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Executive Committee of
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1993 UNDP WORK PROGRAMME AMENDMENTS

This document includes:

a) Comments and Recommendations from the Fund Secretariat on 1993 UNDP Work Programme Amendments;

b) 1993 UNDP Work Programme Amendments.

COMMENTS AND RECOMMENDATIONS FROM THE FUND SECRETARIAT ON 1993 UNDP WORK PROGRAMME AMENDMENTS

1. UNDP is requesting approval of the Executive Committee for 26 amendments to its 1993 Work Programme, including 13 investment projects under US $500,000 and project preparation activities as included in Table 1.

2. The total allocations recommended by the Secretariat are US $5,289,903, including support costs.

Table 1: 1993 UNDP Work Programme Amendments
Activities/Projects and Corresponding Funding Levels

Country	N°	Activity/Project	Amount Requested US $	Amount Recommended US$
Brazil	1	Project preparation assistance	100,000	100,000
China	2	Conversion to CFC-free technology in the manufacture of rigid PUF (Spray) at Beijing Commercial Machinery Factory (BCMF)	435,000	435,000
	3	Elimination of CFC-12 in the manufacture of EPE foam sheet at Danshui Huaya Plastics Industries Company	462,500	462,500
	4	National product qualification and standards evaluation for non-ODS alternatives to CFC applications	362,500	362,500
	5	Applications of a blend of Halon-1211 and CO_2 for use in portable fire extinguishers	65,000	65,000
	6	Testing of vacuum insulation panels for domestic refrigerators and freezers	50,000	(40,000)
	7	Survey and development of a national policy to promote CFC recovery and recycling in China	200,000	100,000
	8	Project preparation assistance	100,000	100,000
Egypt	9	Conversion to CFC-11 free technology in the manufacture of rigid PUF at Specialized Engineering Contracting Company (SECC)	85,000	85,000
	10	Elimination of CFC-12 in the manufacture of extruded polystyrene foam sheet at Arab Packaging Products Company	362,000	362,000

Country	N°	Activity/Project	Amount Requested US $	Amount Recommended US$
	11	Elimination of CFC-11/12 in the manufacture of extruded polystyrene foam sheet at Interfood Packaging	450,000	450,000
	12	Conversion to CFC-11 free technology in the manufacture of flexible PUF at Horse Foam Company	385,000	385,000
	13	Project preparation assistance	75,000	(75,000)
Guatemala	14	Project preparation assistance	30,000	30,000
India	15	Survey of ODS use in the small-scale (including tiny) and informal sectors, data base generation and ODS transition management planning	120,000	120,000
Indonesia	16	Project preparation assistance	100,000	100,000
Malaysia	17	Elimination of CFC-12 in the manufacture of extruded polystyrene and polyethylene foam sheet at Associated Air-Pack Industries	234,000	234,000
	18	Elimination of CFC-11 in the manufacture of pre-insulation pipe, panel and slabstock PUF at Insafoam Insulation Company	310,000	310,000
	19	Elimination of CFC-11 in the manufacture of integral skin PUF at Island Resources Company	230,000	230,000
	20	Conversion of metal cleaning processes from TCA (methyl chloroform) solvents to non-ODS organic solvents at Ngai Cheong Metal Industries	63,480	63,480
	21	Elimination of the use of TCA (methyl chloroform) in home appliance parts manufacturing at Matsushita Electric Company, Main Plant	113,570	113,570
	22	Elimination of the use of TCA (methyl chloroform) in home appliance parts manufacturing at Matsushita Electric Company, Port Klang Plant	173,280	173,280
Panama	23	Project preparation assistance	30,000	30,000
Philippines	24	Project preparation assistance	50,000	50,000
	25	Survey of ODS usage, data base generation and technical assistance for ODS phaseout for small-scale enterprises using ODS	100,000	100,000

Country	N°	Activity/Project	Amount Requested US $	Amount Recommended US$
Thailand	26	Elimination of CFC-114 in the manufacture of extruded polystyrene foam sheet and profiles at Thermaflex Insulation Asia Company	220,000	220,000
		Sub-total	4,781,330	4,681,330
		Project Support Costs (13 per cent of Sub-total)	621,573	608,573
		Total	5,402,903	5,289,903

Note: The Sub-total does not reflect the amount of US $75,000 for project preparation assistance in Egypt, and the amount of US $50,000 for testing of vacuum insulation panels for domestic refrigerators and freezers in China, as these amounts will be charged against the remaining balance (US $86,481) for UNDP's 1991 work programme in Egypt and against the cost of the BHEARI technical assistance foam sector project (US $480,000) in China.

General Comment

3. Although the projects being submitted as amendments were within the category of projects below US $500,000, substantial detailed information was provided to facilitate their review. Where necessary the Secretariat had consultations with UNDP, or on the advice of UNDP, with the respective experts responsible for the respective projects. Recommended funding levels are based mainly on these interactions.

Specific Comments

4. The following comments relate to the activities listed in Table 1 above, where necessary.

CHINA

Project N° 2: Conversion to CFC-free technology in the manufacture of rigid polyurethane foam (spray) at Beijing Commercial Machinery Factory (BCMF) (US $435,000)

1. Beijing Commercial Machinery Factory is a leading manufacturer of rigid polyurethane foam (PUF) in spray applications in China. This project will phase out 30 tonnes of CFC-11 annually; demonstrate the technology employed to other manufacturers and provide assistance to these manufacturers in phasing out CFCs in rigid PUF spray.

2. The CFC phase out will be implemented through the introduction of CFC reduced/HCFC formulations and replacement of equipment. The project also covers spare parts, technology transfer and testing.

3. The US $435,000 requested covers capital costs (US $236,000) and operating costs for four years (US $139,000).

4. The cost-effectiveness of the project, based on annual elimination of CFC-11, is US $15 per kg. ODP phased out. This project is not as cost-effective as Project N° 9 for Egypt, but this is because operational costs were not requested in the Egyptian project.

5. An amount of US $435,000 is recommended for approval.

Project N° 3: Elimination of CFC-12 in the manufacture of EPE foam sheet at Danshui Huaya Plastics Industries Company (US $462,500)

1. The objective of this project is to phase out the use of 160 tonnes of CFC-12 in the manufacture of extruded polyethylene foam sheet through conversion to HCFC-22 based technology. The technology will be provided to the company by its partner, the Maya Group from Singapore with no technology transfer costs involved.

2. Capital costs related to the equipment modification are US $50,000.

3. Operating costs are calculated at US $875,000 for four years using 10 per cent discount rate.

4. The grant amount has been adjusted to US $462,500 to account for the 50 per cent ownership of a Singapore-based company, the Maya Group.

5. The cost-effectiveness of the project, based on the annual elimination of ODP is US $3 per kg. ODP phased out.

6. The company has problems with supply of CFC-12 that causes serious business interruptions. The company has therefore decided to proceed immediately with the conversion and to apply for retroactive reimbursement of the eligible costs. The project is being implemented by the company.

