cost is requested.

PROJECT OF THE GOVERNMENT OF MALAYSIA:
ELIMINATION OF THE USE OF CFC-113 IN THE IC LEAD FRAME CLEANING PROCESS AT SAN MATECH SDN BHD

1. PROJECT OBJECTIVE

The objective of this project is to eliminate the use of CFC-113 in the IC Integrated Circuit) lead frame cleaning processes at San Matech 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

San Matech Sdn Bhd is a Malaysian owned local enterprise. The company's primary business is as a sub-contractor for IC lead frame production to Electronic Multinational Companies in Penang.

4. PROJECT DESCRIPTION

4.1 PROCESS SOILS
Stamping oils from the production of the metal IC lead frames.

4.2 PRESENT PROCESS
San Matech Sdn Bhd used about 5 MT of CFC-113 for the removal of stamping oil from IC lead frames in 1992. The stamping oil must be completely removed from the surface of the IC lead frames before they are sent on to the customer for the next step in the IC manufacturing process. At present, the cleaning is accomplished in Branson two sump open top vapor degreaser using CFC-113.

4.3 PROPOSED ALTERNATIVE PROCESS

Under this project, the present CFC-113 cleaning agent/open top vapor degreaser systems will be replaced with a new hydrocabon cleaning agent/ultrasonic cleaning equipment process. The 2 process lines will be re-routed to converge into one cleaning system, with appropriate electrical and mill right activities. The new cleaning process will remove all the stamping oil from the lead frames before they are sent to the customer. In view of the flammability concern over using a hydrocarbon cleaning agent, new cleaning equipment incorporating a drying stage and all the necessary safety features will be installed. Extra fire extinguishers will be installed where needed. A complete training programme for the factory workers will ensure safe handling of the hydrocarbon cleaning agent from charging the equipment to disposal.

Engineering work on electrical supply, mechanical items, safety items and ventilation improvement will be required to ensure safe installation and operation of the new cleaning process. Analysis of the cleaning process showed that a single new cleaning machine incorporating the proper safety features was more cost effective than retrofitting the vapor degreasers and purchasing drying ovens.

5. TECHNOLOGY

In the solvent sector, there are several options for the replacement of CFC-113 solvent cleaning processes:

- aqueous
- semi-aqueous
- chlorinated solvents
- hydrocarbon solvents
- process changes

San Matech has considered all the various alternatives and decided that a hydrocarbon cleaning process will be the most suitable for their cleaning needs because it:

- has been shown to give satisfactory results in preliminary trials
- is environmentally friendly
- is low in toxicity
- is cost effective.
- does not require major changes in the production process.

6. PROJECT COSTS

6.1 TOTAL CAPITAL COSTS

The following summarizes the anticipated investment cost and related activities:

DESCRIPTION	SUB-TOTAL	TOTAL
· Hydrocarbon cleaning system with ultrasonics & safety equipment.	$80,000	
· Freight and Installation	10,000	
		$90,000
Facility Modification		
· Electrical & Mechanical work	10,000	
· Process modification	9,000	
· Ventilation improvement	8,000	
· Dismantle existing facilities	2,000	
		47,000
· Production, safety, startup training		10,000
· Salvage		(600)
· Contingency & rounding		13,800
		142,200

6.2 INCREMENTAL OPERATING COSTS

The following table summarizes the incremental operating cost:

ITEM	PRESENT SYSTEM	PROPOSED HYDRO CARBON SYSTEM
1) Material Cost CFC or hydrocarbon	$15,000 (5000 kilos x $3.00)	$14,000 (4000 kilos x $ 3.50)
2) Labour cost	$13,584	$13584
3) Energy cost	$1,048 (.06/hp x 8 hrs/day x 312 days/yr. x 7 hp)	$1,498 (.06 x 8 x312 x 10)
4) Maintenance	$1000	$ 1200
Savings		350
NPV of 4 year Savings		1100

6.3 UNIT ABATEMENT COST

- ODS reduction capital cost.....USD 141,100
- Annual incremental cost.....USD (350)
- Project useful life..... 10 years
- ODS reduction.....5,000 kg

Unit Abatement Cost [(a/c + b) /d] USD/kg/yr..... 2.75

7. FINANCING PLAN

The company requests reimbursement of the complete project costs, which are estimated to be:

Capital cost	USD	142,200
Operating cost	USD	(1,100)
Grant request	USD	141,100

8. PROJECT IMPLEMENTATION

8.1 MANAGEMENT

UNDP will oversee the completion of this project.

8.2 SCHEDULE

TASK	TIME FOR COMPLETION				
	Q1	Q2	Q3	Q4	Q1
Project preparation	x	x			
MLF approval		x	x		
Equipment order		x	x		
Process modification				x	x
Installation			x	x	
Trial run				x	x
Training				x	x x

8.3 PROCUREMENT

UNDP will oversee the procurement, with assistance provided by the local UNDP and Westech Malaysia personnel.

9. PROJECT IMPACT

This project will eliminate the use of at least 5 MT of CFC-113 during the first year of implementation. The project employs commercially practical and environmentally acceptable technology.

10. ENVIRONMENTAL ASSESSMENT

Under this project, San Matech Sdn Bhd will eliminate the use of CFC-113 by converting to a hydrocarbon cold cleaning process. Planned Ventilation adjustments will prevent heat and humidity for increasing in the work area. The concern over the flammability risk of the hydrocarbon cleaning agent will be taken care of by specifying the installation of fire safety devices, e.g. explosion proof switches and electrical equipment temperature sensors on the cleaning equipment. The waste solvent will be collected throughout the year and can be sent out for incineration or blended with fuel oil and burned VOCs from hydrocarbon emissions are not expected to become an issue in Malaysia. It is unlikely that this project will have an adverse environmental impact.

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TO: C. J. NORRIS (UNDP) DATE: 10 FEB., 1994

SUBJECT: PROJECT TECHNICAL REVIEW

I have reviewed the Solvent Project, "Elimination of the Use of CFC-113 in the Integrated Circuit (IC) Lead Frame Cleaning Processes at San Matech Sdn Bhd" prepared by factory and UNDP personnel.

Technical Soundness

This project substitutes different, but effective non-ODS technology for the current solvent cleaning lines that are in use, i.e., hydrocarbon cleaning technology for the lead frames. The project preparers were cognizant of the need to perform preliminary process trials to ensure meeting quality standards. Hydrocarbon technology for metal cleaning has been in use world-wide for many years and has generally demonstrated at least equivalent performance vs. ODS cleaning processes in recent high volume conversions in the U.S.

Safety

The use of hydrocarbon technology for metal cleaning operations employs flammable or combustible materials, which can be used safely if proper safeguards are employed. The specification of properly designed equipment ensures that the appropriate safeguards (explosion proof electrical circuits, fire extinguishers, ventilation etc.) are part of the replacement technology. Any hydrocarbon mist emanating from the new process will be controlled via the improved ventilation which is part of the project. The project preparers also recognized the need to have the work force undergo thorough training in the handling and use of a combustible cleaning agent.

Environmental

The use of hydrocarbon technology for metal cleaning has the potential for entrainment of metallic particulate from the stamping operation, especially when ultrasonic agitation of the cleaning bath is used to maximize contaminant removal. Filtration will remove any metal particulates arising from the stamping processes while allowing the contaminated cleaning agent to be disposed of by incineration in a fuels blending programme. Hydrocarbons solvents do have VOC potential. While VOCs are not regulated in developing countries, they may be a future concern.

Cost Effectiveness

The project addresses cost effectiveness, using data that is based on small scale trials. Typically, cost effectiveness improves when the process can full benefit from the process optimization and economy of scale that will result from implementation. The project preparers considered and rejected retrofitting existing equipment on grounds of safety and cost to implement. The calculated unit abatement costs for solvents at $3.3/kg, falls in the acceptable range for non-ODS replacement technology. .

Recommendations

It is recommended that this project be approved with the stipulation the factory carry out the work force training program needed to implement a combustible cleaning agent process.

PROJECT COVER SHEET

COUNTRY:	**Malaysia**
PROJECT TITLE:	**Cycle World Sdn Bhd elimination of CFCs in the manufacturer of the polyurethane insulated panel.**
SECTOR COVERED:	**Foam**
ODS USE IN SECTOR:	**600 MT CFCs (722 tons ODS) in 1991**
PROJECT IMPACT:	**45 MT per year, in 1993**
PROJECT DURATION:	**One year, after approval**
PROJECT USEFUL LIFE:	**10 years**
TOTAL PROJECT COSTS:	**USD 233,000 incremental capital cost USD 120,000 incremental recurrent cost**
PROPOSED MLF GRANT:	**USD 353,000**
COST EFFECTIVENESS:	**USD 1.72**
NATIONAL COORDINATING AGENCY:	**Malaysia Department of Environment (DOE)**
IMPLEMENTING AGENCY:	**UNDP**
APPRAISAL DATE:	**December, 4 1993**

PROJECT SUMMARY

Under this project, Cycle World will eliminate the use of CFCs in its production process through reduced CFC technology, combined with replacement of the residual CFC by HCFC141b resulting in an annual reduction of 45MT of CFC-11, based on 1993 consumption. The equipment that will be installed as part of this project will be capable to employ emerging ODS free technologies such as Co and HCFCs as they mature. The Company expects an increase of recurrent incremental cost of about 12% of the system value. The costs will be partly offset by lower losses in the preparation of blends and elimination of flushing costs.

TECHNICAL ASSESSMENT

The project has been reviewed and approved with modifications by Bert Veenendaal from UNDP's Technical Review Panel. His comments are attached.

PROJECT OF THE GOVERNMENT OF MALAYSIA
CYCLE WORLD SDN BHD ELIMINATION OF CFCs IN THE MANUFATURE OF POLYURETHANE FOAM PANEL

1. PROJECT OBJECTIVE

The objective of the project is to phase out the use of CFCs in the manufacture of polyurethane panel at Cycle World.

2. SECTOR BACKGROUND

The CFC consumption in the foam sector in Malaysia is estimated to have reached at least 600t in 1991. CFC-11 (polyurethane foams) and CFC-12 (polystyrene and polyethylene foam sheet) are the dominant substances in this sector, with much smaller usage of MCF, CFC-114 and CFC-115.

3. ENTERPRISE BACKGROUND

Cycle World was established in late 1992 and assumed production in early 1993. It is a Malaysian owned private enterprise. The Company is presently foam dispensing machine. The products are mainly used in cool room panel and refrigerator truck.

4. PROJECT DESCRIPTION

Cycle World utilizes annually about 45 tons CFC-11 in the manufacture polyurethane panel. A combination of reduced CFC technology and HCFC-141b is selected as the replacement of choice. Existing low pressure equipment has to be replaced with high pressure and a pre-blending unit will have to be installed. Some cost for trials will occur. In addition to equipment changes, recurrent incremental operating cost are expected, related to higher isocyanate use and the use of HCFC-141b.

5. TECHNOLOGY

5.1 OVERVIEW AND SELECTION

There are several options to replace CFCs in the production of rigid polyurethane insulation foam, such as:

- 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 choride, HCFC 123, and water blown technologies have been suggested, but are immature in technology, limited in availability or restricted 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 HFC-356, but full water blown foam with improved skin formation remains aption, 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 extensive process adjustments. The final step is this process is seen as the introduction of (gaseous) HFCs. The high diffusion rate of HCFC-22 limits its use to encapsulated systems.

Pentane technology is lately commercially introduced on several occasions but its flammable character requires safety conditions and limits its use.

A combination of water-blown technology and the use of HCFC-141b is identified by the Company as an alternative that is:

- Proven technology in processing and product performance,
- Environmentally acceptable,
- Available in the Malaysian market,

The choice of high pressure equipment will facilitate the step to a truely ODP-free system without additional capital costs.

The use of HCFC-22 would be econimically preferrable, but has to be evaluated on its short retention time in the foam. It is, for instance, not feasible for slabstock without significant deteriation of insulation properties.

5.2 IMPACT ON PRODUCTION PROCESS

The use of reduce CFC technology will require the employment of high pressure foam production equipment.

HCFC-141b is moderately flammable. For the intended purpose, the blends should not cause any risk, but a monitoring check at commissioning will be performed to assure safe working levels.

The current manual mixing method should be replaced by an automated one. This will save up to 20% ABA (auxiliary blowing agent). The Company is too small to justify in-house blending and will buy pre-mixed blends to obtain those savings.

6. PROJECT COSTS

6.1 TOTAL PROJECT COSTS

The folowing is a summary of the expected costs (in USD) of investment and related activities:

DESCRIPTION	AMOUNT (USD)
FOAM EQUIPMENT	110,000
TRIALS, START UP	5,000
PRE-MIX STATION	65,000
FREIGHT, INSTALLATION	15,000
TECHNOLOGY TRANSFER, TRAINING	15,000
CONTINGENCY, ROUNDING	23,000
TOTAL	**233,000**

[Prices obtained from Impianti OMS, Italy and Cannon, Singapore]

6.2 OPERATING COSTS

o	Before:	45t CFC-11 @2,100 ..... USD	94,000
o	After:	32t additional MDI @ 1,850..... USD	59,200
		18t HCFC-141B @ 5,450 ..... USD	98,100
		INCREMENTAL MATERIAL COSTS ..... USD	63,300
o		Savings on ABA ..... USD	18,000
o		Savings on cleaning agent ..... USD	7,500
o		**RECURRENT INCREMENTAL COSTS ..... USD**	**37,800**

Net Present Value (4y; 10% discount).. USD 120,000

6.3 UNIT ABATEMENT COST

a)	ODS Reduction Project Costs	USD 233,000
b)	Annual Incremental Costs	USD 37,800
c)	Project Useful Costs	10 Years
d)	ODS Reduction/Year	Kg 45,000
e)	Capital Recovery Factor (10% discount)	0.16275

Unit Abatement Costs [(a(e)+ b)/d] USD/kg/y 1.72

7. FINANCING PLAN

The company requests the reimbursement of the complete project costs estimated on

	USD

8. PROJECT IMPLEMENTATION

8.1 MANAGEMENT

UNDP will oversee the completion of this project and provide technical assistance.

8.2 PROCUREMENT

UNDP will oversee the procurement, assisted by Westech/Malaysia.

8.3 SCHEDULE

Implementation schedule will start with MLF approval of the project and will end after monitoring has confirmed that at no place on the machine or in the working area unsafe levels of HCFCs can be deteched.

TASK	TIME FOR COMPLETION					
	Q1	Q2	Q3	Q4	Q5	Q6
1. Preparation						
MLF Approval	x					
Visit Consultant		x				
Order Confirmation		x				
2. Installation						
Arrival, Customs			x			
Machine installation			x	x x		
				x		
				x x		
3. Start-up, Training						
Machine Start-up/Trials				x		
Commissioning				x		

9. PROJECT IMPACT

This project will eliminate the use of at least 45 tons of CFCs in the first year of implementation. The Project employs commercially and environmentally acceptable technology.

Annex A - Technical Assessment

JSL/BV/CC
94-02-15

TECHNICAL ASSESSMENT

PROJECT TITLE:	Cycle World Sdn Bhd elimination of CFCs in the manufacture of polyurethane insulated panel
CATEGORY:	Foamed Plastics-Rigid PUF (commercial refrigeration)
RECOMMENDATION:	The project is supported
INFORMATION:	Adequate
TECHNOLOGY:	Low CFC technology combined with replacement of the residual CFC by HCFC-141b is acceptable as long as the company realizes that HCFC-141b constitutes an interim technology and employs equipment that will allow subsequent introduction ofpermenent technology as this matures
REFERENCES:	Similar projects in Egypt, India and Thailand
ENVIRONMENTAL:	HCFC-141b has a residual ODP
SAFETY:	HCFC-141b is moderately flammable. Pre- and post-audit on workplace safety required
COST EFFECTIVENESS:	Moderately good (as a standard: similar projects have UACs between 2.00 and 3.50)
OTHER ISSUES:	Original comments pointed out to too high costs (569,437) and insufficient documentation on operating costs. The project is adjusted accordingly
REVIEWER:	Bert Veenendaal
DATE:	February 15, 1994

PROJECT COVER SHEET

COUNTRY:	**Malaysia**
PROJECT TITLE:	**Elimination of CFC-11 in the manufacture of integral skin, spoiler and moulded flexible foam at P.U. Tech Sdn Bhd**
SECTOR COVERED:	**Foam**
ODS USE IN SECTOR:	**600 CFCs (722 tons ODS) in 1991**
PROJECT IMPACT:	**24MT CFC-11 per year**
PROJECT DURATION:	**One year**
PROJECT USEFUL LIFE:	**10 years**
TOTAL PROJECT COSTS:	**USD 120,000 incremental capital cost USD 78,000 incremental recurrent cost**
PROPOSED MLF GRANT:	**USD 198,000**
COST EFFECTIVENESS:	**USD2.41**
NATIONAL COORDINATING AGENCY:	**Malaysia Department of Environment (DOE)**
IMPLEMENTING AGENCY:	**UNDP**
APPRAISAL DATE:	**3rd December 1993**

PROJECT SUMMARY

P.U. Tech Sdn Bhd (P.U. Tech) manufactures spoiler (rigid foam), Moulded flexible foam and integral skin. CFC-11 is currently used by the company in the production process. Under this project, P.U. Tech will eliminate the use of CFC-11 by converting to a combination of reduced CFC technology combined with replacement of the residual CFCs by HCFCs, resulting in an annual reduction of 24MT of ODS, based on 1993 consumption. The company realizes that the use of HCFCs constitutes are interim solution. However, the existing high pressure equipment is able to employ emerging ODS-free technology such as carbon dioxide and HFCs as they mature. The company expects an increase of recurrent incremental cost. These cost will be partly offset by lower losses in the preparation of blends.

TECHNICAL ASSESSMENT

The project has been reviewed and approved with modifications by Bert Veenendaal from UNDP's Technical Review Panel. His comments are attached.

PROJECT OF THE GOVERNMENT OF MALAYSIA
ELIMINATION OF CFC-11 IN THE MANUFACTURE
OF INTEGRAL SKIN, SPOILER AND MOULDED FLEXIBLE
FOAM AT P.U. TECH SDN BHD

1. PROJECT OBJECTIVE

The objective of this project is to phase out the use of CFC-11 in the manufacture of integral skin, spoiler and moulded flexible foam at P.U. Tech Sdn Bhd.

2. SECTOR BACKGROUND

The CFC consumption in the foam sector in Malaysia is estimated to have reached at least t in 1991. This is about 8% of the total ODS and 7% of the Malaysian ODP generation. CFC-11 (polyurethane foams) and CFC-12 (polystyrene and polyethylene foam sheet) are the dominant substances in this sector, with much smaller usage of MCF, CFC-114 and CFC-115.

3. ENTERPRISE BACKGROUND

P.U. Tech Industry Sdn Bhd is one of the subsidiaries of the Unitika group of Company. The company was formed in 1982 and manufactures polyurethane (P.U.) spoilers, head rests, arm rests, chair legs and body trims. Most of the products are marketed to the automotive OEMs both locally and overseas. The company is a Malaysian private enterprise.