7. An amount of US $462,500 is recommended for approval.

Project N° 4: National product qualification and standards evaluation for non-ODS alternatives to CFC applications (US $362,500)

1. This project would provide quality assurance testing and standard evaluation of non-ODS chemicals. It will assure user enterprises that the quality of the non-ODS chemicals meet international and domestic standards.

2. The Shanghai Institute of Organo-Flourine Materials is solely assigned with the responsibility of testing, qualification and monitoring of the new chemicals. This project will provide the capability in the Institute to accomplish its role for non-ODS chemicals.

3. The project is recommended for funding in the amount of US $362,500, with the proviso that no quality control equipment will be funded for producers of substitute chemicals in the future.

Project N° 5: Applications of a blend of Halon-1211 and CO_2 for use in portable fire extinguishers (US $65,000)

1. This project is an initial component of the project which blends Halon 1211 and CO_2 for use in portable fire extinguishers, and which will be implemented by Tiin Tian Fire Fighting Equipment Manufacturing Co. in the near future.

2. To use "Non-halon extinguishants and mixtures of halons and other gases such as CO_2" is in the halon phase-out strategy of China.

3. It is therefore recommended to approve funding of US $65,000.

Project N° 6: Testing of vacuum insulation panels for domestic refrigerators and freezers (US $50,000)

1. This project was submitted at the last meeting of the Executive Committee. One Committee member suggested approval of the project if it was agreed that the results of the small research and development component to be financed through the Fund would become publicly available.

2. NEPA (China) has resubmitted the project with acceptance of the above recommendation.

3. Through consultations with UNDP, the project cost has been reduced to US $40,000 from US $50,000. In addition, the cost of this project could be met from the equipment component cost savings from the BHEARI technical assistance foam project approved in June 1992 for UNDP implementation (US $480,000).

4. It is therefore recommended that the amount of US $40,000 be approved. However, the cost would be covered under the BHEARI technical assistance project.

Project N° 7: Survey and development of a national policy to promote CFC recovery and recycling in China (US $200,000)

1. This project does not result in direct ODS reduction; however, it can provide a common infrastructure to various refrigerant recycling projects.

2. Therefore, out of US $200,000, US $100,000 is recommended for funding. It should be borne in mind that the individual refrigerant recycling projects which will be submitted later should build on the results of this project and not repeat some of the activities covered by it.

Egypt

Project N° 9: Conversion to CFC-free technology in the manufacture of rigid polyurethane foam (spray) at Specialized Engineering Contracting Co. (US $85,000)

1. Under this project, the company will convert to non-CFC foams based on carbon dioxide and HCFC-141b. Three existing low pressure foaming units will be replaced by high pressure systems.

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

3. The amount of US $85,000 covers capital costs. No incremental operating costs are requested.

4. The cost-effectiveness of the project based on annual elimination of CFC-11 is US $6 per kg. ODP phased out.

5. An amount of US $85,000 is recommended for approval.

Project N° 10: Elimination of CFC-12 in the manufacture of extruded polystyrene foam sheet at Arab Packaging Products Co. (US $362,000); and

Project N° 11: Elimination of CFC-11/12 in the manufacture of extruded polystyrene foam sheet at Interfood Packaging (US $450,000)

1. These two projects will phase out 120 tonnes of CFC-12 annually at Arab Packaging Products and 80 tonnes of CFC-11/12 annually at Interfood Packaging through conversion to butane as a blowing agent. Butane is a flammable material. Safety related modification in the production environment including some construction work, additional equipment, safety training and technology transfer will be covered by capital costs of US $445,000 and US $450,000 respectively at APP and Interfood Packaging.

2. Operational costs have been calculated taking into account savings related to lower price of butane[1] and higher costs in maintenance, energy, ongoing safety monitoring and training and insurance.

3. The cost-effectiveness of the project based on annual elimination of CFC-12 is US $4 per kg. ODP phased out at APP and US $6 per kg. at Interfood Packaging. This compares with some other similar projects approved earlier.

4. Funding levels of US $362,000 and US $450,000 respectively are recommended for approval for Arab Packaging Products Co. and Interfood Packaging. The cost of butane should be monitored by UNDP.

Project N° 12: Conversion of CFC-11 free technology in the manufacture of flexible and molded polyurethane foam at Horse Foam Company (US $385,000)

1. Under this project the company will phase out the use of 120 tonnes of CFC-11 through conversion to full water blown systems (molded foams) and methylene chloride (slabstock foams). One time phase out of 1,500 kg. of Halon 1211 will be reached through replacement of halon based fire-fighting system by water sprinkler system.

2. Capital costs of US $385,000 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 $3 per kg. ODP.

4. An amount of US $385,000 is recommended for approval.

Malaysia

Project N° 17: Elimination of CFC-12 in the manufacture of extruded polystyrene and polyethylene foam sheet at Associated Air-Pack Industries SDN.BhD (US $ 234,000)

1. The objective of this project is to phase out 50 tonnes of CFC-12 annually at Air-Pack Industries through conversion to iso-pentane as a blowing agent. Iso-pentane is a flammable material. Equipment modifications including safety related measures will be covered by capital costs (US $260,000).

2. There will be savings of US $26,000 in operating costs due to the lower price of iso-pentane.

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[1] According to information received from the Government of Egypt, the price of butane after deregulation is US $1.50/kg. No taxes are included (to be confirmed).

3. The cost-effectiveness of the project based on annual elimination of 50 tonnes of CFC-12 is US $4.7 per kg. ODP. This compares with similar projects at Arab Packaging and Interfood Packaging in Egypt and other similar projects approved earlier.

4. An amount of US $234,000 is recommended for approval.

Project N° 18: Elimination of CFC-11 in the manufacture of pre-insulation pipe, panel and slabstock PUF at Insafoam Insulation Company (US $310,000)

1. Under this project the company will eliminate the use of 30 tonnes of CFC-11 annually 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 $175,000 cover the trials and the replacement of equipment that will be capable to employ emerging ODS free technology as they mature.

3. Incremental recurrent costs of US $135,000 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 $10.3 per kg. ODP.

5. It is recommended that the requested amount of US $310,000 be approved.

Project N° 19: Elimination of CFC-11 in the manufacture of integral skin polyurethane foam at Island Resources SDN.BhD (US $230,000)

1. This project, at a cost of US $230,000, will eliminate 15 tonnes of CFC-11 in the manufacture of integral skin polyurethane foam through conversion to full water blown technology. The company is in the process of replacing a degreasing unit. That will lead to an additional phase out of 15 tonnes of methyl chloroform, or 1.5 tonnes ODP annually.

2. Capital costs (US $145,000) cover the replacement of the foam blowing unit and the cleaning system and trials.

3. Operating costs are related to the higher cost of formulation which will be partially offset by savings as the result of elimination of CFC-11 blowing agent. Operating costs are calculated at US $85,000 for four years using 10 per cent discount rate.

4. The cost-effectiveness of the project based on annual elimination of 16.5 tonnes ODP is US $14/kg. ODP.

5. An amount of US $230,000 is recommended for approval.

Project N° 20: Conversion of metal cleaning processes from TCA (methyl chloroform) solvents to non-ODS organic solvents at Ngai Cheong Metal Industries (US $63,480)

1. This project will eliminate 23 metric tonnes of methyl chloroform/year by using hydrocarbon-based technology to clean metal parts. The project includes safety features for the use of flammable substances spent solvents are incinerated by a clay product facility.

2. The cost-effectiveness based on direct consumption of methyl chloroform is US $2.76/kg. ODS phase-out. Its relative low cost is due to their wise choice to modify second-hand conveyor cleaning machine.

3. It is recommended that the amount of US $63,480 be approved.

Project N° 21: Elimination of the use of TCA (methyl chloroform) in home appliance parts manufacturing at Matsushita Electric Company, Main Plant (US $113,570); and

Project N° 22: Elimination in the use of TCA (methyl chloroform) in home appliance parts manufacturing at Matsushita Electric Company, Port Klang Plant (US $173,280)

1. These two projects will eliminate 9.7 metric tonnes and 10.3 metric tonnes of methyl chloroform/year.

2. Project No. 21 (Main Plant) will use an aqueous process to clean rice cooker lids and home shower tanks.

3. Project No. 22 (Port Klang Plant) will use an aqueous process to clean electric iron sole plates and a petroleum-based process to clean heater pipe tubes, tips and heating elements to avoid rusting.

4. The cost-effectiveness based on direct consumption of methyl chloroform are US $11.7 per kg. ODS phase-out and US $16.8 per kg. ODS phase-out, respectively.

5. Both factors have been confirmed that the waste meets standards by the Department of Environment, and Port Klang factory will install a fire detection and auto-extinguisher system.

6. It is recommended that the amounts of US $113,570 and US $173,280 be approved.

Thailand

Project N° 26: **Elimination of CFC-114 in the manufacture of extruded polystyrene foam sheet and profiles at Thermaflex Insulation Asia Company (US $220,000)**

1. Under this project, the company will phase out 30 tonnes of CFC-114 annually through conversion to isobutane technology which will be made available by Isolative B.U., the Netherlands. The necessary equipment will also be provided by Isolative B.U. Safety-related modifications in the production environment and training are also included in project costs.

2. Incremental capital costs and technology transfer costs have been calculated at US $710,070.

3. Operating costs have been calculated at US $572,000 for four years using 10 per cent discount rate. Savings resulted from lower price for butane have been offset by an increase of raw material, labour, and utility costs.

4. The grant amount has been adjusted to US $220,040 to account for the 20 per cent local ownership.

5. The implementation of this project has already started (mid-1993). It will therefore be subject to retroactive reimbursement. UNDP will audit the implementation of this project.

6. The cost-effectiveness of the project based on annual elimination of 30 tonnes CFC-114 is US $7.35 per kg. ODP saved.

7. A funding level of US $220,000 is recommended for approval.

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

(Eleventh Meeting, 10-12 November 1993, Bangkok)

AMENDMENT TO THE 1993 WORK PROGRAMME

OF THE

UNITED NATIONS DEVELOPMENT PROGRAMME

AMENDMENT TO THE 1993 UNDP WORK PROGRAMME

UNDP's Progress Report to the Eleventh Meeting of the Executive Committee specified several of the missions undertaken by UNDP staff and sectoral experts at Government request during the June-September 1993 period to initiate and finalize projects for submission to the Executive Committee.

Accordingly, the following project proposals under $500,000 are submitted for Executive Committee approval as part of the Amendment to UNDP's 1993 work programme:

1. BRAZIL: Project preparation assistance ($100,000).

2. CHINA: Conversion to CFC-free technology in the manufacture of rigid PUF (Spray) at Beijing Commercial Machinery Factory (BCMF) ($435,000).

3. CHINA: Elimination of CFC-12 in the manufacture of EPE foam sheet at Danshui Huaya Plastics Industries Company ($462,500).

4. CHINA: National product qualification and standards evaluation for non-ODS alternatives to CFC applications ($362,500).

5. CHINA: Application of a blend of Halon-1211 and CO2 for use in portable fire extinguishers ($65,000).

6. CHINA: Testing of vacuum insulation panels for domestic refrigerators and freezers ($50,000).

7. CHINA: Survey and development of a national policy to promote CFC recovery and recycling in China ($200,000).

8. CHINA: Project preparation assistance ($100,000).

9. EGYPT: Conversion to CFC-11 free technology in the manufacture of rigid PUF at Specialized Engineering Contracting Company (SECC) ($85,000).

10. EGYPT: Elimination of CFC-12 in the manufacture of extruded polystyrene foam sheet at Arab Packaging Products Company ($362,000).

11. EGYPT: Elimination of CFC-11/12 in the manufacture of extruded polystyrene foam sheet at Interfood Packaging ($450,000).

12. EGYPT: Conversion to CFC-11 free technology in the manufacture of flexible PUF at Horse Foam Company ($385,000).

13. EGYPT: Project preparation assistance ($75,000).

14. GUATEMALA: Project preparation assistance ($30,000).

15. INDIA: Survey of ODS use in the small-scale (including tiny) and informal sectors, data base generation and ODS transition management planning ($120,000).

16. INDONESIA: Project preparation assistance ($100,000).

17. MALAYSIA: Elimination of CFC-12 in the manufacture of extruded polystyrene and polyethylene foam sheet at Associated Air-Pack Industries ($234,000).

18. MALAYSIA: Elimination of CFC-11 in the manufacture of pre-insulation pipe, panel and slabstock PUF at Insafoam Insulation Company ($310,000).

19. MALAYSIA: Elimination of CFC-11 in the manufacture of integral skin PUF at Island Resources Company ($230,000).

20. MALAYSIA: Conversion of metal cleaning processes from TCA (methyl chloroform) solvents to non-ODS organic solvents at Ngai Cheong Metal Industries ($63,480).

21. MALAYSIA: Elimination of the use of TCA (methyl chloroform) in home appliance parts manufacturing at Matsushita Electric Company, Main Plant ($113,570).

22. MALAYSIA: Elimination of the use of TCA (methyl chloroform) in home appliance parts manufacturing at Matsushita Electric Company, Port Klang Plant ($173,280).

23. PANAMA: Project preparation assistance ($30,000).

24. PHILIPPINES: Project preparation assistance ($50,000).

25. PHILIPPINES: Survey of ODS usage, data base generation and technical assistance for ODS phaseout for small-scale enterprises using ODS ($100,000).

26. THAILAND: Elimination of CFC-114 in the manufacture of extruded polystyrene foam sheet and profiles at Thermaflex Insulation Asia Company ($220,000).

The documentation for the above 26 project proposals is attached.

The budget for testing of vacuum insulation panels for domestic refrigerators and freezers in China ($50,000) will be charged against equipment component savings under the previously approved (June 1992) BHEARI technical assistance foam sector project in China. No additional funds are being requested for this activity.