4. PROJECT DESCRIPTION

The company presently operate with 3 high pressure foaming units utilizing about 24MT of CFCs in the manufacture of rigid foam (spoiler), moulded flexible foam and integral skin. For the spoiler, the company plans to phaseout CFC-11 by converting to HCFC141b. Numerous trials have been carried out with the chemical supplier to formulate the right formulation. The integral skin will be replaced by a combination of reduced CFC technology and HCFC 141b as the ODS replacement of choice. The moulded flexible foam will be replaced by a full water blown technology. A pre-blender will be installed for this purpose. Some additional cost for trials will occur. In addition to that, the company expects an increase in recurrent incremental cost, related to higher use of isocynate and the use of HCFC 141b.

TECHNOLOGY

5.1 OVERVIEW

There are several options to replace CFCs in the production of ISPUF, such as:

- CFC-11 > HCFC-141b > ?
- CFC-11 > 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 HFC-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) HFC's. Pentane technology is lately commercial introduced on several occasions, but its flammable character requires safety conditions and limits its use.

5.2 SELECTION

A combination of reduced CFc technology and the use of HCFCs is selected by the company as an alternative that is:

- Proven technology in processing and product performance,
- Environmentally acceptable,
- Available in the Malaysian market,
- Easy to convert to complete CFC-free technology.

6. PROJECT COSTS

6.1 TOTAL PROJECT COSTS

The following is a summary of the expected costs (in USD) of investment and related activities:

DESCRIPTION	AMOUNT (USD)
PRE-MIX STATION	65,000
FREIGHT, INSTALLATION	10,000
TRIALS, START-UP	15,000
TRAINING, TECHNOLOGY TRANSFER	20,000
CONTINGENCY, ROUNDING	10,000
**TOTAL	**120,000**

[Prices obtained from Impianti OMS, Italy]

6.2 OPERATING COSTS

Before:	24t CFC-11 @ 2,000	USD	48,000
After:	19t additional MDI @ 1,850	USD	30,000
	10t HCFC-141b @ 5,450	USD	54.500
INCREMENTAL MATERIAL COSTS		USD	36,500
Savings on ABA.....		USD	12,000
Savings on cleaning agent.....		USD	1/
RECURRENT INCREMENTAL COSTS.....		**USD**	**24,500**

Net Present Value (4y; 10 % discount).. USD 78,000

6.3 UNIT ABATEMENT COST

a)	ODS Reduction Project Costs	USD	120,000
b)	Annual Incremental Costs (base 1995)	USD	24,500
c)	Capital Recovery Factor (10%;10y)		0.16275
d)	ODS Reduction/Year	Kg	24,000
Unit Abatement Costs [{a(c) + b}/d]		**USD/kg/y**	**1.83**

7. FINANCING PLAN

The company requests the reimbursement of the complete project costs estimated on

USD 198,000

8. PROJECT IMPLEMENTATION

8.1 MANAGEMENT

UNDP-OPS will oversee the implementation of this project.

8.2 SCHEDULE

Implementation started with the company decision to phase out the use of CFC in Aug'93 and will end after trials have confirmed that acceptable product can be made in the new configuration. A detailed activity schedule is provided.

1/ Already self cleaning mixing heads in place.

TASK	TIME FOR COMPLETION					
	Q3	Q4	Q1	Q2	Q3	Q4
1. Preparation						
Board decision	x	x				
Vendor sourcing		xx				
MLF approval			x			
Procurement				x		
2. Installation						
Arrival					x	x
Machine starting					x	x
3. Trial Testing						
Material test			x	x	x	x x
Start-up, trail					x	x
Monitoring						x x

8.3 PROCUREMENT

UNDP-OPS will oversee the procurement, assisted by Westech Malaysia.

9. PROJECT IMPACT

This project will eliminate at least 24MT of CFCs in the first year of implementation. The project employs commercially available and environmentally acceptable technology.

JSL/BV/CC
94-02-16/02

TECHNICAL ASSESSMENT

PROJECT TITLE: P.U. TECH Sdn Bhd elimination of CFCs in the manufacture of integral skin, spoiler and molded flexible foam

CATEGORY: Foamed Plastics-Semi-Rigid PUF/Rigid PUF/Flexible Molded PUF

RECOMMENDATION: The project is supported

INFORMATION: Adequate

TECHNOLOGY: The project provides acceptable replacement technologies that are harmonized to the extend possible. HCFCs to be replaced at a later stage by permanent technologies

REFERENCES: Similar projects in Malaysia and Indonesia

ENVIRONMENTAL: HCFC-141b has a residual ODP

SAFETY: No particular issues

COST EFFECTIVENESS: Good (as a standard: similar projects have UACs between 3.00 and 4.00)

OTHER ISSUES: The original document was improved on capital and operational costs after initial comments

REVIEWER: Bert Veenendaal

DATE: February 15, 1994&

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To Cecilia	From Bert
Co. UNDP	Co. Rappa
Dept.	Phone #
Fax #	Fax #

PROJECT COVER SHEET

COUNTRY:	**Malaysia**
PROJECT TITLE:	**Pexafoam Sdn Bhd elimination of CFC-11 in the manufacture of flexible polyurethane foam (slabstock)**
SECTOR COVERED:	**Foam**
ODS USE IN SECTOR:	**600MT CFCs (722 tons ODS) in 1991**
PROJECT IMPACT:	**120MT of CFC-11 per year (base 1993)**
PROJECT DURATION:	**One year**
PROJECT USEFUL LIFE:	**10 years**
TOTAL PROJECT COSTS:	**USD 195,000**
PROPOSED MLF GRANT:	**USD 195,000**
COST EFFECTIVENESS:	**USD0.26 (unit abatement cost)**
NATIONAL COORDINATING AGENCY:	**Malaysia Department of Environment (DOE)**
IMPLEMENTING AGENCY:	**UNDP**
APPRAISAL DATE:	**4th December 1993**

PROJECT SUMMARY

Pexafoam Sdn Bhd is one of biggest flexible polyurethane foam (slabstock) in Malaysia. Pexafoam produces a wide range of polyurethane flexible foam and are distributed to furniture and electronic industry. CFC-11 is presently used in production process. Through this project Pexafoam will eliminate the use of CFC-11 by converting to methylene chloride. Proper ventilation in the workplace and training on the safe handling of M.C. is needed. Both the existing and new equipment required modification in order to use methylene chloride.

TECHNICAL ASSESSMENT

The project has been reviewed and approved with modifications by Bert Veenendaal from UNDP's Technical Review Panel. His comments are attached.

PROJECT OF THE GOVERNMENT OF MALAYSIA
PEXAFOAM SDN BHD ELIMINATIONN OF CFC-11 IN THE MANUFACTURE OF FLEXIBLE POLYURETHANE FOAM (SLABSTOCK)

1. PROJECT OBJECTIVE

The objective of this project is to phase out the use of CFC in the manufacture of flexible polyurethane foam slabstock (FPUF) at Pexafoam Sdn Bhd.

2. SECTOR BACKGROUND

The CFC consumption in the foam sector in Malaysia is estimated to have reached at least 600t in 1991. CFC-11 (polyurethane foams) and CFC-12 (polystyrene and polyehtylene foam sheet) are the dominant substances in this sector, with much smaller usage of MCF, CFC-114 and CFC-115.

3. ENTERPRISE BACKGROUND

Pexafoam Sdn Bhd is a Malaysian owned private enterprise and assumed operation in 1979. The main business for the company is manufacturing flexible polyurethane foam and moulded polyurethane foam. The products are mainly distributed to furniture industry, automotive industry and electronic industry.

4. PROJECT DESCRIPTION

Pexafoam Sdn Bhd utilized in 1993 about 120MT of CFC-11 in the manufacture of flexible polyurethane and moulded polyurethane foam. For Slabstock, Methylene chloride is selected as choice as the technology is commonly available and cost effective. It includes some modification of equipment in conjuction with safety related modifications in the production environment. Also production and safety training is needed to ensure a smooth and safe operation.

TECHNOLOGY

5.1 OVERVIEW AND SELECTION

There are numerous technologies to replace the use of CFCs in flexible foam by non ODS or low ODS options. It is referred to documentation from OORG, UNEP and UNDP in this area. Management of PexaFoam decided, after attending seminars in Singapore and Jakarta, to opt for the use of an alternative blowing agent--methylene chloride--for the slabstock production.

The combination of these technologies will allow replacement of CFCs in a cost effective way, without unacceptable losses in

performance and processing. Pre-condition is however a well planned reformulation program to implement adjustments in the amount of blowing agent as well as in the amount and type of catalysts.

Also, workplace concentrations of methylene chloride have to be limited to acceptable industrial hygienic standards.

5.2 PRODUCTION PROCESS

The modification needed to implement the use of methylene chloride as a blowing agent include:-

- Extra metering systems,
- Encapsulation, ventilation,
- Fall plate modification,
- Reformulation,
- fire safety in encapsulated areas.

Safety and process training for production staff and personnel will also be needed. The new equipment will be able to handle methlyene chloride.

6. PROJECT COSTS

6.1 Total Capital Costs

The following is a summary of the expected costs of investment and related activities:-

DESCRIPTION	TOTAL (USD)
o Equipment modification	
Maxfoam Machine ()	**10,000**
Block Machine	**20,000**
M.C. Metering system, pumps flow control	**25,000**
o Misc Adjustments	**10,000**
o Ventilation system and control	**40,000**
o Training on safety and process	**20,000**
o Trial material	**50,000**
o Contingency and rounding	**20,000**
Total	**195,000**

6.2 OPERATING COSTS

Operating costs are detailed in Annex A. It is expected that ultimately the operating costs may decline but that this wil take considerable time. Over the customary four (4) eligible years, no decrease of costs are expected.

6.3 UNIT ABATEMENT COST

a) Capital Cost.....USD 195,000
b) Capital recovery ..... factor 0.16275
c) Incremental recurrent costs ..... -0-
d) CFC consumption.....120,000Kg

Unit Abatement Costs [[a(b)+c}/d] USD/kg/y 0.26

7. FINANCING PLAN

The company requests the reimbursement of the complete project costs estimated on

USD 195,000

8. PROJECT IMPLEMENTATION

8.1 MANAGEMENT

UNDP-OPS will oversee the implementation of this project, UNDP-ENR will provide technical assistance.

8.2 SCHEDULE

Implementation schedule will start with the approval of MLF and will end after monitoring has confirmed that at no place on the machine or in the working area unsafe levels of methylene chloride can be detected.

TASK	TIME FOR COMPLETION					
	Q1	Q2	Q3	Q4	Q5	Q6
1. Preparation Select equipment and order	x					
2. Installation Arrival, Machine modifications		x xxx				
3. Start up training Machine trial Safety training			xxx x			
4. Commissioning				x		

9. PROJECT IMPACT

This project will eliminate the use of at least 120 tons of CFCs in the first year of implementation. Market and company growth indicates that this may increase by 8% annually in subsequent years. The projects employs commercially and enviromentally acceptable technology.

10. Annexes

Annex - A - Incremental Recurrent cost
Anne - B - Technical Assessment

JSL/BV/CC
94-02-15

TECHNICAL ASSESSMENT

PROJECT TITLE: Pexafoam Sdn Bhd elimination of CFC-11 in the manufacture of flexible polyurethane foam (slabstock)

CATEGORY: Foamed Plastics-Flexible PUF Slabstock

RECOMMENDATION: The project is supported

INFORMATION: Adequate

TECHNOLOGY: Methylene Chloride is an acceptable replacement technology, provided sufficient precautions to assue workplace safety d for

REFERENCES: Similar projects in Egypt, China, India (in preparation) and Indonesia

ENVIRONMENTAL: There is no limitation in Malaysia on the emission of MC. The substance has a short lifetime, no ODP, and a very small GWP

SAFETY: Issues on workplace safety are a priority and adequately addressed in the project document

COST EFFECTIVENESS: Very good (as a standard similar UACs between 0.50 and 1.50)

OTHER ISSUES: Original comments pointed out to high costs (242,000), confusing choice of technology and insufficient documentation on operating costs. The project is adjusted accordingly

REVIEWER: Bert Veenendaal

DATE: February 15, 1994

Post-It™ brand fax transmittal memo 7671 | # of pages ▸ 3

To Cecelia	From Nancy
Co. UNDP	Co. Rappa
Dept.	Phone #
Fax #	Fax #

PROJECT COVER SHEET

COUNTRY:	**Malaysia**
PROJECT TITLE:	**Pulai Lamipak Industries Sdn.Bhd. elimination of CFC-12**
SECTOR COVERED:	**Foam Plastics**
ODS USE IN SECTOR:	**600 Tons CFCs (722 tons ODS) IN 1991**
PROJECT IMPACT:	**50 tons CFC-12 per year**
PROJECT DURATION:	**Nine Months**
TOTAL PROJECT COSTS:	**USD 410,000 Incr. Capital Cost USD 55,000 Incr. Recurrent Benefits**
PROPOSED MLF GRANT:	**USD 355,000**
COST EFFECTIVENESS:	**USD0.98/kg/yr**
NATIONAL COORDINATING BODY:	**Malaysia Department of Environment (DOE)**
IMPLEMENTING AGENCY:	**UNDP**
APPRAISAL DATE:	**December 5, 1993**

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PROJECT SUMMARY

Pulai Lami Pak Sdn Bhd (Pulai) is one of Malaysia's three manufacturers of EPS/EPE foam sheet. Its products are aimed at the packaging market. The company is a Malaysian owned private sector enterprise. CFC-12 is currently used in the production process. Under this project, Pulai will eliminate the use of CFCs in this process through replacement by L.P.G./alcohol resulting in an annual reduction of 50 tons ODS. The project contains safety features to address the hazards generated by the use of a flammable substance. The company expects no significant change in operating costs. The current building is suited for the use of a flammable substance provided it and the production equipment is modified for this use and appropriate safety procedures are followed.

TECHNICAL ASSESSMENT

The project has been reviewed and approved with modifications by Bert Veenendaal from UNDP's Technical Review Panel. His comments are attached.

PROJECT OF THE GOVERNMENT OF MALAYSIA
ELIMINATION OF CFCs IN THE MANUFACTURE OF EXTRUDED POLYETHYLENE FOAM SHEET AT PULAI LAMIPAK INDUSTRIES SDN.BHD.

1. PROJECT OBJECTIVE

The object of this project is to phase out the use of CFCs in the manufacture of EPE foam sheet at Pulai Lamipak Industries Sdn.Bhd.

2. SECTOR BACKGROUND

The CFC consumption in the foam sector in Malaysia is estimated to have reached at least 600 tons in 1991. CFC-11 (polyurethane foams) and CFC-12 (Polystyrene and polyethylene foam sheet) are the dominant substances in this sector, with much smaller usage of MCF, CFC-114 and CFC-115.

3. ENTERPRISE BACKGROUND

Pulai Lamipak Industries Sdn. Bhd. was established in 1988. The 100% locally owned companies are specialized in the extrusion of expanded polyethylene (EPE) foam sheet. The company is located in Ipoh, Malaysia. Main markets are the protective packaging and electronic industries.

4. PROJECT DESCRIPTION

Pulai Lamipak Industries Sdn.Bhd. utilizes annually about 50 tons CFC-12 in the manufacture of EPE foam sheet. L.P.G. and alcohol is selected as the replacement choice, as isobutane--the preferred candidate--is not available. It is possible to adapt the existing equipment for this purpose. In addition to process related equipment changes, safety related modifications in the production environment have to be implemented to mitigate fire and explosion hazards from the use of L.P.G. Finally, extensive production and safety training is needed to guarantee a smooth and safe operation and to conform to the strict fire standards in Malaysia.

5. TECHNOLOGY

5.1 OVERVIEW AND SELECTION

There are only a few options available in Malaysia to replace CFC in the production of EPE foam sheet, such as:

- o L.P.G.
- o L.P.G. and alcohol
- o 70% n-butane/30% isobutane blend
- o isobutane
- o HFC-134A
- o HFC-152a

A summary of these technologies, their potentials and their limitations is provided through the UNEP Technical Options Committee bi-annual review and through general review papers from UNDP.

L.P.G. and alcohol is selected by the company as an alternative is:

- Proven technology; in processing and product performance
- Environmentally acceptable as an interim solution,
- Low in toxicity,
- Adaptable to the existing equipment

The purpose of the alcohol is to "buffer" the L.P.G. and ____ to obtain a consistent boiling temperature.

A draw back of L.P.G. and alcohol is the high flammability requiring stringent safety precautions.

Users of Hydrocarbons are subject to stringent fire regulations, including the appointment and training of company safety experts for every shift. The emission of L.P.G. or alcohol is not regulated in Malaysia, nor are restrictions expected in the foreseeable future.

5.2 PRODUCTION PROCESS

The use of L.P.G. and alcohol will require substantial changes in the production process and storage facilities.

Required equipment modifications and additions should include:

- Plant Exhaust System
  - The plant/warehouse air must be moving at all times
  - Exhaust ducts mounted at floor level and parallel to the foam extrusion line.
  - Exhaust ducts to draw fresh air across the plant floor in the foam storage area.
  - The plant and warehouse air should be changed every hour.
  - The Lower Explosive Level (LEL) for LPG is 0.5%
  - Target level of LPG in the plant should be less than 0.05%.
  - The exhaust fans do not need explosion proof motors.

- Extrusion Exhaust System
  - Extrusion line should have its own system that targets specific areas
  - Feedthroat, injection port, die/sizing mandrel, foam sheet path or winder.

- Ceiling Fans
  - Production area and the warehouse should have ceiling fans spaced 10 to 13 meter apart.
  - Fans should run continuously and will keep the air circulating to prevent pockets of LPG from building up.

- Foam Storage
  - Air must be moving at all times by using ceiling circulating fans and wall mounted exhaust fans at floor level.

- Fans spaced 10 to 13 meter apart with louvred openings located on the wall opposite the exhaust fans.
- Exhaust ducts to draw fresh air across the plant floor in the foam storage area.
- Polyethylene bags used to package rolls should have holes to allow the LPG to flow out of and fresh air to flow in.
- The holes are about 12 to 14 mm in diameter and spaced about 150 to 200 mm apart.
- Stack rolls on pallets to circulate air around the rolls more easily.
- Ideal temperature for polyethylene foam storage is approximately 120°F(48.88°C).

- Humidifying the Plant
  - Monitoring device to measure relative humidity with automatic humidifying system that atomizes water and sprays it into the air.
  - The plant's relative humidity should be kept at a level of at least 50 to 55%.

- LPG Sensing Equipment
  - LPG monitoring device to detect its level near bulk storage tank, high pressure pump, extruder and surrounding area, reclaim grinder, converting area and foam storage area.
  - Automatic shutdown of LPG when sensor monitor exceeds preset limit.
  - Handheld LPG Sensor to monitor the LPG throughout the plant.
- Blk Storage Tank
  - Installation and location of hydrocarbon blowing agents systems are subject to compliance with Federal, State and Local regulations. The recommended design pressure for a hydrocarbon blowing agent container is 250 psig. This will allow storage of propane which exerts the maximum vapor pressure.
  - The tank should have an electrically/pneumatically operated shutoff control valve on the outlet pie of the tank that can be activated from within the plant. In addition, the electrical power supply to the tank should shutoff from within the plant as well as at the tank.
  - There should be a pneumatically/manually operated shutoff valve just prior to the high pressure pumps.