The budget for project preparation assistance in Egypt ($75,000) will be charged against the remaining balance for UNDP's 1991 work programme in Egypt. No additional funds are being requested for this activity.

The budget for the remaining 24 projects amounts to $4,781,330.

With the addition of project support costs of $621,573, the total requested budget for UNDP's work programme amendment is $5,402,903.

PROJECT OUTLINE

COUNTRY	:	BRAZIL
SECTORS COVERED	:	Foams, refrigeration, solvents, and halons
NATIONAL ODS CONSUMPTION	:	10,000 metric tonnes in 1992
PROJECT TITLE	:	Project preparation assistance
DURATION	:	14 Months (Nov. 1993 - Dec. 1994)
PROJECT IMPACT	:	Preparation of technical assistance, demonstration and investment projects in the foams, refrigeration, solvents and halons sectors.
PROPOSED BUDGET	:	US$ 100,000
IMPLEMENTING AGENCY	:	UNDP
NATIONAL COORDINATING AGENCY	:	Ozone Technology Group (GTO), Industrial Policy Secretariat of the Ministry of Industry, Commerce and Tourism

PROJECT DESCRIPTION

ODS consumption in Brazil has been decreasing in the last few years due to Government rules prohibiting its use in aerosols. It is also a result of lower economic growth in the recent past. Brazil's 1991 ODS consumption by sector has been estimated as follows:

Refrigeration/AC	4,700	tonnes	(47%)
Foams	4,000	"	(40%)
Solvents	700	"	(7%)
Aerosols	100	"	(1%)
Halons and others	500	"	(5%)
	10,000	"	(100%)

During the final preparation of its Country Programme, the Government of Brazil is planning to present to the Executive Committee of the Multilateral Fund about a dozen priority industrial conversion projects that have already been identified. However, considering the size of the country and its industrial parks as well as its current ODS production and consumption, Brazil expects to submit several additional projects over the next year.

Specifically, the project preparation assistance would be used over the period Nov 1993 - Dec 1994 in the formulation of technical assistance, demonstration and investment projects in the foams, refrigeration, solvents and halons sectors and for a CFC reclaiming and recycling project. International and national experts would be recruited to prepare project proposals in these areas, for submission to the Executive Committee for approval at its 12th, 13th and 14th Meetings. In addition, the international experts would assist in the training of national staff to facilitate more effective Brazilian input to future project preparation activities.

PROJECT COVER SHEET

COUNTRY:	China
PROJECT TITLE:	Beijing Commercial Machinery Factory (BCMF) Conversion to CFC-free Technology in the Manufacture of Rigid Polyurethane Foam (Spray)
SECTOR COVERED:	Foamed Plastics
ODS USE IN SECTOR:	17,773t CFCs (17,773t ODP, 1991)
PROJECT IMPACT:	Phaseout of the use of 30 t/y CFC-11 (1992) in the manufacture of rigid polyurethane foam (spray)
PROPOSED BUDGET:	USD 435,000
EXECUTING AGENCY:	Ministry of Commerce (MOC), Tianjin University of Commerce (assisting)
IMPLEMENTING AGENCY:	UNDP
COORDINATING NATIONAL BODY:	National Environmental Protection Agency (NEPA)

PROJECT SUMMARY

MOC is a member of a coalition of ministries that coordinates the implementation of the phaseout of ODS in foams in China. Foam is the largest use sector for ODS (36.8%) with the highest ODP (29.4%).

The BCMF plant is selected by the Ministry as a demonstration plant for the dissemination of ODS technology in the manufacture of R-PUF (spray) in China. BCMF operates three production units for this type of foam. Tianjin University of Commerce is assigned by the ministry for the purpose of scientific and technical support. Representatives of BCMF participated in a survey of technologies in September 1993, and are informed on the latest developments in this area.

Carbon dioxide is selected as the technology of choice for CFC-free spray foam. The current development of this technology does, however, not allow full substitution. HCFC-141b is therefore selected as interim technology. BCMF will under this project install new, high pressure equipment capable of handling the higher viscosities that are inherent to these technologies. The company will demonstrate the technologies to other Chinese producers and so accommodate other companies in their phaseout efforts.

PROJECT OF THE GOVERNMENT OF CHINA

BEIJING COMMERCIAL MACHINERY FACTORY 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 at BCMF, (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 Chinese foam industry consumed in 1991 17,773 tons CFCs (China Country Programme). CFC-11 was the dominant substance (15,600 t, PUF), followed by CFC-12 (2,173 t, EPS/PE). No other ODS was used in statistical significant amounts, although some MCF may be used in adhesive applications. Furthermore some MCF and CFC-113 may be used in mold release agents. Production is divided between larger state owned enterprises and smaller township or private enterprises. Production and process information from state enterprises is well documented. However information on the rest of the industry is less reliable. More detailed information about the sector is provided in the following table:

Categories Subcategories	ODS (t)	Production (t)	Plants (range)
Extruded PS/PE	2,173	13,000	30- 50
Flexible Polyurethane	2,000	50,000	50-100
Pipe Insulation	600	4,000	10- 20
Sprayed PUF	600	4,000	50-200
Appliance Foams	5,000	40,000	40- 70
PUF Panels	7,400	52,000	20- 50
Total Rigid PUF	13,600	100,000	120-340
TOTAL	17,773	163,000	200-490

The Chinese Foam Industry
Selected Industry Data (1991)

Government and industry are committed to sharply reduce, and ultimately eliminate CFC utilization. MLI is responsible for the phaseout coordination in all foam categories. Ministerial responsibility is divided into two areas:

- o Refrigerating foams.
- o Non-refrigerating foams

There are other ministries involved in the refrigeration foams, i.c.:

- o Ministry of Chemical Industry (MCI),
- o Ministry of Commerce (MOC),
- o Ministry of Aerospace Industry (MAI),
- o Ministry of Machinery and Electronics Industry (MMEI),

Complete phaseout for non-refrigeration foams is targeted for the year 2000. Refrigerating foams are expected to be CFC free from the year 2005.

Uninhibited use of CFCs in foams for domestic refrigeration is expected to lead to an increase during 1991-1995 by 8 %/y, and after 1995 by 3 %/y. For other foams, a growth rate of 6 %/y is forecasted.

3. ENTERPRISE BACKGROUND

Beijing Commercial Machinery Factory (BCMF) is a leading manufacturer of rigid polyurethane foams in spray applications in China. In addition, the company manufactures and insulates refrigerated display cabinets ("Lance Technology"). Current equipment consists of three low/medium pressure foaming units with fixed ratio's. Production is on site (mainly cabinets) as well as "on the job" (mainly insulation of large cold storage rooms).

4. PROJECT DESCRIPTION

BCMF utilizes about 30 yt CFC-11 in the manufacture of Rigid PUF (spray applications). Under this project the company intends to phaseout the use of this compound through the introduction of CFC-reduced/HCFC formulations. The existing low pressure/fixed ratio foam equipment will be replaced by high pressure variable ratio equipment. Ultimately, as technology progresses, the intention is to introduce complete water-based formulations. The choice of equipment reflects this goal.