- High Pressure LPG Pump with flow monitoring and control system and automatic shutoff.

- High Pressure Blending System to blend LPG and alcohol.

- Ventilation Supply Blower System
  - Air supply blowers should be installed to supply fresh air to electrical equipment located in areas that can develop high levels of LPG. The blowers create a positive pressure within the electrical units and should

be used with the extruders control panel, main drive motor, underneath the extruder base frame where the oil circulating pumps are located for the transmission and the thrust bearing assemblies, the shed that houses the high pressure LPG pump, the sizing mandrel blowers that supply air to the inside and outside foam surfaces.

- Ionized Air Blower
  - Ionized air is blown into foam surfaces to neutralize static charge build-up. The blowers should be placed on the take-off equipment so that the ionized air is blown onto the foam web at the sizing mandrel stand, S-wrap/pull rolls, winder, reclaim grinder and converting equipment.

- Clothing
  - The operators should be given static resistant shoes and clothing.

- Shipping Precautions
  - If LPG blown foam is placed in an enclosed container such as a truck trailer, the driver must use care when opening the trailer doors. This is especially true when ambient temperatures are above 10°C. The driver should guard against generating any sparks and should not smoke or use an open flame near the truck.

- Customer Precautions
  - Customers that convert foam with a slitter, perforator, poucher and/or sheeter should use Ionized Air Blowers to eliminate static build up.

Production and aging areas are to be separated from other working areas and fitted with sprinklers or otherwise protected against fire hazards.
Production and maintenance personnel have to be trained in the safe handling of hydrocarbons, in addition to production training.

Start-up trials will be necessary to adjust for formulation modifications, processing conditions and product evaluation.

The production process at Pulai Lami Pak Industries Sdn. Bhd. is currently not separated from the other working area. The EPE foam extrusion system needs to be moved to one side of the building along the back wall and a partition built to separate the system from the rest of the plant's equipment and storage area. Hydrocarbon gas and temperature alarm systems will be installed throughout this building. The L.P.G. bulk storage tank will be located in the front of the building and protected with L.P.G. sensors and deluge sprinkler system. Large fire extinguishers will be staged at all critical places; portable fire extinguishers will be placed at every entrance. Initial and follow-up fire safety training will be implemented. Production and maintenance personnel will also be trained in the safe handling of hydrocarbons, in

addition to production training.

Start-up trials will be made to adjust for the different formulations and processing conditions. The start-up will be supervised by a process specialist.

6. PROJECT COSTS

6.1 Capital Costs

The following is a summary of the expected costs of investment and related activities (in USD):

Description	Costs
Exhaust System	25,000
Separation Wall	2,000
Humidity Monitor and Control System	10,000
Grinder Modifications	2,500
High Pressure Pump and Control System	46,500
L.P.G. Blending System	25,000
Air Pressurization Systems	3,000
Bulk Storage Tank	80,000
Bulk Storage Tank-Deluge System	15,000
Ceiling Fans	5,000
Simco Antistatic Blowers and Bars	8,000
L.P.G. Plant Sensing System	35,000
Hand Held L.P.G. Sensor	1,000
Clothing	2,000
Cast Aluminum heaters (explosion proof terminal boxes)	3,500
Melt Blender	15,000
Surface Winder	55,000
Technology Transfer	25,000
Pre/Post Assessment	10,000
Contingency/Rounding	41,500
TOTAL	$410,000

The costs are based on information from a recently completed project in Malaysia (equipment modifications, safety systems), from local suppliers Tank) and from UNDP (training, technology transfer).

6.2 OPERATING COSTS

The following are the current costs for CFC-12 and its intended replacement, L.P.G.

CFC-12	$2.09 USD/kg
LPG	0.50 USD/kg

The use of L.P.G. requires the addition of an anti-shrinkage agent. Costs are assumed at USD 30/ton resin, or--given a resin use of 400 tons for 1991--USD 0.24 per kg blowing agent. A 1:1 replacement of

CFC-12 by L.P.G. is assumed. This amounts to an expected annual decrease in material costs of:

USD 62,500

This has to be held against higher costs in maintenance, insurance, safety monitoring and ongoing safety training. These costs are estimated on USD 45,000/year.
The resulting annual cost saving of USD17,500 translates in a net present value (4 years/10%) of:

USD 55,000

6.3 UNIT ABATEMENT COST

a)	ODS Reduction Project Costs	USD 410,000
b)	Annual Incremental Benefits	USD 17,500
c)	Capital Recovery Factor	0.16275
d)	ODS Reduction/Year	Kg 50,000
	Unit Abatement Costs [(a/c+b)/d]	USD/kg/year 0.98

7. FINANCING PLAN

The company requests the reimbursement of the complete project costs estimated on

USD 355,000

8. PROJECT IMPLEMENTATION

8.1 MANAGEMENT

UNDP will oversee the implementation of this project and provide technical assistance.

8.2 SCHEDULE

Implementation schedule will start with MLF approval of the projects and will end after monitoring has confirmed that at no place on the machine or in the working area unsafe levels of hydrocarbon can be detected.

TIME FOR COMPLETION

Task	Q1	Q2	Q3	Q4	Q5	Q6
1. Preparation MFL Approval Visit Consultant Order Confirmation						
2. Installation Machine Modifications Tank Installation Safety Devices						
3. Start-up, Training Machine Start-up Safety Training Commissioning						

8.3 PROCUREMENT

UNDP will oversee the procurement. UNDP expects at about the same time to procure 3-5 similar projects, resulting in procedural and cost efficiencies. Assistance will be provided by the local UNDP and Westech/Malaysia.

9. PROJECT IMPACT

This project will eliminate the use of at least 50 tons of CFCs in the first year of implementation. The project employs commercially and environmentally acceptable technology.

10. ANNEXES

Annex A- Technical Assessment

TIME FOR COMPLETION

Task	Q1	Q2	Q3	Q4	Q5	Q6
1. Preparation MFL Approval Visit Consultant Order Confirmation						
2. Installation Machine Modifications Tank Installation Safety Devices						
3. Start-up, Training Machine Start-up Safety Training Commissioning						

8.3 PROCUREMENT

UNDP will oversee the procurement. UNDP expects at about the same time to procure 3-5 similar projects, resulting in procedural and cost efficiencies. Assistance will be provided by the local UNDP and Westech/Malaysia.

9. PROJECT IMPACT

This project will eliminate the use of at least 50 tons of CFCs in the first year of implementation. The project employs commercially and environmentally acceptable technology.

10. ANNEXES

Annex A- Technical Assessment

DK/BV/CC
94-02-15-02

(212)906-6947

TECHNICAL ASSESSMENT

PROJECT TITLE:	**PULAI LAMIPAK INDUSTRIES Sdn. Bhd.** elimination of CFC-12
CATEGORY:	Foamed Plastics; Thermoplastic Foams (polyethylene foams)
RECOMMENDATION:	The project is supported
INFORMATION:	Adequate. Very complete on safety and technology
TECHNOLOGY:	Acceptable. The use of alcohol as a buffer to stabilize the quality (boiling point) of LPG is a simple and cost effective solution that can be applied there where butane or pentane is not available
REFERENCES:	Similar projects in China, Egypt, India, Indonesia, Malaysia, The Philippines and Thailand
ENVIRONMENTAL:	LPG is a VOC and photochemically active. Emerging regulations to be monitored
SAFETY:	The risks related to the flammability of butane are adequately addressed. UNDP has asked the process specialist who prepared this project to developed a safety manual that could be passed out to previous and future recipients
COST EFFECTIVENESS:	The costs are acceptable, in about the middle range of UACs for similar projects
OTHER ISSUES:	None
REVIEWER:	Bert Veenendaal
DATE:	February 10, 1994

PROJECT COVER SHEET

COUNTRY:	**Malaysia**
PROJECT TITLE:	**P.U. MATE SDN BHD elimination of CFCs in the manufacture of integral skin polyurethane foam**
SECTOR COVERED:	**Foamed Sector**
ODS USE IN SECTOR:	**600MT CFCs (722 tons ODS) in 1991**
PROJECT IMPACT:	**10MT of CFC-11**
PROJECT DURATION:	**One year, after MLF approval**
TOTAL PROJECT COSTS:	**USD 105,000 incremental capital cost USD 8,000 Incremental recurrent cost**
PROPOSED MLF GRANT:	**USD 113,000**
COST EFFECTIVENESS:	**USD2.80**
NATIONAL COORDINATING AGENCY:	**Malaysia Department of Environment (DOE)**
IMPLEMENTING AGENCY:	**UNDP**
APPRAISAL DATE:	**4th December 1993**

PROJECT SUMMARY

P.U. Mate Sdn Bhd is manufacturer of polyurethane integral skin foam (ISF) whose product is aimed at the furniture and automotive market. CFC-11 is currently used in the production process with a high pressure foaming machine. This project will eliminate the use of CFCs in its production process through reduced CFC technology combined with replacement of the residual CFC by HCFC 22, resulting in an annual reduction of 10MT of CFC-11 based on 1993 consumption. The company realizes that the use of HCFC-22 constitutes an interim solution. The equipment will be capable to employ emerging ODS free technologies such as carbon dioxide and HFCs as they mature. The Company expects an increase of recurrent incremental operating costs. This cost will be partly offset by lower losses in the preparation of blends and savings in cleaning solvents.

TECHNICAL ASSESSMENT

The project has been reviewed and approved with amendments by Bert Veenendaal from UNDP's Technical Review Panel. His comments are attached.

PROJECT OF THE GOVERNMENT OF MALAYSIA
P.U. MATE ELIMINATION OF CFCs IN THE MANUFACTURE
OF INTEGRAL SKIN POLYURETHANE FOAM

1. PROJECT OBJECTIVE

The objective of this project is to phase out the use of CFCs in the manufacture of integral skin polyurethane foam (ISF) at P. U. Mate Sdn Bhd ("P.U. Mate").

2. SECTOR BACKGROUND

The CFC consumption in the foam sector in Malaysia is estimated to have reached at least 600t in 1991. This is about 8% of the total ODS and 7% of the Malaysian ODP generation. CFC-11 (polyurethane foams) and CFC-12 (polystyrene and polyethylene foam sheet) are the dominant substances in this sector, with much smaller usage of MCF, CFC-114 and CFC-115.

3. ENTERPRISE BACKGROUND

P.U. Mate was established in 1992 and is a Malaysian owned private enterprise. The main products are polyurethane integral skin arm rest, head rest for the furniture and automotive industries. The company is expected to double the production by 1994.

4. PROJECT DESCRIPTION

P.U. Mate will utilize in 1993 about 10 t CFC-11 in the manufacture of ISF. A combination of reduced CFC technology and HCFC-22 is selected as the replacement of choice. Existing high pressure machine will be used, however, pre-blending equipment will have to be installed for this purpose. Some additional costs for trials will occur. In addition to equipment changes, recurring incremental operating costs are expected, related to higher isocyanate use and the use of HCFC-22. The costs of the project will be partly offset by lower losses of blowing agent in the blending operation (more efficient equipment and the proceeds from phased out equipment.

TECHNOLOGY

5.1 OVERVIEW

There are several options to replace CFCs in the production ISPUF, such as:

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

In addition, compounds such as methylene Chloride, and water blown technologies have been suggested, but these are immature in technology, limited availability or restricted applicability.

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 HFC-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) HFC's.

Pentane technology is lately commercial introduced on several occasions, but its flammable character requires safety conditions and limits its use.

5.2 SELECTION

A combination of reduced CFC technology and the use of HCFC-22 is selected by the Company as an alternative that is:

- Proven technology in processing and product performance,
- Environmentally acceptable,
- Available in the Malaysian market,
- Easy to convert to complete CFC-free technology.

6. PROJECT COSTS

6.1 TOTAL PROJECT COSTS

The following is a summary of the expected costs (in USD) of investment and related activities:

DESCRIPTION	AMOUNT (USD)
TRIALS, START UP	5,000
PRE-MIX STATION	65,000
FREIGHT,INSTALLATION	10,000
TRAINING, TECHNOLOGY TRANSFER	15,000
CONTINGENCY, ROUNDING	10,000
TOTAL	**105,000**

[Prices obtained from Impianti OMS, Italy]

6.2 OPERATING COSTS

Before:	15t CFC-11 @ 2,100 .....USD	31,500
After:	12t additional MDI @ 1,850 .....USD	22,200
	6t HCFC -22 @ 3,250 .....USD	19,500

INCREMENTAL MATERIAL COSTS .....USD	10,700
Savings on ABA .....USD	6,000
Savings on cleaning agent .....USD	2,500
RECURRENT INCREMENTAL COSTS .....USD	**2,200**
Net Present Value (4y; 10% discount)..USD	**8,000**

6.3 UNIT ABATEMENT COST

a)	ODS Reduction Project Costs	USD	105,000
b)	Annual Incremental Costs (base 1995)	USD	2,200
c)	Capital Recovery Factor (10%; 10y)		0.16275
d)	ODS Reduction/Year	Kg.	10,000
Unit Abatement Costs [{a(c) + b}\d]		**USD/KG/Y**	**3.11**

7. FINANCING PLAN

The company requests the reimbursement of the complete project costs estimated on

USD 113,000

8. PROJECT IMPLEMENTATION

8.1 MANAGEMENT

UNDP-OPS will oversee the completion of this project, and will provide technical assistance.

8.2 SCHEDULE

Implementation schedule will start with MLF approval of the project and will end after trials have confirmed that acceptable product can be made in the new configuration. A detailed activity schedule is provided in the following table:

TASK	TIME FOR COMPLETION					
	Q1	Q2	Q3	Q4	Q5	Q6
1. Preparation						
MLF Approval	x					
Procurement Preparation		x				
Order Confirmation		x				
2. Installation						
Arrival, Customs			x			
Machine Installation				x		
Start-up, Trials				xx		

8.3 PROCUREMENT

UNDP will oversee the procurement, and provide technical support assisted by Westech/ Malaysia.

9. PROJECT IMPACT

This project will eliminate the use of at least 10 tons of CFCs in the first year of implementation. The project employs commercially available and environmentally acceptable technology.

10. ANNEXES

Annex A - Technical Assessment

JSL/BV/CC
94-02-14

TECHNICAL ASSESSMENT

PROJECT TITLE:	P.U. MATE Sdn Bhd elimination of CFCs in the manufacture of integral skin polyurethane foam
CATEGORY:	Foamed Plastics-Semi-Rigid PUF
RECOMMENDATION:	The project is supported
INFORMATION:	Adequate
TECHNOLOGY:	HCFC-22 is an acceptable interim replacement technology, provided the company is committed to follow-up with a permanent solution as soon as mature technology is available. the equipment is designed to be capable to allow may of such technologies without modification
REFERENCES:	Similar projects in Malaysia and Indonesia
ENVIRONMENTAL:	HCFC-22 has a (small) residual ODP
SAFETY:	No particular issues
COST EFFECTIVENESS:	Good (as a standard: similar projects have UACs between 3.00 and 4.00)
OTHER ISSUES:	The original document was improved on capital and operational costs after initial comments
REVIEWER:	Bert Veenendaal
DATE:	February 16, 1994

PROJECT COVER SHEET

COUNTRY:	**Malaysia**
PROJECT TITLE:	**N.Y.L Sdn Bhd elimination of CFC-11 in the manufacture of flexible polyurethane foam (slabstock)**
SECTOR COVERED:	**Foam**
ODS USE IN SECTOR:	**600MT CFCs (722 tons ODS) in 1991**
PROJECT IMPACT:	**55MT of CFC-11**
PROJECT DURATION:	**One year**
PROJECT USEFUL LIFE:	**7 years**
TOTAL PROJECT COSTS:	**USD 130,000**
PROPOSED MLF GRANT:	**USD 130,000**
COST EFFECTIVENESS:	**USD0.38**
NATIONAL COORDINATING AGENCY:	**Malaysia Department of Environment (DOE)**
IMPLEMENTING AGENCY:	**UNDP**
APPRAISAL DATE:	**3rd December 1993**

PROJECT SUMMARY

N.Y.L Sdn Bhd is one of Malaysia flexible polyurethane foam (slabstock) manufacturer. N.Y.L. produces a wide range of polyurethane flexible foam marketed to mainly furniture and packaging industry. CFC-11 is presently used in production process. Through this project, N.Y.L will eliminate the use of CFC-11 by converting to Methylene Chloride. A new equipment with all the necessary parts to cater for the use of Methylene Chloride will be installed and proper training on the safe handling of Methylene Chloride is foreseen. The project covers only the incremental costs related to the use of Methylene Chloride.

TECHNICAL ASSISTANCE

The project has been reviewed and approved with modifictions by Bert Veenendaal from UNDP's Technical Review Panel. His comments are attached.

PROJECT OF THE GOVERNMENT OF MALAYSIA
N.Y.L SDN BHD ELIMINATIONN OF CFC-11 IN THE MANUFACTURE OF FLEXIBLE POLYURETHANE FOAM (SLABSTOCK)

1. PROJECT OBJECTIVE

The objective of this project is to phase out the use of CFC-11 in the manufacture of flexible polyurethane foam at N.Y.L Sdn Bhd.

2. SECTOR BACKGROUND

The CFC consumption in the foam sector in Malaysia is estimated to have reached at least 600t in 1991. This is about 8% of the total ODS and 7% of the Malaysian ODP generation. CFC-11 (polyurethane foams) and CFC-12 (polystyrene and polyehtylene foam sheet) are the dominant substances in this sector, with much smaller usage of MCF, CFC-114 and CFC-115.

3. ENTERPRISE BACKGROUND

N.Y.L. Sdn Bhd is a Malaysian owned private enterprise and was founded by Mr William Tay in 1989. The Company produces only flexible polyurethane foam and are mainly marketed to the furniture industry.

4. PROJECT DESCRIPTION

N.Y.L. Sdn Bhd utilised about 52MT of CFC-11 in the manufacture of flexible polyurethane foam. Methylene Chloride has been chosen as a prefered alternative as the technology is commonly available. Since the Company has plans to purchase a new equipment. This will be modified to use Methylene Chloride. In conjunction with that, safety related modifications in the production environment and safety training is planned to ensure a smooth and safe operation. A regulation is expected to be enforced by the government to ban the use of CFCs in the manufacture of flexible polyurethane foam, by the middle of 1994.

TECHNOLOGY

5.1 SELECTION

There are numerous technologies to replace the use of CFCs in flexible foam by non ODS or low ODS options. It is referred to literature from UNEP and UNDP on this subject. Management of N.Y.L. decided, after attending seminars in Singapore and Jakarta,

to opt for the use of an alternative blowing agent--methylene chloride--for the slabstock production.

The combination of these technologies will allow replacement of CFCs in a cost effective way, without unacceptable losses in performance and processing. Pre-condition is however a well planned reformulation program to implement adjustments in the amount of bblowing agent as well as in the amount and type of catalysts.

Also, workplace concentrations of methylene chloride have to be limited to acceptable industrial hygienic standards.

5.2 PRODUCTION PROCESS

The modification needed to implement the use of methylene chloride as a blowing agent include:-

- Extra metering systems,
- Encapsulation, ventilation,
- Fall plate modification,
- Reformulation,

Safety and process training for production staff and personnel will also be needed. The new equipment will be changed to installed parts that able to handle methlyene chloride.