The project will induce recurrent incremental costs based on the higher use of isocyanates as well as on the higher price of HCFCs.

BCMF will function as a demonstration project for the Chinese ODS phaseout program in Spray foams, a program that resorts under the ministry of Commerce. The plant will be accessible for demonstrations and the technical staff will be available to support colleagues in other companies in their phaseout efforts. Representatives from BCMF have been on an technical evaluation mission in the USA and have been brought up to date with the newest ODS phaseout technology for spray foams as a preparation for this project and their future educative task.

5. TECHNOLOGY

5.1 OVERVIEW

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

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

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

BCMF has decided for the water/HCFC-141b solution. However, trials with HCFC-22 will also be performed as this compound is indigenous produced and therefore better available. HCFCs will most likely subsequent be replaced by fully water blown systems. HFC 134a remains another option. In BCMF's case, the use of cyclopentane would be cost prohibitive and most likely unacceptable from a safety standpoint.

5.3 IMPACT ON PRODUCTION PROCESS

The existing three foaming units will have to be replaced by high pressure units with variable gear ratio's.

Trials and product testing will be needed under supervision of an external process expert to assure suitable product quality.

6. PROJECT COSTS

6.1 CAPITAL COSTS

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

o	2 high output HP foaming unit incl. freight, installation, start-up		USD	150,000
o	1 medium output HP foaming unit incl. freight, installation, start-up		USD	55,000
o	Spare parts		USD	10,000
o	Trials, training, testing		USD	10,000
o	Technology Transfer		USD	25,000
o	Testing equipment			
	K-factor tester	USD 8,000		
	CLD-tester	USD 5,000		
	Flammability testers	USD 5,000		
	Dimensional Stability tester	USD 1,000	USD	19,000
o	Contingency and rounding		USD	27,000
	TOTAL INCREMENTAL CAPITAL COSTS		**USD**	**296,000**

Prices and estimates for the costs of technology transfer originate from information provided during a study tour by Foam Enterprises Inc.,Gusmer and Glass-Mate (all USA).

6.2 OPERATING COSTS

The chosen ODS replacement procedure will be that where possible water-based foams will be used from the onset. These formulations are, however, not (yet) feasible in vertical spraying and complex cavities. In those cases, HCFC-141b or, in view of potential sourcing problems, HCFC-22 will be used.

The use of fully water blown systems would lead to an overall increase in chemical costs of 15%/y (source: ICI). At an annual component use of 120t/y @ USD 2,500 this would amount to

USD 45,000/y.
=============

However, at least initially, HCFCs will also be used. An annual CFC-11 use of 30t @ USD 1,500, to be replaced by the the same amount of HCFC @ 2,650[1] this would amount to

USD 34,500/y.
=============

The average of both methods would amount to annual recurrent incremental costs of about USD 40,000/y or,at a discount factor of 10%, a Net Present Value of

USD 139,000
===========

6.3 UNIT ABATEMENT COSTS

a)	Incremental Capital Costs......................USD	296,000
b)	Project Life Time..................................	10 years
c)	Incremental Recurrent Costs/y..................USD	40,000
d)	CFC Consumption ....kg	30,000
	UNIT ABATEMENT COSTS [(a/b+ c)/d].............USD/kg/y	**2.32**

7. FINANCING PLAN

The company requests

<u>USD 435,000</u>
===========

representing the full incremental capital and recurrent costs.

8 PROJECT IMPLEMENTATION

8.1 MANAGEMENT

It is proposed that UNDP will oversee the this project.

8.2 PROCUREMENT

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[1] The price is based on HCFC-22. This compound is locally available. HCFC-141b is currently difficult to source in China.

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

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			
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 30 tons of CFC-11 in the first year of implementation. The project employs commercially available and environmentally acceptable technology.

THE RESOURCE POOL

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

Jerry S. Pool, President

3609 Huntingridge Drive
High Point, NC 27265
phone: 919-869-5712
fax: 919-869-5712

BEIJING COMMERCIAL MACHINERY FACTORY BCMF

SCOPE

The project is concerned with the replacement of CFC 11 and rigid PUF spray systems.

RECOMMENDATION

The project is supported.

RELEVANCY AND ADEQUACY OF INFORMATION

The information provided in the project document is generally good. It would however have been helpful to describe what testing equipment is currently available at BCMF. Although there is no disagreement that this testing equipment is needed, it might already be available. If not available, it could be argued that the company is provided with an advantage beyond CFC replacement and that, at the minimum, the costs of this equipment should be shared.

TECHNICAL SOUNDNESS

The proposed ODS replacement - initially by HCFCs followed by water based systems - is the best possible solution, provided that from the onset the share of HCFCs in the total amount of blowing agent will be minimized. It may be necessary for this purpose to have a on-~~site~~ blending unit (about USD $75,000). The cost of this unit could be offset by lower incremental recurrent costs. It is a fact that current water based systems only work in horizontal spray applications and not in overhead applications. However, it is expected that universally applicable water based systems will be developed in the next few years and the company should maintain close contact with the technology provider to assure that timely conversion to such systems will take place.

LESSONS FROM EXPERIENCE

There is one comparable project in Egypt (SECC). The equipment used in China is larger and therefore incomparable in price. The question can be posed if such size is needed or that perhaps smaller scale equipment could be used. The money that would be freed in this way could be applied against a pre-blender (discussed earlier).

ENVIRONMENTAL ISSUES

Although initially through the use of HCFCs, residual ODP value remains, it is clear from the project that ultimately a zero ODP option is chosen. Carbon dioxide is not photochemically active, has no ODP value and a rather small GPW value.

SAFETY ISSUES

There are no special safety concerns related to the technology chosen.

COST EFFECTIVENESS

The unit abatement costs are unfavorable compared with the above mentioned SECC projects, even if incremental recurrent costs are not regarded (SECC did not claim these costs). The main reasons for this are: higher equipment costs, technology transfer, testing equipment. It seems not feasible to change the overall equipment costs, the only suggestion previously made is to downsize the equipment and to include a pre-blender. Spare parts were not included in SECC for the reason that this company is the distributor of such equipment in the Egyptian market and has therefore, as a standard, spare parts in storage. Another difference; technology transfer is not needed at SECC because the company is extremely knowledgeable (the owner of the company should be considered as a process specialist for future projects). The issue of testing equipment was discussed before. Overall, it should be stated that the cost for BCMF may be more standard and the cost for SECC extremely low.