6. PROJECT COSTS

6.1 Operating Cost

The following is a summary of the expected costs of investment and related activities:-

	DESCRIPTION	TOTAL (USD)
o	M.C metering system (pumps flow control)	25,000
o	Ventilation system and control	40,000
o	Training on safety and process/ technical transfer	20,000
o	Trial material	30,000
o	contigency and rounding	15,000
	Total	130,000

6.2 OPERATING COSTS

It is expected that the operating cost of using methylene chloride may decline, however, this will only happen when the company has obtained sufficient experience of handling methylene chloride. Therefore, it is assumed that no recurrent incremental cost will be incurred. Annex A provides a more detailed calculation.

6.3 UNIT ABATEMENT COST

a) Capital Cost.....USD130,000
b) Capital Recovery .....factor .16275
c) Incremental recurrent costs .....
d) CFC consumption.....55,000Kg

Unit Abatement Costs [a(b) + c)/d USD/kg/y 0.38

7. FINANCING PLAN

The company requests the reimbursement of the complete project costs estimated at

USD 130,000

8. PROJECT IMPLEMENTATION

8.1 MANAGEMENT

UNDP-OPS will oversee the implementation of this project, and provide technical assistance.

8.2 SCHEDULE

Implementation schedule will start with the approval of the MLF and will end after monitoring has confirmed that at no place on the machine or in the working area unsafe levels of methylene chloride can be detected.

TASK	TIME FOR COMPLETION					
	Q1	Q2	Q3	Q4	Q5	Q6
1. Preparation						
Order equipment and confirmation	x					
2. Installation						
Arrival,		x				
Machine modification		x				
Tank installation		x				
Safety devices		x				
3. Start up training						
Machine starting			x	x		
Safety training				x		
4. Monitoring				x		

9. PROJECT IMPACT

This project will eliminate the use of at least 55MT of CFC-11 in the first year of implementation. Market and company growth indicates that this may increase by 8% annually in subsequent years. The projects employs commercially and enviromentally acceptable technology.

JSL/BV/CC
94/02/15/02

TECHNICAL ASSESSMENT

PROJECT TITLE: NYL Sdn Bhd elimination of CFCs in the manufacture of flexible polyurethane foam (slabstock)

CATEGORY: Foamed Plastics-Flexible PUF Slabstock

RECOMMENDATION: The project is supported

INFORMATION: Adequate

TECHNOLOGY: Methylene Chloride is an acceptable replacement technology, provided sufficient precautions to assure workplace safety

REFERENCES: Similar projects in Egypt, China, India and Indonesia

ENVIRONMENTAL: There is no limitation in Malaysia on the emission of MC. The substance has a short atmospheric lifitime, no ODP and a very smal GWP

SAFETY: Issues on Workplace safety are priority with the use of MC, a hazardous chemical. This is adequatelt addressed in the project document

COST EFFECTIVENESS: Very good (as a standard: similar projects have UACs between 0.50 and 1.50)

OTHER ISSUES: Original comments pointed out insufficient documentation on operating costs. The project is adjusted accordingly

REVIEWER: Bert Veenendaal

DATE: February 15, 1994

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To Cecelia	From Bert
Co. UNDP	Co. Rappa
Dept.	Phone #
Fax #	Fax #

PROJECT COVER SHEET

COUNTRY:	Malaysia
PROJECT TITLE:	Safety and Technical Programme to Aid Manufacturers of Aerosol Products
SECTOR COVERED:	Aerosols
ODS USE IN SECTOR:	350 MT in 1991
PROJECT IMPACT:	Reduced potential for fires and injuries from use of flammable hydrocarbon gas propellant substitutes
PROJECT DURATION:	24 months
TOTAL PROJECT COSTS:	$235,700
PROPOSED MLF GRANT:	$235,700
NATIONAL IMPLEMENTING ENTERPRISE:	Aerosol Industrial Working Group
NATIONAL COORDINATING AGENCY:	Malaysia Department of Environment (DOE)
IMPLEMENTING AGENCY:	UNDP

PROJECT SUMMARY

In Malaysia, there have been two major fires in plants which had recently gone through the process of changing to the use of hydrocarbons as aerosol propellants. To reduce the potential for further, similar incidents, Enterprises who are in similar transitional positions, as well as the smaller enterprises who have no idea of the safety requirements for hydrocarbons, will be addressed under this project, and the project will deliver safety audits for the enterprises, along with recommendations to correct deficiencies and enhance safety of the sites who are either converting, or are anticipating converting.

PROJECT OF THE GOVERNMENT OF MALAYSIA:

Safety and Technical Programme to Aid Manufacturers of Aerosol Products

1. PROJECT OBJECTIVE

The objective of this project is to ensure the safe and effective use of hydrocarbon propellants at Aerosol Manufacturing sites in Malaysia.

2. BACKGROUND OF THE SECTOR AND THE ENTERPRISES IN THE SECTOR

In 1991, the use of ODS in Malaysia Aerosol applications has been estimated at approximately 350 metric tonnes per year. In 1991, however, a number of enterprises had already phased out of CFCs and switched to hydrocarbon technology, which has led to an estimate of more than 1000 MT/yr consumed initially by Malaysia, at about the time of the signing of the Montreal Protocol. The DOE has set a target date of the end of 1995 for the phase out of CFCs in the Aerosol sector. Conversion has largely been to propane/butane, and the companies who have converted, are doing the purification of these gases at their filling sites.

About 200-400 metric tonnes of CFCs are still being consumed in the sector, by the smaller companies among the estimated 40 aerosol filling enterprises in Malaysia.

The strategic plan for the phaseout of Aerosols in Malaysia calls for the establishment of a filling center to service some of the small and mid-sized enterprises which cannot convert to hydrocarbons due to where they are located. For those enterprises who are larger, or are more acceptably located, conversions to hydrocarbon propellants is the technology of choice. The conversions to date have taken place mainly in the larger enterprises. Many of these enterprises are still in the process of conversion of their various product lines, and have been recently shaken by 2 major hydrocarbon based fires in Malaysia, where the plants were completely destroyed.

3. TECHNOLOGY DISCUSSION

Hydrocarbons (HCs) are the most commonly used substitutes for CFCs in aerosol propellants. They account for 80% of worldwide conversions from CFCS and about 90% of current aerosol propellant used in the United States. Advantages of HCs include their widespread availability, low cost, non-toxicity, and good dispersion characteristics.

While HCs provide a cost effective propellant alternative, these gases are also very flammable and/or explosive. Because their flashpoints are extremely low, any fire or apark can ignite these hydrocarbons at ambient temperatures, and experience has shown that the resulting fires or explosions can be devastating. In order to prevent these gases from igniting or exploding, the concentration of hydrocarbons in the air must be kept below the lower explosive limit. Fugitive emissions, e.g. minor leaks from valves, etc., must be prevented and routinely audited. Potential low point accumulations must be corrected via surveys and proper air movement designs, and all potential sources of ignition, or energy that would support ignition, must be eliminated from the area where the hydrocarbons have potential to be released. Plant operations personnel and managers need to know what to look for, how to observe and test manufactured product and operating equipment, and what operating procedures and sequences are considered safe in the handling and use of hydrocarbon gases.

The intrinsic flammability of these gases requires special care in the following areas:

a) propellant receiving and storage
b) propellant filling of containers
c) in-plant storage of filled aerosol products
d) disposal of defective, filled test units
e) laboratory operations

4. PROJECT DESCRIPTION

The focus of this project is to bring improved knowledge, and therefore, improved capability to those enterprises in the sector who are in various stages of the process of conversion, or who are about to embark on the process of conversion away from CFCs to hydrocarbons (HCs). This will be accomplished by bringing them safety training and technical assistance in the form of safety audits at the various sites. The follow up to this set of activities will be to tailor specific programmes and timing that will lead to correction of deficiencies found, as well as fundamental elements to be put into place before proceeding on a conversion project at those enterprises who have not yet started to convert.

To raise awareness of the safety hazards and mitigation strategies, the safety and technical assistance programme will consist of six main components:

a) plant safety audits
b) training programme and implementation
c) provision of safety equipment
d) follow up
e) information awareness programme
f) transfer of project experience to other Article V countries

a) Plant Safety Audits

Those companies who have started to transition ,or are currently using flammable propellant gases, will be selected and then visited by a team of experts, consisting of an international and a local aerosols expert, where hazards and/or potential safety enhancements will be identified. The report will include those items that were identified, the changes needed to make improvement, and it will identify costs and benefits associated with action to be taken to address the items identified.

b) Hands - On Training Programme

Representatives from the enterprises will be invited to participate in a training programme. The programme will address the special circumstances of each company and will focus on the recommendations from the safety audits. Where LPG storage tanks and cylinders are to be used, local fire fighting personnel will be asked to develop a schedule for implementing the recommendations, and will schedule plant visits to ensure that such recommendations are being implemented. Most training materials will be translated into Bahasa Malaysia.

c) Provisions of Safety Equipment

Where determined by the experts, those enterprises will be identified that may be eligible to receive provisions of safety equipment, which could include aerosol crimp gauges, portable gas detectors, portable fire extinguishers, and manual gassing adapters. The proper use of crimp gauges will greatly reduce the risk of warehouse fires caused by hydrocarbon leaks due to poor crimping. Portable gas detectors, although not robust, do provide an excellent means for plant management to identify problem areas within the facility. Manual gassing adapters are often sources of gas leakage, and changing to new adapters will nearly always result in an improvement in the safety of a filling operation.

d) Follow Up

Two follow up visits will be made to each facility. The first will be made by a local and an international expert, who will spend a day at a facility, review programmes and correct problem areas. The second visit will generally be made by the local expert, and the international will only be invited if the local expert deems it necessary.

e) Information Awareness

Many of the smaller companies who have not yet embarked on a programme to replace CFCs, will be invited to participate in a technical workshop that explains the government strategy and preferred technologies, the safety considerations and requirements in making a conversion, and the options available for phasing out - including the option of contract filling. At the workshop, a list of companies needing to phase out will be

developed, including the preferred technology for the enterprise. Additionally, consumers will be given an awareness campaign to educate them on the changes in products resulting from the switch to hydrocarbon containing propellants in Malaysia's aerosol cans.

f) Transfer of Project Experience to other Article 5 Countries

Expertise, educational materials, and products from the training programme can be used in the global aerosols project to transfer from Malaysia to other Article 5 Countries. Those lessons learned in Malaysia could be used to adapt the project to other countries. This would result in savings in project preparation, and the effective use of developing country expertise

5 PROJECT COSTS

As detailed in Annex A, the total cost is US $ 235,700. Because there are no operational costs, ODS savings, or non-ODS investment costs in this project, the total cost is also the incremental cost.

6 PROJECT MANAGEMENT

DOE shall be the overall supervising and oversight agency, and will be responsible for the implementation of this project, through the Aerosol Industrial Working Group.

7 SCHEDULE

TASK	1994	1995		1996	
	2H	1H	2H	1H	2H
Safety Audit	X X				
Safety Training Seminar		X X			
Safety Equipment		X X			
Follow Up Visit 1			X X		
Follow Up Visit 2				X	

8 **PROJECT IMPACT**

While this project will not directly eliminate any ODS, it will ensure that the CFC phaseout in the Aerosol sector continues to maintain its momentum, and is not resisted by an industry that has begun to become hesitant, based on some recent catastrophes experienced in the sector. Additionally, aerosol filling plants in Malaysia will receive significant improvements in manufacturing safety and in worker safety.

ANNEX A

PROJECT COSTS (US $)

Safety Audits, Training Workshop, and Followup visits

1	Plant Safety audit - approximately 15 to 18 plants	$ 15,000
2	Plant training programme and workshop - 3 day workshop, plus visits to sites for followup training and survey, as requested by attendees to the workshop and those who were audited.	$ 18,500
3	Follow up visits to selected sites where improvements are needed	$ 28,800
4	Air travel for international aerosol consultant	$ 24,000
5	Translation of training materials into Bahasa Malaysia	$ 8,000
6	Miscellaneous expenses	$ 5,000
	sub-total	$ 99,300

7	Information awareness campaign for small companies and consumers sub-total	$ 25,000
8	Safety Equipment for Aerosol manufacturers - approximately 15 to 20 enterprises.	
8a	2 each 6 kg CO2 fire extinguishers	$ 250
8b	2 each 12 kg ABC fire extinguishers	$ 250
8c	1 set of aerosol crimp gauges	$ 1,500
8d	1 each portable gas detector	$ 1,500
8e	2 each manual gassing adapters	$ 2,500
	sub-total for each enterprise $6,000	
	number of enterprises 15	
	sub-total	$ 90,000
9	Contingency @10%	$ 21,400
10	**GRAND TOTAL**	**$235,700**

PROJECT OUTLINE

COUNTRY:	MALAYSIA
SECTORS COVERED:	All sectors
NATIONAL ODS CONSUMPTION:	4,194 metric tonnes in 1991
PROJECT TITLE:	Project preparation assistance
DURATION:	One year
PROJECT IMPACT:	Preparation of projects in the foams, solvents, aerosols, halons and refrigeration/airconditioning, sectors
PROPOSED BUDGET:	US$ 100,000
IMPLEMENTING AGENCY:	UNDP
NATIONAL COORDINATING AGENCY:	Department of Environment

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PROJECT DESCRIPTION

ODS consumption in Malaysia has increased significantly over the last few years. National ODS consumption in 1991 was 4,194 tonnes distributed as follows: refrigeration/AC (56.3%), solvent cleaning (26.6%), foams (7.8%), aerosols (4.7%) and halons (4.6%) respectively.

Malaysia has been striving to accelerate its ODS phaseout programme. At the request of the Government, the Executive Committee at its 10th Meeting in June 1993 had approved $50,000 for UNDP project preparation assistance in Malaysia. Over $54,000 has already been expended to date under this project. The results of UNDP's project preparation activities in Malaysia have been the following:

a) One project has been completed that has effectively phased out 150 tonnes/year of ODS.
b) Seven projects (3 solvents, 4 foams) amounting to $1.8 million were approved for UNDP implementation during the 11th Executive Committee Meeting.
c) Twelve projects (3 solvents, 8 foams, 1 aerosols) amounting to $3.5 million have been submitted for approval at the 12th Executive Committee Meeting.

The Government of Malaysia has indicated that further UNDP assistance is required in project preparation and finalization in the foams, solvents, aerosols, refrigeration/airconditioning and fire extinguishing sectors. The funds will be used for the recruitment of international and national experts working jointly in these areas.

The Government requests Executive Committee approval for $100,000 for this purpose.

PROJECT PROPOSAL REPORT

COUNTRY:	Mauritius
PROJECT TITLE:	Compagnie Manufacturiere de Produits Cosmetiques Itee - (COMANU) Aerosol Conversion Project
SECTOR COVERED:	Aerosols
ODS USE IN SECTOR:	25 tons CFC 12 (25 tons ODP) in 1992 5 tons CFC 12 (5 tons ODP) in 1993 (estimate)
PROJECT IMPACT:	Phase out 25 tons per year of CFC 12 (25 tons ODP).
PROJECT DURATION:	12 months
PROJECT ECONOMIC LIFE:	10 years
TOTAL PROJECT COST:	U.S. $124,300.00
PROPOSED OTF FINANCING:	U.S. $124,300.00
IMPLEMENTING ENTERPRISE:	COMANU
COORDINATING NATIONAL BODY:	THE MINISTRY OF THE ENVIRONMENT AND QUALITY OF LIFE
IMPLEMENTING AGENCY:	UNDP

IMPORTANT NOTE:

The "ODS USE IN SECTOR" AND "PROJECT IMPACT" data given above appear contradictory, but they are not. A full explanation appears in the text of this project proposal.

PROJECT SUMMARY:

COMANU is a contract packager of aerosols, with 100% Mauritian capital. In 1992 we converted all of our customers from CFCs to CO_2 propellant. Our largest client is the UNILEVER company, but other clients were also effected. This proved to be a very poor choice, as CO_2 aerosols (most are perfumes and deodorants) are not living up to the performance expectations of the public.

We now understand that this conversion was not proper; that CO_2 is technically not a viable alternate propellant for aerosol perfumes and deodorants. We must either return to CFCs, or convert again to a flammable propellant, hydrocarbon aerosol propellant (HAP) or dimethyl ether (DME). As we do not have sufficient capital to convert to a flammable propellant without financial assistance, if this project is not approved we will have no option but to return to CFCs, at about our 1991 volume of consumption, approx. 25 m.t. per year.

This project (if approved) will accomplish the conversion to hydrocarbon (HC) propellants at COMANU. We have good machinery, completely explosion proof, that does not require replacement. Our existing facility has little unoccupied space, not quite sufficient to use of the "open air filling room" (OAFR) method. The UNEP aerosol consultant that visited us in May recommended an enclosed explosion proof filling room.

We will require 2 conveyors to transport the cans from where the concentrate is filled to the gassing room and to return them to the packing area. Some safety equipment is needed. Startup/safety training will be done by a foreign expert.

PROJECT OBJECTIVES:

Avoid the use of 25 tons of CFC 12 annually at COMANU by completing the conversion process from CO_2, which isn't working, to HAPs. No consumption of CFC exists now, but it will exist if we are forced to return to using CFC 12 as a propellant.

SECTOR BACKGROUND:

COMANU is the largest filler of aerosols in Mauritius. There are three other fillers, Mauritius Cosmetics, Grays, Ltd. and Prince. COMANU accounts for well over 50% of all fillings, and traditionally has used about 80% of all CFCs in the aerosol sector.

Based on the April, 1993 aerosol study mission it would appear that the following estimates for CFC consumption in the aerosol sector are within reason:

1991	22.0 tons
1992	25.0 tons
1993	5.1 tons

What is perfectly certain is that a major reduction in the use of CFC in the aerosol sector has occurred. This reduction may be temporary, as COMANU's clients don't accept the results with CO_2; and if it is not possible to fill a flammable propellant, they will ask to return to CFC filled aerosols, and we will reluctantly be forced to oblige them.

Current findings would indicate that virtually the entire aerosol market is in perfumes and personal deodorants. This is unusual but not unknown (Ecuador is another case).

ENTERPRISE BACKGROUND:

COMANU was founded in 1982 with shareholders 100% Mauritian. This industry forms part of a large group of companies that sells automobiles, dyestuffs, pharmaceuticals, computers, etc. We do not manage any of our own brands - we are contract packagers

We are by far the largest aerosol filler in Mauritius, filling all of Unilever's brands - "Impulse", "Rexona" and "Axe", which are market leaders. Until several months ago, we also filled the important "Fa" brand, which has converted to a pump sprayer.

COMANU has 1 PAMASOL hand filling machine capable of filling 1,200,000 cans per year on a 1 shift basis. It is currently being used at about 30% of capacity.

PROJECT DESCRIPTION:

COMANU has enough space for on-going operations, but we cannot safely fill HAPs or DME "open air" at this plant. The lot is just slightly too small; and other buildings block the natural (wind) ventilation..

If this project is approved and financial assistance is forthcoming, we will purchase an explosion proof gassing room complete with dual speed ventilation systems, gas detectors, etc. This room will be installed outside the actual building where we now have a driveway. To transport the cans from the main building to the gassing room and to return them to the main building, 2 each 5 meter conveyor belts will be required.

There is a high tension transformer very nearby that must be moved a minimum of 5 meters. Simple safety equipment must be purchased and safety/startup training will be provided by a foreign expert.

JUSTIFICATION FOR ALTERNATE TECHNOLOGY SELECTION:

The difficulties involved in using CO_2 as a propellant for cosmetics is clearly indicated in the 1991 UNEP Technical Options Report on Aerosols, Sterilants, Miscellaneous Uses and Carbon Tetrachloride. CO_2 propelled deodorants are not acceptable to consumers.

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

Aerosol grade hydrocarbon propellant (HAPs) can be readily imported into Mauritius, and also DME although this appears to be a less satisfactory solution.

PROJECT COST:

The total project incremental cost of $113,000.00 plus 10% contingency was calculated as the economic capital cost (see "Recurring Costs/Savings" below).

Capital Costs:

$113,000.00 for the above specified equipment and training, plus 10% contingency.

Recurring Costs/Savings:

COMANU does only contract packaging, and that no client will accept the change from CFCs to HC without a reduction in price. As a contract filler COMANU receives no savings in conversion from 1 propellant to another. Immediate savings will go to the marketer, the owner of the brands packaged.

Further, the worldwide "free trade" movement that has resulted almost universally in reductions in import restrictions and tariffs is also affecting Mauritius. Our aerosols are increasingly competing with imported products that are filled with hydrocarbons. There is thus much pressure on local manufacturers to meet price competition from imports.

For this reason, it is not expected that any "savings" in propellant conversion would remain with the marketer. Our clients (aerosol product marketers) have generally already lowered prices to meet this competition, based on CO_2 propelled products, which have much the same costs as HAP propelled products (CO_2 is always less expensive than HAP, and much less is used; but it is necessary to use considerably more product concentrate, which is very expensive when perfumes and deodorants are filled. For these product categories, products filled with CO_2 and HAP usually cost out about the same).

Given the actual competitive situation, any slight savings that might occur would certainly quickly filter down from the marketers to the end consumer. It would never accrue to us at COMANU.

UNIT ABATEMENT COSTS:

The calculated unit abatement costs for this project is $0.81 per kilogram (see Annex #2) - See "Note #1 above".

IMPLEMENTATION:

This is a very simple project to implement, as it can be completed in 2 phases during 3 quarters:

Task	Q1	Q2	Q3	Q4
Purchase filling room / conveyers	XXXX			
Start up / training visit			XXXX	

PROCUREMENT:

The filling room 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 and enclosed gassing rooms. Experience with HC aerosol formulations would be useful.

DISBURSEMENTS:

As negotiated with the suppliers.

REQUIRED REGULATORY ACTIONS:

Once all aerosol manufacturers have had an opportunity to convert, and once the technical expert contracted to do the training has certified that plant personnel are fully trained, the use of CFC in aerosols in Mauritius should be prohibited.

RESULTS:

This project will result in avoiding the use of 25,000 kilograms of CFC in the first year. If our volume grows anew with CFC propellants, the actual affect could be to reduce CFC consumption considerably more.

ANNEX #1 COMANU PROJECT CONVERSION COSTS:

The project costs are as follows:

1).	1 ea. ENCLOSED EXPLOSION PROOF FILLING ROOM	$	80,000.00
2).	1 ea. Two conveyors 5 meters explosion proof		16,000.00
3).	1 ea. Move transformer		2,000.00
4).	1 ea. Lot safety equipment		5,000.00
	Sub total	$	103,000.00
5).	Plant safety/startup training		10,000.00
	Sub total	$	113,000.00
6).	10 % Contingency		11,300.00
	Total	$	124,300.00

ANNEX # 2 - 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 = $ 124,300. OC = 0

(C)F = $ 20,260 OS = 0

W = 25,000

Doing the calculation, unit abatement cost = $ 0.81 / 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 volatile 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 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.

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 manage the control of these two factors.

(The end).

COMPAGNIE MANUFACTURIERS de PRODUITS COSMETIQUES Ltee (COMANU), MAURITIUS

PROJECT TECHNICAL REVIEW

Scope

The project covers the supply of the necessary equipment and training to enable COMANU to safely handle and fill flammable aerosol propellants such as hydrocarbons (HAP) and dimethyl ether (DME). This will enable over 50% of the aerosols filled in Mauritius, almost exclusively perfumes and deodorants, to be successfully reformulated to non-ODS technology without any significant loss in terms of end-product performance and consumer acceptability.

Recommendation

Whilst this project proposal is unusual in that it deals with a situation where the enterprise has already eliminated CFCs, the chosen technology is **NOT** sound for the product applications involved. Without the facilities to safely move to the alternative non-ODS technology based on the flammable HAP, there is then a very real concern that market forces will drive the enterprise back to using CFCs. The enterprise should not be penalised for having taken early, voluntary, measures to eliminate CFCs, and having selected unsuitable replacement technology, then have to wait until a move back to the use of CFCs before this project is approved. The project contains no elements relating to the actions already taken by COMANU. **It is therefore recommended that the project be approved.**

Relevance and Adequacy of Information Provided

This is a well prepared project and all the relevant information is included.

Technical Soundness

Liquefied gas propellants, be they CFCs, HAP, or DME, are unquestionably the propellants of choice for the aerosol industry, providing ease of product formulation, handling, and manufacture, whilst at the same time providing finished aerosol products which will consistently and repeatedly meet consumers performance requirements (even with some degree of unintentional misuse on the part of the consumer. These comments apply particularly to the less sophisticated markets of the Article 5.1 countries.

There have been many developments in recent years relating to spray product technology, including the use of compressed gas aerosol propellants such as carbon dioxide, compressed air, and nitrogen, pump sprays, as well as a wide variety of novel propellant-free spray packaging devices which have all been promoted as ODS replacement options to the CFC based aerosol. However, they all come with a number of technical, performance, or cost penalties and have not found wide acceptance in any markets, except for specialised applications.

As a contract aerosol packer, COMANU's product range is dictated by the nature of the aerosol market in Mauritius which is presently comprised almost exclusively of perfumes and deodorants. There is no doubt that of currently available ODS replacement technologies, HAP or DME is the most suitable for these applications.

Should a demand for other household or technical aerosol products emerge as the Mauritian economy develops, then the approval of this project would additionally enable HAP or DME to be used, rather than CFCs.

Site conditions dictate the use of a separate explosion proof propellant gassing room.

Because of the hazards associated with handling flammable HAP, the project correctly encompasses the purchase of relevant safety equipment and provides for commissioning and general safety training by a foreign expert.

Lessons from Experience

COMANU clearly acted in good faith, but without adequate technical guidance, in their early, voluntary move to replace ODS. Fortunately, this should not be a costly error providing this project is approved. However, the lesson is clear that the earliest possible guidance on ODS replacement technologies is required in all Article 5.1 countries.

Environmental Issues

HAP is a "Volatile Organic Compound" (VOC) and can contribute to boundary level photochemical smog and ozone formation. However, the quantities of HAP involved are small, and VOCs are not presently regulated in Mauritius. This is unlikely to be a concern in the short to medium term, but it may need to be addressed at some future time.

Safety Issues

There are important safety issues associated with the flammable nature of HAP and the hazards involved in storage, transfer, aerosol filling, etc. The need to relocate an electrical

transformer is noted. These matters are adequately addressed in both the project proposal and Annex #3. Local safety training requirements must be provided by a foreign expert, covering both the commissioning stage, and subsequent manufacturing operations.

Cost Effectiveness

Given the unusual nature of this project the cost effectiveness assessment is inevitably somewhat subjective. However, the unit abatement cost of $0.81/kg as provided in Annex #2 is in line with experience in other countries. No incremental operating costs or benefits are claimed. The case for this, as presented in the project proposal, is considered as accurate.

Other

No other comments.

Stuart Kelly
11 February 1994

PROJECT OUTLINE

COUNTRY:	MAURITIUS
SECTORS COVERED:	Foams, refrigeration
NATIONAL ODS CONSUMPTION:	70.2 tonnes ODP in 1991
PROJECT TITLE:	Project preparation assistance
DURATION:	Six months
PROJECT IMPACT:	Preparation of projects in the refrigeration and foams sectors
PROPOSED BUDGET:	US $25,000
IMPLEMENTING AGENCY:	UNDP
NATIONAL COORDINATING AGENCY:	Ministry of the Environment and Quality of Life

==========

PROJECT DESCRIPTION

The Mauritius Country Programme (CP) for the phaseout of ozone depleting substances (ODS) under the Montreal Protocol was prepared with the assistance of UNEP. The CP was presented and approved at the 10th Executive Committee meeting held in Montreal in June 1993. Mauritius has designated UNEP as the implementing agency for the "Institutional Strengthening" project of the CP while UNDP is designated as implementing agency for all technical assistance and investment projects evolving from the CP.

Accordingly, the Government has requested UNDP to include in its work programme for the 12th Executive Committee Meeting a project preparation request for the following projects and technical assistance activities:

a) Phasing out of CFC use in rigid insulation foams;
b) Phasing out of CFC use as a refrigerant in locally manufactured domestic refrigerators and in commercial refrigeration such as cold storage;
c) Assessment of the feasibility and implications of retrofitting CFC-12 refrigerators;
d) Training of technicians in the refrigeration sector;
e) Assessment of safety measures in the flexible foam sector in the use of methylene chloride.

The US$ 25,000 preparatory assistance funds will be utilized over a six-month period to recruit international/national consultants to work with the national staff in the preparation of project proposals in these sectors. The completed project proposals will form part of UNDP's 1994 work programme amendment that will be submitted for Executive Committee approval at its 13th and 14th meetings.

PROJECT COVER SHEET

COUNTRY:	**Philippines**
PROJECT TITLE:	**NIKON INDUSTRIAL CORPORATION phaseout of the use of CFCs in the manufacture of rigid PUF for thermoware**
SECTOR COVERED:	**Foamed Plastics**
ODS USE IN SECTOR:	**417t CFCs (=ODP) in 1991**
PROJECT IMPACT:	**Phaseout of 15t CFC-11/y**
PROJECT DURATION:	**One year from approval**
PROJECT ECONOMIC LIFE:	**Ten years**
TOTAL PROJECT COST:	**USD 230,000 Incremental Capital Cost USD 85,000 Incremental Recurrent Costs**
PROPOSED MLF GRANT:	**USD 315,000**
COST EFFECTIVENESS:	**USD 4.50/kg/y**
COORDINATING NATIONAL BODY:	**Department of Environment and Natural Resources (DENR)**
IMPLEMENTING AGENCY:	**UNDP**
APPRAISAL DATE	**January 11, 1994/February 8, 1994**

PROJECT SUMMARY

Under this project NIKON INDUSTRIAL CORPORATION ("NIKON") will phaseout the use of CFCs in the manufacture of rigid polyurethane foam for its thermoware products. The non-ODS technology of choice will be based on chemically generated CO_2, complemented for an interim period by HCFC-141b. The two low pressure foam dispensing units will be replaced by high pressure ones with variable gear ratio's. The project includes trials and training/technology transfer. The company will induce incremental recurrent costs based on higher material cost.

TECHNICAL ASSESSMENT

The project is reviewed and supported by Jerry S. Pool from UNDP's Technical Review Panel. His comments are attached.

PROJECT OF THE GOVERNMENT OF THE PHILIPPINES

ELIMINATION OF THE USE OF CFCs IN THE MANUFACTURE OF THERMOWARE AT NIKON INDUSTRIAL CORPORATION

1. PROJECT OBJECTIVE

The objective of this project is (i) to phase out the use of CFCs in the manufacture of thermoware at NIKON and (ii) to establish a demonstration project for the elimination of CFCs in rigid PUF for non-refrigeration application in the Philippines.

2. SECTOR BACKGROUND

The CFC consumption in the foam sector in the Philippines is estimated to have reached about 420t in 1991 (ref.: Table 1). CFC-11 (polyurethane foams) and CFC-12 (polystyrene foam sheet) are the dominant substances in this sector.

CATEGORY		CFC-11	CFC-12
Polyurethane Foams (PUF)			
Flexible PUF		25	
Rigid PUF	Appliances	285	
	General Insulation	90	
Extruded Polystyrene Foams			17
TOTAL		**395**	**17**

Table-1: CFC-Use in the Foam Industry in the Philippines (1991; metric tons)

The Government intends to eliminate the use of CFCs in this sector in or before 1998 through awareness programs, regulations and incentives. A specific ban on the use of CFCs in the manufacture of flexible foams is scheduled for 1994.

3. ENTERPRISE BACKGROUND

NIKON is a manufacturer of thermoware and small electrical appliances such as wall clocks and electric fans. The company started operations in 1986 and is 100% Filipino owned. The number of employees has grown to 950 at the end of 1993.

Water jugs have been produced since 1988. In situ polyurethane foam and expanded polystyrene foams are used as insulation material. The PUF is generated through two low pressure foam dispensers, using CFC-11 as blowing agent. EPS is currently externally purchased, but will be produced in house in the near future. The feedstock for this application, pre-expanded PS, contains no CFCs.

The company is a member of the Pollution Control Association of the Philippine Industry (PCAPI), the national organization of pollution control officers from the industry sector. The PCAPI has been involved in information campaigns regarding ODS control and replacement technologies.

4. PROJECT DESCRIPTION

NIKON utilizes about 15 tons CFC-11 in the manufacture of thermoware. Management of the company is committed to the phaseout of this ODS to protect export markets as well as to contribute to the ODS phaseout program in the Philippines, which needs participants that are capable and willing to evaluate the CFC-free rigid PUF systems in non refrigeration applications.

The introduction of all water blown foam is identified as the preferred pathway to CFC phaseout at the enterprise, and the phaseout program/costs is based on this decision. However, it may be possible that other compounds, such as HCFC-141b, will be needed until all the technical challenges related to the use of all water blown rigid foam (viscosity, mixing, flow characteristics, vault building) are overcome.

The two low pressure foam dispensing units will have to be replaced by high pressure systems, capable to meter at different component ratio's.

Initial formulation development will be performed by system manufacturers, followed by extensive in-house production trials. Product testing will be done during the evaluation phase by suppliers, followed by outside certification testing for the purpose of independent verification of the insulation values achieved.

Incremental recurrent costs are expected, based on the higher use of isocyanate.

5 TECHNOLOGY

5.1 OVERVIEW

There are currently three main directions in the development of CFC-free systems for thermoset insulation foams:

- CFC-11 > partial water/HCFC-141b > ?
- CFC-11 > partial water/ HCFC-22, 142b > HFC-134a, 152a
- CFC-11 > Pentane

In addition, compounds such as perfluoroalkanes, HCFC 123, fluorinated ethers and 2-chloropropane have been suggested, but are immature in technology, limited available or toxicologically contested.

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 HFC-356, but full water blown foam with improved cell structure remains an option, specifically in "lesser demanding" systems such as water heaters and thermoware, were dimensional changes--although costly-- are possible.

The second one--also called the "gas" solution--utilizes a gaseous mixture of physical blowing agents, requires high pressure equipment, and sometimes extensive adjustments. The final step in this process is seen as the introduction of (gaseous) HFC's.

Cyclopentane and isopentane technology is lately commercial introduced in Germany. Its flammable character requires safety conditions and limits its use. In NIKON's case, the use of pentane would be cost prohibitive from a safety standpoint.

5.2 SELECTION

NIKON has decided for a solution employing only carbon dioxide generated from the water/isocyanate reaction. The interim use of HCFC-141b until all process details are worked out remains an option. The reason is an economical one as well as an ecological one: all water blown systems--although more expensive currently than CFC-blown--are less costly then systems employing HCFCs or--even worse--HFCs. In addition, carbon dioxide--the resulting blowing agent--has no residual ODP, where HCFCs have

5.3 IMPACT ON THE PRODUCTION PROCESS

The lack of CFCs or HCFCs will increase the viscosity of the polyol blend, which cannot be well metered and mixed by the low pressure equipment.
In addition, the ratio between the material components (polyol blend and isocyanate) will change. Equipment with fixed gear ratio's will have to be modified to the new ratio's, or--better--variable rate dispensing equipment should be used.

Vault-free material is essential and viscosity and reactivity changes will influence the filling patterns. The higher viscosities and different reaction times of the new systems will therefore require extensive trials, initially at the suppliers site, followed by industrial evaluation.

6. PROJECT COSTS

6.1 SUMMARY OF PROJECT COSTS

Incremental Capital Costs	USD	230,000
Incremental Recurrent Costs	USD	85,000
TOTAL PROJECT COSTS	**USD**	**315,000**

6.2 CAPITAL COSTS

The following incremental capital costs are expected, related to this project:

o	2 High pressure foam dispensing units incl. freight & installation, @ USD 90,000	USD	180,000
o	Trials, testing, training	USD	10,000
o	Technology transfer	USD	20,000
o	Contingency/Rounding	USD	20,000
TOTAL INCREMENTAL CAPITAL COSTS		**USD**	**230,000**

6.3 RECURRENT INCREMENTAL COSTS

The company expects recurrent incremental costs based on higher material cost from formulation changes. These costs are expected to amount to USD 96,000/y over the four years following implementation (1995 thru 1998). Net present value of these costs at 10% discount amounts to:

USD 85,000

Annex-B provides more detailed information.

6.4 UNIT ABATEMENT COSTS

a)	Incremental Capital Costs	USD	230,000
b)	Project Life Time		10 years
c)	Incremental Recurrent Costs	USD	24,000
d)	CFC Consumption	kg	15,000
f)	Capital Recovery Factor (@ 10% interest)		0.16275
UNIT ABATEMENT COSTS [{a(f) + c}/d]		**USD/kg/y**	**4.50**

7. FINANCING PLAN

The company requests disbursement of **USD 315,000**, representing all eligible incremental costs.

8. PROJECT IMPLEMENTATION

8.1 MANAGEMENT

It is proposed that UNDP will oversee the this project. This project is significant for future projects in the Philippines under the Montreal Fund as it will function as a "beacon" project. An intensive observation and supervision by an Agency experienced in similar projects seems therefore logical.

8.2 PROCUREMENT

It is proposed that UNDP will arrange the project procurement. UNDP would cooperate with the local UNDP office and with DENR.

8.3 SCHEDULE

TASK	TIME FOR COMPLETION					
	Q1	Q2	Q3	Q4	Q5	Q6
1. Preparation						
MLF Approval	x					
Procurement preparation	xx					
Vendor selection	x					
2. Installation						
Arrival, Customs			x			
Installation			x			
3. Start-up,						
Machine Start-up				x		
Trials, Training				xx		
Certification				x		

9. REQUIRED REGULATORY ACTION

The project requires no regulatory action.

10. PROJECT IMPACT

This project will eliminate the use of at least 15 tons of CFC-11 in the first year of implementation. Market growth indicates that this may increase by 10-15% annually in subsequent years. The project employs commercially and environmentally acceptable technology.

11. ANNEXES

Annex-A: Detailed calculation of recurrent incremental costs
Annex-B: Technical Assessment

NIKON.PRO
94-02-08/02

ANNEX-A

INCREMENTAL RECURRENT COSTS

The use all water blown foam triggers price consequences, related to the use of a different foam formulation.