PROJECT COVER SHEET

COUNTRY:	China
PROJECT TITLE:	Elimination of CFC-12 in the manufacture of EPE foam sheet at DANSHUI HUAYA PLASTICS INDUSTRIES CO. LTD.
SECTOR COVERED:	Foamed Plastics
ODS USE IN SECTOR:	17,773t CFCs (=ODP) in 1991
PROJECT IMPACT:	160t CFC-12 per year, based on 1993 consumption
PROJECT DURATION:	n.a. (retroactive reimbursement)
PROJECT ECONOMIC LIFE:	10 years
TOTAL PROJECT COST:	USD 50,000 Incremental Capital Cost USD 875,000 Incremental Recurrent Cost
PROPOSED MLF GRANT:	USD 462,500 (reflecting the Chinese share of ownership)
COST EFFECTIVENESS:	USD 1.00/kg/y (unit abatement cost)
COORDINATING NATIONAL BODY:	National Environmental Protection Agency (NEPA)
IMPLEMENTING AGENCY:	UNDP
APPRAISAL DATE:	September 16, 1993

PROJECT SUMMARY

Danshui Huaya Plastics Industries Co Ltd. ("Danshui") is a joint venture between The Maya Group of Singapore and several Chinese (semi)governmental organizations. The company manufactures extruded polyethylene foam sheet.

CFC-12 is currently used in the production process. Under this project, Danshui will eliminate the use of CFCs through replacement by HCFC-22 resulting in an annual reduction of 160 tons ODS, based on current (1993) consumption. Solutions involving hydrocarbons are not possible at the current location in view of the residential character of the plant's immediate neighborhood. As the supply of CFCs is currently very erratic, causing serious business interruptions, the company has decided to commence immediately with the project.

PROJECT OF THE GOVERNMENT OF CHINA

DANSHUI HUAYA PLASTICS INDUSTRIES CO LTD ELIMINATION OF CFCs IN THE MANUFACTURE OF EXTRUDED POLYETHYLENE FOAM SHEET

1. PROJECT OBJECTIVE

The objective of this project is to phase out the use of CFCs in the manufacture of extruded polyethylene foam sheet (EPE) at Danshui Huaya Plastics Industry Co. Ltd.

2. SECTOR BACKGROUND

The Chinese foam industry consumed in 1991 17,773 tons CFCs (China Country Programme). CFC-11 was the dominant substance (15,600t,PUF), followed by CFC-12 (2,173t, EPS/PE). No other ODS was used in statistical significant amounts, although some MCF may be used in adhesive applications. Furthermore some MCF and CFC-113 may be used in mold release agents. Production is divided between larger state owned enterprises and smaller township or private enterprises. Production and process information from state enterprises is well documented. However information on the rest of the industry is less reliable. More detailed information about the sector is provided in the following table:

Categories Subcategories	ODS (t)	Production (t)	Plants (range)
Extruded PS/PE	2,173	13,000	30- 50
Flexible Polyurethane	2,000	50,000	50-100
Pipe Insulation	600	4,000	10- 20
Sprayed PUF	600	4,000	50-200
Appliance Foams	5,000	40,000	40- 70
PUF Panels	7,400	52,000	20- 50
Total Rigid PUF	13,600	100,000	120-340
TOTAL	**17,773**	**163,000**	**200-490**

The Chinese Foam Industry
Selected Industry Data (1991)

Government and industry are committed to sharply reduce, and ultimately eliminate CFC utilization. MLI is responsible for the phaseout coordination in all foam categories. Ministerial responsibility is divided into two areas:

- o Refrigerating foams.
- o Non-refrigerating foams

There are other ministries involved in the refrigeration foams, i.c.:

- o Ministry of Chemical Industry (MCI),
- o Ministry of Commerce (MOC),
- o Ministry of Aerospace Industry (MAI),
- o Ministry of Machinery and Electronics Industry (MMEI),

Complete phaseout for non-refrigeration foams is targeted for the year 2000. Refrigerating foams are expected to be CFC free from the year 2005. Uninhibited use of CFCs in foams for domestic refrigeration is expected to lead to an increase during 1991-1995 by 8 %/y, and after 1995 by 3 %/y. For other foams, a growth rate of 6 %/y is forecasted.

3. ENTERPRISE BACKGROUND

Danshui Huaya Plastics Industries Company Ltd. ("DANSHUI") was established as a partnership between

- o Beijing Foreign Trade Department........15.0%
- o Shenzhen Qinchou Economic trading Co....17.5%
- o Qinchou Plastic Factory Co..............17.5%
- o Maya Group, Singapore...................50.0%

The company produces in a facility in Danshui/Huiyan, in the Guandong province, The plant is embedded in a residential setting. Current employment is 45-50 persons.

Production has grown rapidly since the start-up of the facility and is expected to show future strong growth:

1991:	182t resin	60t CFC-12
1992:	315t resin	120t CFC-12
1993:	420t resin	160t CFC-12 (est.)
1994	540t resin	200t CFC-12 (est.)

Growth in 1993 could have been higher if not for problems in the supply of CFC-12. The difficulties in buying CFC-12 caused serious production interruptions and loss of business.

4. PROJECT DESCRIPTION

Danshui currently utilizes about 160 yt CFC-12 in the manufacture of EPE foam sheet. The company is committed to phase out the use of CFCs, and has identified butane as the replacement of choice. However, the use of butane at the current location is not possible without unacceptable endangerment of the residents. The company therefore has to resort to an inflammable blowing agent. HCFC-22 is selected as an interim solution. Permanent solutions such as HFC-134a or carbon dioxide are under consideration for implementation at a later date.

The company has already experience in the use of HCFC-22 through its partner, the Maya Group from Singapore, and will not need any external technology exchange.

The modification costs for HCFC-22 are relatively minor. However, the operating costs are considerable higher than those of CFC-12. The project includes these costs for the first four years after implementation.

The current supply for CFC-12 is erratic and causes serious business interruptions. The company has therefore decided to proceed immediately with the conversion and to apply for retroactive reimbursement of the eligible costs.

5. TECHNOLOGY

5.1 OVERVIEW AND SELECTION

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

- o Atmospheric gasses (nitrogen, carbon dioxide),
- o Hydrocarbons (LPG, Butane, Pentane),
- o "Berstorff" technology (nitrogen with alcohol),
- o HCFCs (-22, -142b),
- o HFCs (-134a, -152a),

A summary of these technologies, their potentials and their limitations is provided trough the UNEP technical Options Committee and in several UNDP studies.

Danshui's production unit is located in a building that is embedded in a residential area. It is virtually impossible to achieve acceptable safety standards in case of a conversion to hydrocarbons. The use of HCFC-22 appears the most cost effective solution using a non-flammable blowing agent. This technology is

- o Proven technology in processing and product performance,
- o Acceptable in food packaging,
- o Non-flammable and low in toxicity,
- o Easy adaptable to the existing equipment,

HCFC-22 has, however, an ODP (0.05; UNEP) and should be considered as an interim solution. A replacement by HFC-134a at a time that price and availability would allow this, or by carbon dioxide provided this technology is further developed, is foreseen.

5.3 REQUIRED MODIFICATIONS

The use of HCFC-22 will require the following changes in equipment and processing:

- o Special storage tanks (250 psig i.s.o. 185 psig). As Danshui rents the gas cylinders from its supplier no costs are related to this change;
- o Replacement of all elastomers that come in contact with the foamant (o-rings, accumulator bags, back pressure regulator diaphragms, relief valves, etc.) by compatible materials such as neoprene or butyl rubber;
- o Recalibration of the foamant metering system.
- o Readjustment of the cell size by talc addition or CO2 nucleation;
- o Readjustment of the surface (increased air ring pressure);
- o Readjustment of the density by reducing the foamant volume (80-100% of the CFC-12 volume);
- o Careful control of the rollstock related to the faster diffusion of HCFC-22 resulting in less post expansion. As an alternative the introduction of anti-diffusion agents can be considered;

6. PROJECT COSTS

6.1 CAPITAL COSTS

Modifications of the extruder.................USD 50,000

TOTAL INCREMENTAL CAPITAL COSTS...............USD 50,000

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6.2 OPERATING COSTS

The current costs of HCFC-22 are RMB 14,600/t compared with RMB 8250/t for CFC-12 (Annex-A). Assuming identical consumption, this leads to extra costs of RMB 5,350/t CFC, or (1 USD = 5.5 RMB)

USD 973/t. Assuming 20% annual growth this leads to the following cost development:

	1994	1995	1996	1997	TOTAL
ODS use (t/y)	200	240	280	335	1055
Cost Differential (000 USD)	194	212	272	325	1003
Discount Factor (10% Discount)	1.000	0.909	0.826	0.751	
Net Present Value (000 USD)	**194**	**212**	**225**	**244**	**875**

The NPV of the recurrent incremental costs is so with:

USD 875,000
==========

6.3 UNIT ABATEMENT COST

a) ODS Reduction Project Costs.................USD 50,000
b) Annual Incremental Costs (1994).............USD 194,000
c) Project Useful Life........................ 10 years
d) ODS reduction/y (1994).....................kg 200,000

Unit Abatement Costs [(a/c + b)/d]........USD/kg/y 1.00
==

7. FINANCING PLAN

Requested is the reimbursement of the eligible incremental costs. As the company is 50% Chinese owned, this will amount to 50% of USD 925,000 or

USD 462,500
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8. PROJECT IMPLEMENTATION

8.1 MANAGEMENT

The project will be substantially implemented by the company at time of approval. UNDP will oversee the project.

8.2 SCHEDULE

Implementation schedule started with Danshui Board approval of the installation of CFC-free technology (August 1993), and will end after monitoring has confirmed that at no place on the machine or in the working area unsafe levels of HCFC-22 can be detected.

TASK	TIME FOR COMPLETION					
	Q3	Q4	Q1	Q2	Q3	Q4
1. Preparation						
Board Approval	x					
Equipment Selection	x					
Order Confirmation	x					
2. Installation						
Machine Modifications		x				
3. Start-up, Training						
Machine Start-up		x				
Safety Training		x				
UNDP Audit			x			

8.3 PROCUREMENT

Maya Group will procure the project. UNDP will review this procurement.

9. PROJECT IMPACT

This project will eliminate the use of at least 200 tons of CFCs in the first year of implementation. Market and company growth indicates that this may increase up to 20% annually in subsequent years. The project employs commercially viable and environmentally acceptable technology.

10. ANNEXES

Annex A: CFC/HCFC price information

Copies of CFC_s Invoices:

No. 0118513

Supplied by: Nan Tong Hong Jiao Refreferating Equipment Manufacturing Factory

CFC-22: Unit Price: 14.60 Yun(RMB)/kg

Total: 5840 Yun (RMB)/400 kg

NO. 0005756

Supplied by: Shanghai Chemical & Light Industry Company Department 2

CFC-12: Unit Price: 8250Yun (RMB)// ton

Total: 20625 Yun (RMB)/ 2.5 tons

61875 Yun (RMB)/ 7.5 tons

PROJECT COVER SHEET

COUNTRY OR REGION:	China
SECTOR COVERED:	Sectors: Multiple
NATIONAL ODS CONSUMPTION	60,352 tonnes of ODP in 1991
PROJECT TITLE:	NATIONAL PRODUCT QUALIFICATION AND STANDARDS EVALUATION FOR NON-ODS ALTERNATIVES TO CFC APPLICATIONS
PROJECT DURATION:	One year from funding availability
PROJECT IMPACT:	No tonnes directly reduced. Will enable the rapid scaleup of CFC alternatives through product standardization.
PROPOSED BUDGET:	US $362,500
EXECUTING AGENCY:	SHANGHAI INSTITUTE OF ORGANO-FLUORINE MATERIALS (SIOFM)
IMPLEMENTING AGENCY:	UNDP
NATIONAL COORDINATING: AGENCY	NATIONAL ENVIRONMENTAL PROTECTION AGENCY THROUGH THE MINISTRY OF CHEMICAL INDUSTRY

PROJECT SUMMARY

As the new alternatives are introduced by both local manufacturers and international producers/importers, the Shanghai Institute of Organo Fluorine Materials (SIOFM) is being assigned the responsibility of product qualification, monitoring and standards evaluation of the new compounds to be sure that the enterprises meet the national and international standards set for these compounds. This project will provide the capability in SIOFM to accomplish its role. Analytical equipment will be purchased and installed in existing laboratory space, modified to accommodate the need. The project will enable the Government to fully monitor the implementation of China's quality standards for these new compounds.

PROJECT OF THE GOVERNMENT OF CHINA

NATIONAL PRODUCT QUALIFICATION AND STANDARDS EVALUATON TESTING/ FOR NON-ODS ALTERNATIVES TO CFC APPLICATIONS

1. Project Objective

The objective of this project is to provide analytical and test equipment that will enable local and international manufacturers of CFC alternatives to rapidly demonstrate that they meet national standards, and thereby qualify to produce or import products to replace CFCs in various uses. The project will use demonstrated technology and equipment that is accepted in the international analytical community, and can be periodically cross-checked with other quality control centers internationally. This will enable the Shanghai Institute of Organo Flourine Materials (SIOFM) to fully monitor product qualification and standards evaluation of CFC alternatives, and faciitate the implementation of China's quality standards for these new compounds.

2. Sector Data

Total ODS consumption in China in 1991 was 48,239 tonnes with a ODP (ozone-depleting potential) value of 60,352 tonnes for all sectors. China has forecast that unconstrained ODS consumption would by year 2010 result in ODS consumption of 229,318 tonnes with a ODP value of 292,714 tonnes with attendant damage to the global ozone layer. Growth will occur in all sectors, including the chemicals manufacturing sector, and installation of alternative manufacturing processes are planned in order for China to meet these growth needs.

3. Background

China is currently in the early phases of the adoption of alternative technologies, and the production of alternative products, that will replace CFCs and halons. Since China will be both importing and manufacturing these new alternative compounds, there will be a need for uniform standards and for certification of products as to whether they meet the standards.

The many enterprises engaged in this activity, comprising both local and international entities, are individually evaluating their products for suitability in the market by using a variety of analytical techniques. The various manufacturers will make claims regarding suitability for use and will certify purity based on their analytical results.