ASSUMPTIONS

- CFC-11 price - USD 2.40/kg[1]
  HCFC-141b price - n.a (only interim)
  MDI - USD 2.50/kg
- 1 part CFC-11 replaced by water/CO_2 requires about 1.6 parts of MDI
- 1 USD = 27 pesos

MATERIAL COST

Before: 15t CFC-11 @ USD 2,400.....USD 36,000

After: 24t MDI @ 2,500.....USD 60,000

Additional material Costs/y.....USD 24,000

This amounts at a discount rate of 10% over four years of operation to a Net Present Value (NPV) of

USD 85,000

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[1] Prices are obtained from the company's purchase records and converted to USD (original prices in NT$ and Pesos).

RESOURCE POOL

Consulting In: Environmental and OSHA Compliance. Urethanes Process and Machinery Technology.

Jerry S. Pool, President

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High Point, NC 27265
phone: 910-869-5712
fax: 910-869-5712

NIKON INDUSTRIAL CORPORATION
PHILIPPINES

SCOPE

The project is concerned with the replacement of CFC-11 in the manufacturing of rigid polyurethane foam.

RECOMMENDATION

The project is supported.

RELEVANCY AND ADEQUACY OF INFORMATION

The document provides adequate information.

TECHNICAL SOUNDNESS

The HCFC-141b is a good interium choice on the way to fully water blown foam for the insulated thermoware. K-factor is not critical for this application.

LESSON FROM EXPERIENCE

The same approach is being used in other countries.

ENVIRONMENTAL ISSUES

HCFC-141b has a residual ODP and will eventually be phased out, so continued effort to move to water blown,will occur naturally.

SAFETY ISSUES

There are no particular safety issues to be addressed.

COST EFFECTIVENESS

The cost is typical of fairly low ODP elimination projects.

Jerry Pool
10/Feb/94

PROJECT COVER SHEET

COUNTRY:	**Thailand**
PROJECT TITLE:	**MIC-CELL CO., LTD., elimination of CFC-12 and CFC-114**
SECTORS COVERED:	**Foamed Plastics**
ODS USE IN SECTORS	**1510 tons CFCs in 1991**
PROJECT IMPACT:	**Phase out of 44 tons total per year of CFC-12 and CFC-114**
PROJECT DURATION:	**One year**
PROJECT ECONOMIC LIFE	**10 years**
TOTAL PROJECT COSTS:	**USD $365,500 Incr. Capital Cost** **USD 26,000 Incr. Recurrent Benefits**
PROPOSED MLF GRANT	**USD $339,500**
COST EFFECTIVENESS	**USD 0.59/kg/yr**
NATIONAL COORDINATING BODY:	**Ministry of Environment, Department of industrial Works (DIW)**
IMPLEMENTING AGENCY:	**UNDP**
APPRAISAL DATE:	**December 6, 1993**

PROJECT SUMMARY

Mic-cell Co., Ltd., a fully Thai owned company, manufactures extruded low density polyethylene (LDPE) foam sheet and profiles for insulation purposes. The company intends to phase out the current use of CFC-12 and CFC-114 through the introduction of a mixture of L.P.G. and alcohol. In this way, the company expects to be able to maintain the insulation value of its products at acceptable levels. Under this project, Mic-cell will eliminate the use of CFCs in their process through replacement by L.P.G. resulting in an annual reduction of 44 tons ODS. The project contains safety features to address the hazards generated by the use of a flammable substance. The company expects no significant change in operating costs. The current building is suited for the use of a flammable substance provided it and the production equipment is modified for this use and appropriate safety procedures are followed. Technology for the retro-fitting will be provided by an independent process expert.

TECHNICAL ASSESSMENT

This project has been prepared by Dennis Knaus, Process Specialist,Envirotek, Inc. It has been reviewed by Bert Veenendaal, UNDP Foam Sector Expert.

PROJECT OF THE GOVERNMENT OF THAILAND
ELIMINATION OF CFCs IN THE MANUFACTURE OF EXTRUDED POLYETHYLENE FOAM SHEET AND PROFILES AT MIC-CELL CO., LTD.

1. PROJECT OBJECTIVE

The object of this project is to phase out the use of CFCs in the manufacture of extruded low density polyethylene (LDPE) foam sheet and profiles at Mic-cell. Co., Ltd. ("Mic-cell").

2. SECTOR BACKGROUND

ODS are used as blowing agents in the production of five types of foams in Thailand--appliance insulation, flexible foams, rigid insulating foams used in construction,polystyrene packeging and miscellaneous foams. With the exception of polystyrene and polyethylene foams, CFC-11 is used to some extent in the production of all these foam types. producers of foam products in Thailand used more than 1,600t of ODS in 1991, Primarily CFC-11 and CFC-12.

The flexible foam (polyurethane foam) sub-sector has already substantial phased out the use of CFCs by replacing it with methylene chloride.

In other sub-categories CFC is, as before, the blowing agent of choice and replacement efforts are so far restricted to investigations, trials and project preparations.

3. ENTERPRISE BACKGROUND

Mic-cell. Co., Ltd. was founded in November 1991. The company is 100% Thai owed. It produces closed cell polyethylene foam sheets and profiles for use as insulation. Its products are marketed through the related company "Thai Insul Ltd." The company is located in Bangkok, Thailand.

Production is on a partly self assembled extrusion system consisting of mainly German components (Berstoff, Lewa).

The company occupies modern buildings and has ample space and machine capacity for expansion. The market for PE insulation is mainly concentrated in the air-conditioning area for hotels and office buildings and is fast growing in S.E. Asia with growth rates in excess of 20% per annum. This is related to expanding tourist industry, general business expansion, as well as modernization of existing facilities. Capacities of CFC use at Mic-cell may therefore increase rapidly in coming years to reach levels of 150-200 tons/year. The existing equipment has the necessary capability for such a production level. Some product information is provided in Annex-A.

4.PROJECT DESCRIPTION

Mic-cell. Co., Ltd. utilizes annually about 40 tons CFC-114 and 4 tons CFC-12 in the manufacture of extruded LDPE foam sheet and profiles. Management is committed to the phase out of these ozone depleting compounds.

L.P.G. is selected as the replacement choice, as isobutane--the preferred candidate--is not available. It is possible to adapt the existing equipment for this purpose. In addition to process related equipment changes, safety related modifications in the production environment have to be implemented to mitigate fire and explosion hazards from the use of L.P.G. Finally, extensive production and safety training is needed to guarantee a smooth and safe operation and to conform to the strict fire standards in Malaysia.

5.TECHNOLOGY

5.1 OVERVIEW AND SELECTION

There are only a few options available in Thailand to replace CFCs in the production of extruded LDPE foam sheet, such as:

L.P.G.
L.P.G. and alcohol
70% n-butane/30% isobutane blend
isobutane
HFC-134a
HFC-152a

A summary of these technologies, their potentials and their limitations is provided through the UNEP Technical Options Committee bi-annual review and through general review papers from UNDP.

L.P.G./alcohol is selected by the company as an alternative is:

Proven technology; in processing and product performance,
Environmentally acceptable as an interim solution,
Low in toxicity,
Adaptable to the existing equipment.

A draw back of L.P.G./alcohol is the high flammability requiring stringent safety precautions.

Users of hydrocarbons are subject to stringent fire regulations, including the appointment and training of company safety experts for every shift. The emission of L.P.G. or alcohol is not regulated in Thailand, nor are restrictions expected in the foreseeable future.

5.2 PRODUCTION PROCESS

The use of L.P.G. and alcohol will require substantial changes in the production process and storage facilities.

Required equipment modifications and additions should include:

Plant Exhaust System

The plant/warehouse air must be moving at all times.

Exhaust ducts mounted at floor level and parallel to the foam extrusion line.

Exhaust ducts to draw fresh air across the plant floor in the foam storage area.

The plant and warehouse air should be changed every hour.

The Lower Explosive Level(LEL) for LPG is 0.5%.

Target level of LPG in the plant should be less than 0.05%.

The exhaust fans do not need explosion proof motors.

Extrusion System Partition

Extrusion Exhaust System

Extrusion line should have its own system that targets specific areas.
Feedthroat, injection port, die/sizing mandrel, foam sheet path or winder.

Ceiling Fans

Production area and the warehouse should have ceiling fans spaced 10 to 13 meter apart.
Fans should run continuously and will keep the air circulating to prevent pockets of LPG from building up.

Foam Storage

Air must be moving at all times by using ceiling circulating fans and wall mounted exhaust fans at floor level.
Fans spaced 10 to 13 meter apart with louvered openings located on the wall opposite the exhaust fans.
Exhaust ducts to draw fresh air across the plant floor in the foam storage area.
Polyethylene bags used to package rolls should have holes to allow the LPG to flow out of and fresh air to flow in. The holes should be about 12 to 14 mm in diameter and spaced about 150 to 200 mm apart.
Stack rolls on pallets to circulate air around the rolls more easily.

Ideal temperature for polyethylene foam storage is approximately 120°F(48.88°C).

Humidifying The Plant

Monitoring device to measure relative humidity with automatic humidifying system that atomizes water and sprays it into the air.
The plant's relative humidity should be kept at a level of at least 50 to 55%.

LPG Sensing Equipment

LPG monitoring device to detect its level near bulk storagetank,highpressure pump, extruder and surrounding area, reclaim grinder, converting area and foam storage area.
Automatic shutdown of L.P.G. when sensor monitor exceeds preset limit.
Handheld LPG Sensor to monitor the L.P.G. at random locations throughout the plant.

Bulk Storage Tank

Installation and location of hydrocarbon blowing agents systems are subject to compliance with Federal, State and Local regulations. The recommended design pressure for a hydrocarbon blowing agent container is 250 psig. This will allow storage of propane which exerts the maximum vapor pressure.
The tank should have an electrically/pneumatically operated shutoff control valve on the outlet pipe of the tank that can be activated from within the plant. In addition, the electrical power supply to the tank should shutoff from within the plant as well as at the tank.
There should be a pneumatically/manually operated shutoff valve just prior to the high pressure pumps.

High Pressure LPG Pumping System

is satisfactory, but it needs an explosion proof motor and automatic shutoff.

High Pressure Blending System

to blend L.P.G. and alcohol.

Cast Aluminum Heaters

with explosion proof terminal boxes on the gate and die.

Melt Blender

More thorough and intensive mixing of the LDPE and additives is required, when L.P.G. is used as the blowing agent, to achieve the same cell size and quality of product.

Surface Winder with Secondary Lay-on Roll

Center winding, as used by Mic-cell, is satisfactory only with CFCs. When the blowing agent is L.P.G., the post expansion of the foam sheet substantially increases causing the inner layers of a roll to be crushed. Typically, a 3 mm thick sheet made with L.P.G. that is center wound will be crushed to only 2 mm at the core while the outer wraps on the roll will be 3.5 to 4 mm. This thickness differential is unacceptable for obvious reasons and requires a surface winder with a secondary lay-on roll to reduce or eliminate crushing of the foam sheet.

Ventilation Supply Blower System

Air supply blowers should be installed to supply fresh air to electrical equipment located in areas that can develop high levels of L.P.G. The blowers create a positive pressure within the electrical units and should be used with the extruders control panel, main drive motor, underneath the extruder base frame where the oil circulating pumps are located for the transmission and the thrust bearing assemblies, the shed that houses the high pressure L.P.G. pump, the sizing mandrel blowers that supply air to the inside and outside foam surfaces.

Ionized Air Blower

Ionized air is blown onto foam surfaces to neutralize static charge build-up. The blowers should be placed on the take-off equipment so that the ionized air is blown onto the foam web at the sizing mandrel stand, S-wrap/pull rolls, winder, reclaim grinder and converting equipment.

Clothing

The operators should be given static resistant shoes and clothing.

Shipping Precautions

If L.P.G. blown foam is placed in an enclosed container such as a truck trailer, the driver must use care when opening the trailer doors. This is especially true when ambient temperatures are above 10 °C. The driver should guard against generating any sparks and should not smoke or use an open flame near the truck.

Customer Precautions

Customers that convert foam with a slitter, perforator, poucher and/or sheeter should use Ionized Air Blowers to eliminate static build up.

Production and aging areas are to be separated from other working areas and fitted with sprinklers or otherwise protected against fire hazards.

Production and maintenance personnel have to be trained in the safe handling of hydrocarbons, in addition to production training.

Start-up trials will be necessary to adjust for formulation modifications, processing

conditions and product evaluation.

The production process at Mic-cell. Co., Ltd. is currently not separated from the other working area. The extruded LDPE foam system needs to have a partition built to separate the system from the rest of the plant's equipment and storage area. Hydrocarbon gas and temperature alarm systems will be installed throughout this building. The L.P.G. bulk storage tank will be located in the front of the building and protected with L.P.G. sensors and deluge sprinkler system. Large fire extinguishers will be staged at all critical places; portable fire extinguishers will be placed at every entrance. Initial and follow up fire safety training will be implemented. Production and maintenance personnel will also be trained in the safe handling of hydrocarbons, in addition to production training.
Start-up trials will be made to adjust for the different formulations and processing conditions. The start-up will be supervised by a technology and process specialist.

6. PROJECT COSTS

6.1 Capital Costs

The following is a summary of the expected costs of investment and related activities (in USD):

Description	Cost
Exhaust System	25,000.00
Melt Blender	15,000.00
Cast Aluminum Heaters with explosion proof	
Tterminal boxes	5,500.00
Surface Winder with Secondry Lay-on Roll	75,000.00
Separation Wall	2,000.00
Humidity Monitor and Control System	10,000.00
Grinder Modifications	2,500.00
High Pressure Pump explosion proof motor and automatic shut-off	6,500.00
L.P.G. Blending System	25,000.00
Air Pressurization Systems	3,000.00
Bulk Storage Tank	80,000.00
Bulk Storage Tank- Deluge System	15,000.00
Ceiling Fans	5,000.00
Antistatic Blowers and Bars	8,000.00

L.P.G. Plant Sensing System	35,000.00
Hand Held L.P.G. Sensor	1,000.00
Clothing	2,000.00
Technology Transfer	40,000.00
Training	10,000.00
TOTAL	$ 365,500.00

The costs are based on information from a recently completed project in Malaysia (equipment modifications, safety systems), from local suppliers (tank) and from UNDP (training, technology transfer).

6.2 OPERATING COSTS

The following are the current costs for CFC-12 and its intended replacement, L.P.G.:

CFC-12	$2.09 USD/kg
L.P.G.	$0.80 USD/kg

Prices are documented in Annex-B. They can fluctuate significantly.
The use of L.P.G. requires the addition of a dimentional stability control agent. Costs are assumed at USD 30/ton resin, or--given a resin use of 400 tons for 1991--USD 0.24 per kg blowing agent. A 1:2 replacement of CFC-12 by L.P.G. is assumed. This amounts to an expected annual decrease in material costs of:

USD 52,500

This has to be held against higher costs in maintenance, insurance, safety monitoring and ongoing safety training. These costs are estimated on USD 45,000/year and specified in annex-C.

The resulting annual cost saving of USD 7,500 translates in a net present value (4 years/10%) of:

USD 26,000

6.3 UNIT ABATEMENT COST

a)	ODS Reduction Project Costs	USD $365,500
b)	Annual Incremental Benefits	USD 7,500
c)	Project Useful Life	7 years
d)	ODS Reduction/year	kg 50,000
	Unit Abatement Costs[(a/c + b)/d]	USD/kg/year 0.59

7. FINANCING PLAN

The company requests the disbursement of the complete project costs estimated on

USD 379,500

8. PROJECT IMPLEMENTATION

8.1 MANAGEMENT

UNDP will oversee the implementation of this project and provide technical assistance.

8.2 SCHEDULE

Implementation schedule will start with MLF approval of the project and will end after monitoring has confirmed that at no place on the machine or in the working area unsafe levels of hydrocarbon can be detected.

TASK	TIME FOR COMPLETION					
	Q1	Q2	Q3	Q4	Q5	Q6
1. Preparation						
MFL Approval	x					
Visit Consultant	x					
Order Confirmation		x				
2. Installation						
Arrival, Customs			x			
Machine Modifications			x			
Tank Installation			x			
Safety Devices			x			
3. Start-up, Training						
Machine Start-up				x		
Safety Training				x		
Commissioning				x		

8.3 PROCUREMENT

UNDP will over see the procurement. UNDP expects at about the same time to procure 3-5 similar projects, resulting in procedural and cost efficiencies. Assistance will be provided by the local UNDP and an independent technology and process consultant.

9. PROJECT IMPACT

This project will eliminate the use of at least 50 tons of CFCs in the first year of implementation. The project employs commercially and environmentally acceptable technology.

10. ANNEXES

Annex -A: Technical Assessment

TECHNICAL ASSESSMENT

PROJECT TITLE:	MIC-CELL CO.,LTD. elimination of CFC-12 and CFC-114
CATEGORY:	Foamed Plastics; Thermoplastic Foams (specialties)
RECOMMENDATION:	The project is supported
INFORMATION:	Adequate. Very complete on safety and technology
TECHNOLOGY:	Acceptable. The use of alcohol as a buffer to stabilize the quality of LPG is a surprisingly simple and cost effective solution. The maintenance of the K-factor remains to be seen
REFERENCES:	Similar projects in India and Thailand
ENVIRONMENTAL:	LPG is a VOC and photochemically active. Emerging regulations to be monitored
SAFETY:	The risks related to the flammability of butane are adequately--even superior--addressed. UNDP has developed a safety manual that should be passed out
COST EFFECTIVENESS:	The costs are acceptable, although somewhat higher than for Profeel-Sentinel in India. This is based on the smaller plant size. It is, however considerable mor cost effective than Thermaflex
OTHER ISSUES:	None
REVIEWER:	Bert Veenendaal
DATE:	February 10, 1994

PROJECT COVER SHEET

COUNTRY:	**Thailand**
PROJECT TITLE:	**HENGER PANEL Elimination of the use of CFCs in the manufacture of laminated rigid polyurethane foam insulation panels**
SECTOR COVERED:	**Foamed Plastics**
ODS USE IN SECTOR:	**1510t CFCs (=ODP) in 1991**
PROJECT IMPACT:	**15 TONS CFC-11/y**
PROJECT DURATION:	**One year**
PROJECT ECONOMIC LIFE:	**10 Years**
TOTAL PROJECT COSTS:	**USD 210,000 Incremental Capital Cost USD 47,500 Incremental Recurrent Cost**
PROPOSED MLF GRANT:	**USD 257,500**
COST EFFECTIVENESS:	**USD 3.39/kg/y (unit abatement cost)**
NATIONAL COORDINATING BODY:	**Ministry of Environment, Department of Industrial Works (DIW)**
IMPLEMENTING AGENCY:	**UNDP**
APPRAISAL DATE:	**December 10, 1993/February 9, 1994**

PROJECT SUMMARY

Under this project Henger M.F.R. Co. Ltd. ("Henger Panel") will eliminate the use of CFCs in the manufacture of laminated rigid PUF panels through the introduction of a combination of chemically generated CO_2 and HCFC-141b. The introduction of high pressure technology in combination with pre-blending equipment allows to introduce at a later stage a wide range of lower ODP and finally non-ODP solutions, such as full water blown/fine cell technology, HFC 134a etc. Incremental recurrent costs are partially offset by savings from the elimination of cleaning solvents and less material losses.

TECHNICAL ASSESSMENT

The project has been reviewed and is supported by Jerry S. Pool, member of UNDP's Technical Review Panel. His comments are attached.

PROJECT OF THE GOVERNMENT OF THE THAILAND

HENGER PANEL ELIMINATION OF THE USE OF CFCs IN THE MANUFACTURE OF LAMINATED RIGID PUF PANELS

1. PROJECT OBJECTIVE

The objective of this project is (i) to phase out the use of CFCs in the manufacture of laminated rigid PUF panels at Henger Panels and (ii) to institute a demonstration project for non/low ODS technology in rigid PUF in Thailand.

2. SECTOR BACKGROUND

ODS are used as blowing agents in the production of five types of foams in Thailand--appliance insulation, flexible foams, rigid insulating foams used in construction,polystyrene packeging and miscellaneous foams. With the exception of polystyrene and polyethylene foams, CFC-11 is used to some extent in the production of all these foam types. producers of foam products in Thailand used almost 1,600t of ODS in 1991, Primarily CFC-11 and CFC-12.

The flexible foam (polyurethane foam) sub-sector has already substantial phased out the use of CFCs by replacing it with methylene chloride.

In other sub-categories CFC is, as before, the blowing agent of choice and replacement efforts were so far restricted to investigations, trials and project preparations.

3. ENTERPRISE BACKGROUND

Henger Panel was founded in 1990. The company is owned by its President, Mr. Somsak Hengvasaraphibul, Engineer. The company manufactures insulated panels for trucks, mobil offices and cold storage. Thes sector enjoys in Thailand very rapid growth related to the general economic situation as well as to the tourist industry.

Henger Panel operates currently a two component low pressure 200 kg/min output foam dispensing unit. CFC-11 is purchased seperately and pre-mixed in the polyol component.

4. PROJECT DESCRIPTION

Henger Panel utilized in 1993 about 15t CFC-11 in the manufacture of rigid PUF in laminated insulation panels. This is expected to increase to 20t in 1995. The company intends to replace this ODS as soon as possible.

A combination of reduced ABA (auxiliary blowing agent) technology and HCFC-141b is considered as the interim replacement of choice, followed by a non ODP technology that is not yet selected. Existing low pressure foam dispensing equipment has to be replaced with high pressure and a pre-blending unit will have to be installed. Some additional cost for trials will occur. In addition to equipment changes, recurrent incremental operating cost are expected, related to higher isocyanate use and the use of HCFC-141b.

5. TECHNOLOGY

5.1 OVERVIEW AND SELECTION

There are several options to replace CFCs in the production of rigid polyurethane insulation foam, such as:

- 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 are either immature in technology, limited in availability or restricted applicable.

The first solution--also called the "liquid" solution--employs technology that is closely related to the existing. The final step in this process is not yet decided. One potential solution is HFC-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 extensive 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.

Pentane technology is lately commercially introduced on several occasions, but its flammable character requires safety conditions and limits its use. In addition, cyclopentane is regionally restricted in availability.

A combination of water-blown technology and the use of HCFC-141b is identified by the company as an alternative that is:

- Proven technology in processing and product performance,
- Environmentally acceptable,
- Available in the Thai market,

The choice of high pressure equipment will facilitate the step to a truely ODP-free system without additional capital costs.

The use of HCFC-22 would also be feasible, but has to be evaluated on its retention in the foam.

5.2 IMPACT ON PRODUCTION PROCESS

The use of reduced CFC technology will be facilitated through the employment of high pressure foam production equipment.
HCFC-141b is moderately flammable. For the intended purpose, the blends should not cause any risk, but a monitoring check at commisssioning will be performed to assure safe working levels.
The current mixing method should be replaced by an automated, pressurised one. This will save up to 20% ABA.

6. PROJECT COSTS

6.1 TOTAL PROJECT COSTS

The following is a summary of the expected costs (in USD) of investment and related activities:

DESCRIPTION	AMOUNT (USD)
FOAM EQUIPMENT	110,000
TRIALS, START-UP	5,000
PRE-MIX STATION	65,000
FREIGHT, INSTALLATION	15,000
CONTINGENCY,ROUNDING	15,000
TOTAL	**210,000**

[Prices obtained from Impianti OMS, Italy and Cannon, Singapore]

6.2 OPERATING COSTS

o	Before: 15t CFC-11 @ 2,100.....USD	31,500
o	After: 12t additional MDI @ 2,500.....USD	30,000
	6t HCFC-141b @ 4,000.....USD	24,000
	INCREMENTAL MATERIAL COSTS.....USD	23,500
o	Savings on ABA.....USD	6,000
o	Savings on cleaning agent.....USD	2,500
o	**RECURRENT INCREMENTAL COSTS.....USD**	**15,000**

o	**Net Present Value (4y; 10 % discount)..USD**	**47,500**

6.3 UNIT ABATEMENT COST

a)	ODS Reduction Project Costs	USD 210,000
b)	Annual Incremental Costs (base 1995)	USD 15,000
c)	Project Useful Costs	10 Years
d)	ODS Reduction/Year	kg 15,000
f)	Capital Recovery factor (10% discount)	0.16275
	Unit Abatement Costs [{a(f) + b)/d]	**USD/kg/y 3.39**

7. FINANCING PLAN

The company requests the reimbursement of the complete project costs estimated on **USD 257,500**

8. PROJECT IMPLEMENTATION

8.1 MANAGEMENT

UNDP will oversee the completion of this project and provide technical assistance.

8.2 PROCUREMENT

UNDP will oversee the procurement and provide technical assistance.

8.3 SCHEDULE

Implementation schedule will start with MLF approval of the project and will end after monitoring has confirmed that at no place on the machine or in the working area unsafe levels of HCFCs can be detected.

TASK	TIME FOR COMPLETION					
	Q1	Q2	Q3	Q4	Q5	Q6
1. Preparation						
MLF Approval	x					
Pre Audit	x					
Order Confirmation(s)		x				
2. Installation						
Arrival, Customs			x			
Installation			x			
3. Start-up, Training						
Machine Start-up				x		
Trials/Training				x		
Post Audit/Commissioning				x		

9. PROJECT IMPACT

This project will eliminate the use of at least 20 tons of CFCs in the first year of implementation and ensure safety in plants that have already transferred to non-ODS technology on their own. The project employs commercially and environmentally acceptable technology.

10. ANNEXES

Annex A: Detailed equpment costs
Annex B: Technical Assessment

HENGERPA.PRO
94-02-10/01

RESOURCE POOL

Consulting In: Environmental and OSHA Compliance. Urethanes Process and Machinery Technology.

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HENGER PANEL
THAILAND

SCOPE

The project is concerned with the replacement of CFC-11 in the manufacturing of rigid polyurethane foam.

RECOMMENDATION

The project is supported.

RELEVANCY AND ADEQUACY OF INFORMATION

The document provides adequate information.

TECHNICAL SOUNDNESS

The HCFC-141b is a good interium choice on the way to Zero-ODS blown foam for the rigid panels, however, K-factor for cold storage will not be as good as cyclopentane blown. The equipment selected will be usable on any of the developing technologies. The project is supported.

LESSON FROM EXPERIENCE

The same approach has been used in similar projects.

ENVIRONMENTAL ISSUES

HCFC-141b has a residual ODP and will eventually be phased out.

SAFETY ISSUES

There are no particular safety issues to be addressed.

COST EFFECTIVENESS

The cost is typical of low ODP elimination projects.

Jerry Pool
10/Feb/94

PROJECT COVER SHEET

COUNTRY:	**Thailand**
PROJECT TITLE:	**Elimination of the use of CFCs in the manufacture of extruded polystyrene foam sheet in Thailand (Phase I; two companies)**
SECTOR COVERED:	**Foamed Plastics**
ODS USE IN SECTOR:	**1510t CFCs (=ODP) in 1991**
PROJECT IMPACT:	**100 TONS CFC-12/y (base 1994)**
PROJECT DURATION:	**One year**
PROJECT ECONOMIC LIFE:	**10 Years**
TOTAL PROJECT COSTS:	**USD 610,000 Capital Cost USD 155,000 Operational Benefits**
PROPOSED MLF GRANT:	**USD 455,000**
COST EFFECTIVENESS:	**USD 0.95/kg/y (unit abatement cost)**
NATIONAL COORDINATING BODY:	**Ministry of Environment, Department of Industrial Works (DIW)**
IMPLEMENTING AGENCY:	**UNDP**
APPRAISAL DATE:	**December 6, 1993/January 10/11, 1994**

PROJECT SUMMARY

This project will eliminate the use of CFCs in the manufacture of extruded polystyrene foam sheet (XPS) at two companies in Thailand by introducing the use of butane. The project includes safety measures to address the flammable nature of butane. This is the the first phase of a two phase CFC elimination program for XPS applications in Thailand.

TECHNICAL ASSESSMENT

The project has been reviewed and supported by Bert Veenendaal, UNDP sector expert "Foams" Technical Review Panel. His comments are attached.

PROJECT OF THE GOVERNMENT OF THE THAILAND

ELIMINATION OF THE USE OF CFCs IN THE MANUFACTURE OF EXTRUDED POLYSTYRENE FOAM SHEET IN THAILAND (PHASE I; 2 COMPANIES)

1. PROJECT OBJECTIVE

The objective of this project is to phase out the use of CFCs in the manufacture of XPS foam sheet at two companies in Thailand.

2. SECTOR BACKGROUND

ODS are used as blowing agents in the production of five types of foams in Thailand--appliance insulation, flexible foams, rigid insulating foams used in construction,polystyrene packeging and miscellaneous foams. With the exception of polystyrene and polyethylene foams, CFC-11 is used to some extent in the production of all these foam types. producers of foam products in Thailand used almost 1,600t of ODS in 1991, Primarily CFC-11 and CFC-12.

The flexible foam (polyurethane foam) sub-sector has already substantial phased out the use of CFCs by replacing it with methylene chloride.

In other sub-categories CFC is, as before, the blowing agent of choice and replacement efforts were so far restricted to investigations, trials and project preparations.

3. BACKGROUND OF THE XPS INDUSTRY IN THAILAND

There are three identified companies in Thailand that manufacture XPS foam sheet (ref.: Table-1. These companies are believed to produce the majority of XPS (about 80%) in the country.

One company cnverted previously to butane, but reversed that decision after a fire in its storage area showed that the conversion conditions were not adequate. After relocation of the plant (see annex-1), reintroduction of butane is scheduled. One other company has plans ready that need, however, considerable modifications to assure workplace safety.

COMPANY	BLOWING AGENT TYPE	AMOUNT
Pornshri Co. Ltd.	CFC-11/12	125t
Food Box Co. Ltd	CFC-12	60t
Thai Polyseal Material Industries Co. Ltd.LPG	CFC-12	30t

Table-1: XPS manufacturers in Thailand and blowing agent use in 1993

4. PROJECT DESCRIPTION

This project will eliminate the use of CFCs at two companies in Thailand that produce XPS through conversion to the use of butane.

The companies participating are:

- Food Box Co. Ltd.
- Thai Poly Seal Material Industries Co. Ltd.

The project includes adequate safety features to assure the responsible use of a flammable substance.

An international process expert will oversee the implementation of the project, provide technology transfer, safety manuals and perform safety training.

5. TECHNOLOGY

5.1 OVERVIEW AND SELECTION

There are several options to replace CFCs in the production of XPS foam sheet, such as:

- Atmospheric gases (Nitrogen, Carbon Dioxide),
- Hydrocarbons (LPG, butanes, pentanes),
- HCFCs (-22; -142b),
- HFCs (-134a; -152a),

Summaries of these technologies, their potentials and their limitations are provided through the UNEP Technical Options Committee's bi-annual review and through review papers from UNDP. Hydrocarbons, specifically butane is selected by the Thai companies

as an alternatives that is:

- Proven technology in processing and product performance,
- Environmentally acceptable,
- Low in toxicity,
- Adaptable to existing equipment,
- Cost effective,
- Available in the local market.

A draw back of hydrocarbons is the high flammability, requiring extensive safety precautions.

Users of hydrocarbons are subject to stringent fire regulations. The emission of hydrocarbons is not regulated in the Philippines, nor are restrictions expected in the foreseeable future.

5.2 PRODUCTION PROCESS

The use of hydrocarbons will require substantial changes in the production process and storage facilities.
Required equipment modifications and additions may include:

- **Storage**
  - Separate, explosion proof, location of the butane tank.
- **Feeding systems**
  - Injection systems for additives (anti-diffusion and anti-static agents),
  - Replacement of the foamant metering pump and injection system,
  - New gaskets and seals.
  - New pressure gauges
- **Extrusion system**
  - Replacement or modification of the screw,
  - Replacement or modification of the extrusion die.
- **Electrical systems**
  - Installation of spark arresters,
  - Sealing of electrical control cabinets,
  - Explosion proof motors and switches.
- **Auxiliary safety devices**
  - A ventilation system to prevent the accumulation of hydrocarbon vapors,
  - Monitoring and alarm systems for hydrocarbon vapors,
  - Extra fire extinguishers.

Production and aging areas are to be separated from other working areas and to be protected against fire hazards.

Production and maintenance personnel has to be trained in the safe handling of hydrocarbons, in addition to production training.

Start-up trials will be necessary to adjust for foamant volume and permeability.

6. PROJECT COSTS

6.1 Capital Costs

The following is a summary of the expected costs of investment and related activities. The costs are based on information from Mr. Koo Swee Hee, an international process expert.

DESCRIPTION	COST (US$)
FOOD BOX CO. LTD.	**290,000**
THAI POLYSEAL CO. LTD.	**233,400**
PRE/POST SAFETY AUDITS; COMMISSIONING, POST MONITORING	**25,000**
CONTINGENCY & ROUNDING	**61,600**
TOTAL	**610,000**

6.2 OPERATING COSTS

Annual operating benefits of USD 45,000 are calculated and specified in annex-C. At 10% discount and over four years of operation this amounts to a net present value (NPV) of

USD 155,000

6.3 UNIT ABATEMENT COST

a)	ODS Reduction Project Costs	**USD 610,000**
b)	Annual Incremental Benefits	**USD 45,000**
c)	Project Useful Life	**10 years**
d)	ODS reduction/y (1994 forecast)	**kg 100,000**
f)	Capital Recovery Factor (10% discount)	**0.16275**
	Unit Abatement Costs [(a/c + b)/d]	**USD/kg/0.95**

7. FINANCING PLAN

The eligible grant is calculated to be:

USD 594,500

8. PROJECT IMPLEMENTATION

8.1 MANAGEMENT

UNDP will oversee the implementation of this project and provide technical assistance.

8.2 SCHEDULE

Implementation schedule will start with MLF approval of the project and will end after monitoring has confirmed that at no place on the machines or in the working areas unsafe levels of hydrocarbons can be detected.

TASK	TIME FOR COMPLETION					
	Q1	Q2	Q3	Q4	Q5	Q6
1. Preparation						
MLF Approval	x					
Pre Audit	x					
Order Confirmation(s)		x				
2. Installation						
Arrival, Customs			x			
Machine Modifications			x			
Tank Installation			x			
Safety Devices			x			
3. Start-up, Training						
Machine Start-up				x		
Safety Training				x		
Post Audit/Commissioning				x		

8.3 PROCUREMENT

UNDP will oversee the procurement. UNDP expects at the about the same time to procure 3-5 similar projects, resulting in procedural and cost efficiencies.

9. PROJECT IMPACT

This project will eliminate the use of at least 100 tons of CFCs in the first year of implementation and ensure safety in plants that have already transferred to non-ODS technology on their own. The project employs commercially and environmentally acceptable technology.

10. ANNEXES

Annex A: Visit Report Pornsri Co. Ltd.
Annex B: Detailed project specifications and costs
Annex C: Incremental Recurrent Cost
Annex D: Technical Assessment

ANNEX-C

INCREMENTAL RECURRENT COST

ASSUMPTIONS

1. The following are the current costs for CFC-12 and its intended replacement, butane (January 1994):

CFC-12	2.10 USD/kg
Butane	0.80 USD/kg

2. The use of hydrocarbons requires addition of an anti-shrinkage and a static-dissipative agent. Costs are assumed at USD 0.25/kg blowing agent.

INCREMENTAL MATERIAL COST

Before conversion:
100t CFC-12 @ 2,100.....USD 210,000
After conversion:
100t butane @ 800..... USD 80,000
Additives..... USD 25,000.....USD 105,000

Incremental Material Savings.....USD 105,000

OTHER INCREMENTAL OPERATING COSTS

- Higher Insurance: Building USD 20,000
  Transport USD 10,000.....USD 30,000
- Higher Maintenance:
  5% of capital costs.....USD 30,500

Incremental operating costs.....USD 60,500

The resulting annual cost savings of USD 45,000 translates in a net present value (4y/10%) of:

USD 155,000
==========

Annex - D

TECHNICAL ASSESSMENT

PROJECT TITLE:	Elimination of the use of CFCs in the manufacture of extruded polystyrene foam sheet in Thailand (Phase I)
CATEGORY:	Foamed Plastics; Thermoplastic Foams
RECOMMENDATION:	The project is supported
INFORMATION:	adequate
TECHNOLOGY:	Acceptable. Despite emerging interest for the use of carbon dioxide, butane remains the most selected phaseout technology
REFERENCES:	Similar projects in Egypt, India, Indonesia, Malaysia, PRC, The Philippines and Venezuela
ENVIRONMENTAL:	Butane is a VOC and photochemically active. Emerging regulations to be monitored
SAFETY:	The risks related to the flammability of butane are adequately addressed. UNDP has developed a safety manual that should be passed out
COST EFFECTIVENESS:	The costs are acceptable. The cost effectiveness is moderately, based on the relatively small size of the operations
OTHER ISSUES:	None
REVIEWER:	Bert Veenendaal
DATE:	February 10, 1994

PROJECT COVER SHEET

COUNTRY:	**URUGUAY**
PROJECT TITLE:	Technical Assistance to the Conservation and Demonstration Programme for Domestic and Commercial Refrigeration, and Installation of Equipment for Recovery/Recycling of CFC-12.
SECTOR COVERED:	Maintenance in the Refrigeration and Airconditioning Sectors.
ODS USE IN SECTOR:	143 tons per year (as per figures for 1992).
PROJECT IMPACT:	Reduction in CFC-12 consumption by 22.5 tons/year.
PROJECT DURATION:	2 years.
ECONOMIC LIFE:	5 years.
TOTAL COST:	$US 175,000
PROPOSED MLF GRANT:	$US 175,000
COST-BENEFIT RATIO OF PHASEOUT:	$US 2.1 / kg CFC-12
COORDINATING NATIONAL BODY:	Government Technical Committee on Ozone of the Ministry of Housing, Territorial Regulation and Environment
COMPANIES INVOLVED:	A single importer (ORBEN-Dupont), and four distributors REPLAST, FIELECTRIC, FRYMON and CHALAR
IMPLEMENTING AGENCY:	UNDP

PROJECT SUMMARY:

The project objective is to conduct 4 national workshops for the training of technicians and distributors of CFCs in the domestic and commercial refrigeration sector, with emphasis on training in recycling and recovery of CFC-12.

The workshops would include practical demonstrations of recycling and recovery equipment. After the demonstrations, 100 sets of recovery equipment and 10 of recycling equipment would be provided to technicians and distributors, according to a plan that would be designed and carried out by the Government once the workshop results had been evaluated.

In addition, a system for monitoring CFC-12 use (with bi-monthly evaluation) is planned to ensure the success of the recycling programme.

PROJECT OF THE GOVERNMENT OF URUGUAY

TECHNICAL ASSISTANCE TO THE CONSERVATION AND DEMONSTRATION PROGRAMME FOR DOMESTIC AND COMMERCIAL REFRIGERATION, AND INSTALLATION OF EQUIPMENT FOR RECOVERY AND RECYCLING OF CFC-12.

1. PROJECT OBJECTIVES.

The two objectives of the project are:

1. To provide technical assistance for the domestic and commercial refrigeration services sector, by means of workshops on CFC-12 recovery and recycling.

2. National programme of installation of equipment for CFC-12 recovery and recycling for the refrigeration services sector.

2. SECTOR BACKGROUND

Uruguay's Country Programme for the reduction of Ozone Depleting Substances (ODS) was approved in July 1994. It stipulates that based on 1992 figures, the maintenance activities related to the refrigeration and airconditioning sectors account for 45% of the overall yearly ODS consumption (or 143 tons/yr). The need for assistance as requested herewith is described in the Country Programme on page 44 and onwards.

From a survey conducted by the Government Technical Committee on Ozone, it appears that there is one importer of CFC-12 in the country, 4 distributors and approximately 1,000 refrigeration technicians. In general, the technicians are involved in both commercial and domestic refrigeration, and the sector is composed of small workshops.

Although the fact that the sector is dispersed, the announcement of the training workshops could be carried out through the 4 distributors, which cover the entire national market. The sector distribution indicates that 65 per cent of those involved are concentrated in the capital, Montevideo, and its surroundings, while the rest are divided between the industrial area in the north and Maldonado, which is the seaside resort area with the highest population density.

Training activities undertaken by the sector on its own initiative, both by the importer and the distributors, are listed as follows:

Nov 1992: Seminar on environment, CFCs and their substitutes, for technicians in the refrigeration sector, organized by ORBEN, the national importer (DUPONT representative), DUPONT-Argentina and the local distributor REPLAST.

Jun 1993: Seminar to introduce solutions and product alternatives to chlorofluorocarbons in refrigeration, intended for vendors, technicians and mechanics in the refrigeration sector, organized by ORBEN, the importer.

Aug 1993: Seminar on application of the substitute HFC-134a intended for the refrigeration service sector, organized by REPLAST, a local distributor and the Brazilian motorcompressor firm Embraco, attended by 300 mechanics.

Evolution in prices in the international market directly affects consumption in the country. In accordance with the provisions of the Copenhagen Amendment, CFC-12 production will cease by the end of 1995 in the developed countries, which will affect its availability. In view of the fact that Uruguay has to import all of its CFC-12, and taking into account that the refrigeration service sector is the major consumer, the need has arisen to take steps to rationalize and economize the consumption of that sector until new alternatives are introduced.

It should also be noted that the training workshops will utilize some of the existing training documentations and materials developed in the region previously, such as the ones prepared in a previous workshop in Venezuela in 1992 (including a training videotape). Furthermore, following UNEP documents will be made available at the workshops:

- Manual for Trainers, based on Regional Training Courses.
- Manual and Guidelines on Good Practices for Small and Medium-Size Systems.
- Technical Directory on Recovery and Recycling Machines

3. PROJECT JUSTIFICATION.

For the reasons stated above, training for technicians in the sector and installation of CFC-12 recovery and recycling equipment is considered a priority for the country.

The project is aimed at phasing out CFC-12 for the domestic and commercial refrigeration sectors, which will result in a phaseout of 22.5 tons of CFC-12 per year through an active recovery and recycling programme. To ensure its success, the Government will introduce a comprehensive monitoring system to check on a bi-monthly basis how much CFC's are be recycled by each of the 100 recovery equipments provided through this project. (See annex for more information in this regard).

According to the estimate of 100 recovery equipment units working 25 days per month, and recovering 0.75 kg/day/machine, one obtains the overall CFC savings of 22.5 tons/year mentioned on the cover sheet of this project.

4. PROJECT ACTIVITIES.

Phase 1: Training of Technicians in Domestic and Commercial Refrigeration Services by means of workshops on CFC-12 recovery and recycling.

1.1. Announcement by the Government simultaneously through the press and the distributors to their clients in the sector. About 180 technicians will be trained during the four workshops.
1.2. Two workshops to be held in Montevideo.
1.3. One workshop to be held in Salto, in the northern industrial zone.
1.4. One workshop to be held in Maldonado.
1.5. Establishment of a system for monitoring CFC-12 use.

Phase 2: Establishment of a system for monitoring

2.1. Bimonthly survey of the country's register of CFC-12 imports, by the Government Technical Committee on Ozone.
2.2. Bimonthly affidavit of stock and sales from the importer and distributors, both of new and recycled CFC-12.
2.3. Bimonthly affidavit from the technicians participating in the project concerning the stock and consumption of both new and

recycled CFC-12.

2.4. Bimonthly evaluation of data obtained from the registration of imports and the affidavits from project members.

Phase 3: Concession and operation of CFC-12 recovery equipment to technicians trained in its use.

3.1. Selection of technicians to whom the operation of the equipment will be awarded. The selections will be made based on the evaluation of participation in the Workshop and the advice of distributors as welll as on the volume of operations of each service technician.

3.2. Execution of a contract for the operation of the equipment between the Government and refrigeration technicians, to ensure that the programme is properly run. This contract will establish the commitment between the operator and the Government concerning the quantity to be recycled, maintenance costs, term of operation, and value of the substance recovered.

Phase 4: Concession and operation of CFC-12 recycling equipment to distributors.

4.1. Installation of recycling equipment, supplied to each distributor according to its client list, quantity it agrees to recycle, and per geographical distribution criteria to be established.

4.2. Execution of a contract for the operation of the equipment between the Government and the distributors to ensure that the programme is properly run. This contract will establish the commitment between the operator and the Government concerning the quantity to be recycled, maintenance costs, term of operation, and the level, quality and value of the recycled CFC.

4. EXPECTED PROJECT RESULTS.

- Over a 2-year period, beginning with the installation of the equipment, a reduction of 45 tons/year of CFC is expected.
- Training for the most important technicians in the maintenance sector is expected, in accordance with the ranking criteria established by the Government Technical Committee on Ozone. Limiting the number of participants in the four workshops planned will allow their successful development.
- To carry out the programme, the installation of an estimated 100 sets of recovery equipment and 10 for recycling.

5. TIMETABLE

- The training workshops are planned for May 1994.
- The start of the CFC-12 monitoring system is planned for March 1994
- Installation of CFC-12 recovery and recycling equipment is planned for July 1994, after the operators have been selected and trained, and the contractual terms for the operation of the equipment have been defined.

6. COORDINATING NATIONAL BODY.

Government Technical Committee on Ozone, with the support of the Board of Trade and the CFC import and distribution sectors.

7. PROJECT COSTS

7.1. Cost for training and capital cost.

ITEM	US$
Cost of training four workshops	
Foreign expert	16,000
Materials	10,000
Infrastructure	8,000
Subtotal	34,000
Installation of Recovery/Recycling equipment	
Recovery equipment (100 units)	80,000
Recycling equipment (10 units)	42,000
Maintenance	10,000
Transport of 110 units	9,000
Subtotal	141,000
Grand Total	175,000

7.2. Recurrent Cost.

No significant recurrent cost or savings are anticipated as demonstrated in the table (see annex 2).

7.3. Unit Abatement Cost.

a) Incremental Capital Cost	175,000 US$
b) Project Economic Life Time	5 years
c) Incremental Recurrent Cost	nil
d) CFC Consumption	22.5 tons/yr
e) Capital Recovery Factor (for 5 years)	0.2638
Unit abatement cost (a * e + c) / d	2.1 US$/kg

ANNEX 1: MEASURES TO PROMOTE THE USE OF EQUIPMENT FOR THE RECOVERY OF CFC-12

There has been some previous experiences with work in this sector in the country and these are listed in the project. A review of those experiences shows some concern on the part of users about the future of SAO and their price.

In addition, the Ministry of Housing, Land-use Management and the Environment has introduced a package of measures to promote the recovery and recycling of CFC-12. The measures taken are described below:

1. The Ministry has been promoting a public awareness campaign as part of the activities under the country programme with a view to influencing the opinion of the public which is the user of the various refrigeration services. The campaign includes the massive distribution of leaflets, the intervention by the Ministry's technical staff in the media and the organization of information seminars on the destruction of the ozone layer.

2. As part of the public awareness campaign, information seminars on the environment will be organized in technical institutes which teach refrigeration.

3. The Ministry is currently providing guidance to importers and distributors of SAO with a view to accelerating the elimination of the substance. More particularly, the refrigeration marketing subsector has already been sensitized as can be seen from the public information campaigns which they have carried out and which have been described earlier in this report.

4. In addition to the strictly technical training, the workshops to be organized as part of this project will include an introduction to the environment as a means of sensitizing the participants.

5. The operators of the recovery equipment will be issued with environmental certification for ease of recognition by consumers.

6. A contract is expected to be signed between users and the Government which will establish, inter alia, the quantity of CFC to be recovered and recycled.

7. A system will be established to monitor the use of CFC-12 every two months to ensure compliance with the objectives of the project.

Some additional information on modalities for distribution of the equipment units follows:
Of the 100 equipment for recovery, 65 will be distributed in Montevideo, which concentrates 50% of the population of the country and with 65% of the sector's technicians. Meanwhile, the remaining 35 will be installed in the places where the 4 distributors have their greatest influence: 10 in Paysandu and 10 in Salto (industrial pole of the north), 5 in the City of Rivera (in the Northeast Zone of the most important population area) and 10 in the City of Maldonado (East Zone, bathing resort with the mayor concentration of the population).

The stations will be selected during the workshops according to the evaluation of the technicians' intervention, considering the amount of CFC 12 which the suppliers purchase in each of the zones under consideration and geographical location. As the workshops will be small, the number of stations coincides with the number of equipment, with the exception of Montevideo where a few workshops exist where 2 recuperation equipment could be installed.

The recycling equipment will be distributed as follows: 8 in Montevideo, among the 4 distributors, 1 in the City of Paysandu in the northern industrial pole, and 1 in the City of Maldonado. The 8 equipment items in Montevideo will be located in the 4 plants of the 4 distributors that are in the country, while the ones in Maldonado and Paysandu will be placed in the plants which according to the distributor, has the most weight in the zone and will thereby be the nucleus of the rest of the recuperation stations.

The plants for the installation of the recycling equipment will be selected according to the zones where each distributor has the most influence since they will have the responsibility for its operation, considering the geographical points relating to the installation of the recuperation equipment. The above mentioned applies for the 8 recycling equipment in Montevideo, in the case of the equipment in Paysandu and the one in Maldonado, in each case with its equipment which will be sufficient to concentrate the CFC 12.

ANNEX 2: EVALUATION OF THE RECURRENT COST/SAVINGS OF THE PROJECT.

The following table illustrates that there is no significant recurrent cost or savings anticipated as a result of the implementation of this project. The Pre-Project would reflect the present revenues/costs for a repair or disposal of a refrigeration unit. The Post-Project figures would reflect the situation with recycling equipment in place.

In the pre-project situation, a typical service station where refrigerators are repaired used to have a certain number of costs related to the operation of venting and recharging, as well as revenues charged to the customers. The difference between these revenues and costs correspond to the profits made by this service station.

It is anticipated that a service station will cooperate in recycling operations (i.e. "post-project situation") and to the success of this project, if profits will be in the same order of magnitute as before. It is for this reason that Profits before and after the project should be considered, and not only costs.

In the table, all figures reflect the revenues and costs related to 22.5 tonnes per year of CFC-12.

	Pre Project	Post Project
Revenue from CFC sold to Customer	78,750	nil
Revenue from Labour Cost Charged to Cust.	N/A	N/A
Revenue from Transportation Cost Charged	nil	19,800
Total Revenues (a)	78,750	19,800
Cost of CFCs purchased (22.5 tonnes/year)	67,500	nil
Cost of Labour	N/A	N/A
Cost of Transportation	nil	18,000
Total Costs (b)	67,500	18,000
Difference (Profits) --> (c) = (a) - (b)	11,250	1,800

Difference pre-project, post-project -9,450 US$

Calculation Criteria:
Revenue from CFCs sold : 22,500 kg X US$ 3.5 / kg = US$ 78,500
Cost from CFC purchased: 22,500 kg X US$ 3 / kg = US$ 67,500

It is estimated that the time needed in the past for venting/recharging would not be significantly different than the time needed for recycling. Therefore the Labour Cost are indicated as N/A.

For cost of transportation:
100 stations X 1 transport/month/station X US$ 15/transportation = US$ 18,000 / year equivalent to 22,500 kg of CFC recycled.

For revenues from transportation:
18,000 US$ X 1.1 = US$ 19,800

PROJECT COVER SHEET

COUNTRY:	**VENEZUELA**
PROJECT TITLE:	Pilot Programme in Recovery and Recycling of CFC-12 in Mobile Airconditioning.
SECTOR COVERED:	Mobile Airconditioning (MAC)
ODS USE IN SECTOR:	1000 tonnes of CFC-12 in 1993
PROJECT DURATION:	10 months
TOTAL COST:	$US 13,400 (FONDOIN indicates it would like these funds to be transferred from a previously approved activity VEN/REF/09/TAS/11 - Recovery and Recycling in the Domestic Refrigeration Sector. The proposed funding therefore does not represent additional funds from MLF.
IMPLEMENTING AGENCY:	UNDP
COORDINATING NATIONAL BODY:	FONDOIN

PROJECT DESCRIPTION:

Through bilateral assistance, FONDOIN and the USEPA have been developing this Pilot Programme which consists of carrying out a market study (completed), identification and selection of mechanical service centres which would participate (in progress), procurement (April 94) and assigning (June 94) of recovery and recycling equipment units, preparation (in progress) and implementation of a demonstration workshop (May 94), the follow-up on the use of the recovery/recycling units (June to November 94) and the evaluation of final results of the project (December 1994).

The above-described programme is implemented in cooperation with UNDP's Global MAC project, through which recovery and recycling equipment units have been procured and sent to Venezuela.

For the following phases of the programme, the assistance of a local expert is required, for which no funds were set aside so far. Both FONDOIN, USEPA and UNDP are of the opinion that without this local expert, it will be difficult to ensure the success of the overall programme. The expert would facilitate the identification and selection of remaining mechanical service centres, finalization of model contract agreements with service centres, translation of educational material into Spanish, preparation and supervising the demonstration workshop, finalization and signing of hand-over contracts for the recovery/recycling equipment, reviewing monitoring and follow-up of questionnaires to be filled out by the beneficiaries of the equipment,

evaluation of monthly information and sending it to USEPA, provide training and technical assistance to the service centres as may be required, and final evaluation of the programme as a whole, with due consideration on any need follow-up and expansion of the programme for the future.

The funds required would include an engineer (US$ 10,000), local travel (US$ 1,000), tele-communications (US$ 1,000) and sundries (US$ 1,400).

No additional funds are needed for the implementation of this activity and it is proposed to transfer funds from a previously approved UNDP project VEN/REF/09/TAS/11 - Recovery and Recycling in the Domestic Refrigeration Sector. The total allocated budget for that project was US$ 39,600 of which US$ 13,200 was spent so far. It is anticipated that the remaining activities under this project can be completed in a satisfactory way with US$ 13,000, so that the remaining balance (US$ 13,400) can easily be transferred to the MAC programme as proposed above.

PROJECT OUTLINE

COUNTRY:	VIETNAM
SECTORS COVERED:	All sectors
NATIONAL ODS CONSUMPTION:	To be determined
PROJECT TITLE:	Project preparation assistance
DURATION:	One year
PROJECT IMPACT:	Project identification/preparation in all sectors, particularly in foams, refrigeration and solvents
PROPOSED BUDGET:	US$ 100,000
IMPLEMENTING AGENCY:	UNDP
NATIONAL COORDINATING AGENCY:	Ministry of Foreign Affairs

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PROJECT DESCRIPTION

Vietnam has recently ratified the Vienna Convention and the Montreal Protocol, and the Government is currently discussing its strategy for Country Programme preparation based on the country study which is being implemented by UNEP under the Government of Finland Trust Fund.

During UNDP's Regional Workshop on Foams held during 7-8 December 1993 in Bangkok, representatives from the Government of Vietnam requested UNDP assistance in starting ODS phaseout activities. In a formal communication that followed sent through UNDP/Hanoi, the Government requested UNDP to include in its work programme for the 12th Executive Committee Meeting a project preparation request for Vietnam. The sectors identified as requiring immediate UNDP project preparation assistance are foams, refrigeration and solvents.

The funds requested will be utilized over a one year period to recruit international and national consultants to work with representatives from the entities concerned as well as with governmental bodies in project identification and preparation.

It is expected that the completed projects will be submitted for approval during the 13th, 14th and 15th Executive Committee Meetings.

PROJECT OUTLINE

COUNTRY	:	GLOBAL
SECTOR COVERED	:	Foams, solvents
PROJECT TITLE	:	Safety pre-assessment and post-assessment of foam and solvent sector projects implemented by UNDP
PROJECT DURATION	:	Continuous
PROJECT IMPACT	:	Successful safety pre-assessment and post-assessment of projects so as to reduce potential "liability" issues.
PROPOSED BUDGET	:	US$ 25,000
IMPLEMENTING AGENCY	:	UNDP

PROJECT DESCRIPTION

UNDP has completed several foam sector investment projects. Both UNDP's executing agency (OPS) as well as UNDP experts are of the opinion that the issue of potential liability for the implementing agencies has become more pronounced. It is now strongly felt that documentation is needed to demonstrate that plant safety has improved - or at the minimum has not deteriorated - following project implementation.

The project pre-assessment and post-assessment of these safety issues can be done through what is termed an "industrial hygienic survey". The equipment needed to do this is the following:

One isocyanate monitor	US$ 5,000
One multipurpose gas analyzer	16,000
One air velocity meter	1,500
One digital camera	600
One set of 10 disposable organic vapour respirators	150
Miscellaneous supplies/contingency	1,750
Total	25,000

The multipurpose gas analyzer can monitor virtually any gas in parts per million (ppm). However isocyanate has to be checked in parts per billion (ppb) and so an isocyanate monitor is also needed. The air velocity meter by showing airflow is used to test workplace atmosphere. The digital camera allows pictures to be transferred directly into a report and its greater sensitivity, including of background details, is essential for adeauate safety issue documentation. The respirators are for the personal safety of the auditor.

It is proposed that one kit only be purchased at the present time so as to gain the necessary experience and evaluate its usefulness. Ultimately, if proved useful, two additional kits would be needed by UNDP's experts/auditors.

Executive Committee approval for the one kit is requested.