4. Project Description

5. Technology Discussion

5.1 Selection

Equipment selected for installation in SIOFM is based on the need to analyze replacement materials such as HCFCs, HFCs, Hydrocarbons, and various synthetic and natural oils, primarily for the refrigerant sector, but also for other sectors when needed and if the schedule permits. Some of the newer replacement materials require high degrees of purity (e.g. -HFC-134A). Analyses will be run for moisture, acid number, composition/impurities/decomposition products,chloride and fluoride ions, viscosity of lubricants, and purity/composition of lubricants, non volatile residues and high boiling residues, and particulates. The project will not provide for metallic impurity/additive analyses, as they are laboratory tests used often, but are not required standard analyses.

Modifications will be made to the rooms housing the equipment, to provide climate control via modifications to the heating/ventilation and air conditioning system for those rooms, and appropriate hoods with accompanying exhaust system.

Equipment will consist of

GC/mass spec for qualitative analyses of impurity, composition and decomposition products

Karl Fischer coulometric titrator for moisture analysis

Thermal conductivity/flame ionization gas chromatograph for highly accurate quantitative analysis

Viscometer for analysis of lubricant viscosity

Spectrophotometer for analysis of clean lubricant quality

Ion selective analyzer for detection of fluorine and chlorine ions/radicals

Potentiometric titrator for acid number

6. **Project Costs**

6.1 Total Project Costs Requested from the Multilateral Fund

Equipment	price/cost, $	
1	GC/mass spec unit	180,000
1	Karl Fischer Coulometric titrator	6,500
1	Thermal conductivity/flame ionization gas chromatograph	25,000
1	Viscometer	2,500
1	Spectrophotometer	6,000
1	Ion-selective analyzer	3,000
1	Potentiometric titrator	20,000
	subtotal	243,000

Other Project Costs

design and construction of laboratory modifications	45,000
equipment installation	5,000
technology transfer and training of technicians and laboratory management personnel	16,000
international expert fee	8,500
contingency items	45,000
subtotal	119,500
TOTAL	362,500

7. Financing Plan

7.1 From Multilateral Fund:

Investment Costs $362,500

8. Project Implementation

8.1 Management

Project management will be carried out by MCI under the direction of NEPA

8.2 Schedule

	YEAR	1993	1994	1995	1996
STEP	**DESCRIPTION**				
1	Domestic investigation	xx			
2	Selection of laboratory plan	x			
3	Selection of suppliers, negotiations, let contracts	x			
4	design	x			
5	Construction		x		
6	Equipment installation		xx		
7	Technology transfer and training		xx		
8	equipment run-in and acceptance testing		xx		
9	startup laboratory and commission facilities			x	

9. Project Impact

Successful completion of this project will result in

* a nationally recognized agency, **SHANGHAI INSTITUTE OF ORGANO FLUORINE MATERIALS** fulfilling its role as the product qualification and standards evaluation focal point for CFC alternatives;

* quality of alternatives from various sources being evaluated, followed and controlled using common standards. This will allow China to maintain phase out schedules by assuring that the challenging targets regarding quality standards, needed for some of the new alternatives, are being met as the various substitute technologies are implemented

PROJECT SUMMARY

COUNTRY:	People's Republic of China
PROJECT TITLE:	APPLICATION OF A BLEND HALON-1211 AND CO2 FOR USE IN PORTABLE FIRE EXTINGUISHERS.
SECTOR COVERED:	Halons
ODS CONSUMPTION IN THE SECTOR:	Halon-1211: 4,000 tonnes/yr Halon-1301: 50 tonnes/yr
PROJECT DURATION:	One year
PROJECT IMPACT:	No direct impact
TOTAL PROJECT COST:	US$ 65,000 and 75,000 YUAN
PROPOSED ODS GRANT:	US$ 65,000
EXECUTING AGENCY:	Ministry of Public Security
IMPLEMENTING AGENCY:	UNDP
NATIONAL COORDINATING: AGENCY	National Environmental Protection Agency

PROJECT SUMMARY

The purpose of this project is to examine the possibility to use a blend of halon-1211 and CO_2 in portable fire extinguishers. In order to utilize the better fire extinguishing performance of halon-1211 as compared to CO_2 and simultaneously reduce the consumption of halon 1211, initial tests have shown that a blend of 50% CO_2 and 50% halon-1211 seems to achieve the same fire extinguishing rating.

The internal pressure is important for the construction of the cylinder and the steel used for each cylinder. Pressure will be measured for different mixtures in order to optimize the blend. Chemical data for the blend, design specifications for extinguishers, recycling aspects and other aspects will be covered by the project.

If the application is successful, the use of the blend will be introduced as a demonstration project at one factory, and could ultimately lead to a 50% reduction of halon-1211 consumption.

PROJECT OBJECTIVES

The objective of the project is to examine the possibility of using a blend of halon 1211 and CO_2 as fire extinguishing media instead of only halon 1211. With a successful outcome of the project, the medium term prospect is that halon consumption can be reduced to 50%, making a significant reduction of overall halon use possible.

A number of aspects however have to be evaluated before practical application is possible. The aim of the project is to establish information on:

> Optimized mixture of Halon 1211 and CO_2 concerning pressure level of the mixture and fire extinguishing performance.
>
> Equipment development and establishment of design specifications for a prototype fire extinguisher for testing purposes including requirements for cylinders, valves and fittings.
>
> Filling and refilling techniques at manufacturers and service centers.

Other issues to be addressed in the project are influence on the recycling of halons; the possibility and need for separating Halons 1211 and CO_2 have to be evaluated; as well as possible influence on requirements for recycling machines, destruction techniques etc.

SECTOR BACKGROUND:

China's halon consumption is currently 12,500 tonnes ODP or more than 25% of the total CFC and halon consumption in China if the weighted ODP value of the ODS consumed in China is considered. At present only 60% of the total existing production capacity of Halon 1211 is utilized. (ODP factor used; Halon 1211 = 3, Halon 1301 = 10).

Approximately 3,500 tonnes Halon 1211 and 10 tonnes 1301 is produced annually in China by 13 to 18 factories, of which not more than 5 have an annual production of more than 300 tonnes. Additional 5-700 tonnes halon 1211 and 50 tonnes 1301 is imported from developed countries annually (all figures are 1991 figures)

Around 2,645 tonnes Halon 1211 is used for the production of approximately 1.2 million portable halon fire extinguishers produced annually by 80 factories in China. 355 tonnes of halon 1211 and 45 tonnes of halon 1301 are used for fixed installations produced by 25 factories out of the 80 factories.

600 tonnes Halon 1211 and 5 tonnes Halon 1301 are used by 900 servicing and maintenance companies in China. Due to the rapid economic development in China during the last few years, a large number of halon 1301 fire extinguishing systems have been imported and installed. Those systems are not include in the above figures as they have been imported as "fire fighting equipment" and not as halons. They however will have an influence on the amount of Halon 1301 for service and maintenance in the future.

The Ministry of Public Security (MPS) is responsible for fire prevention, fire safety, fire fighting and licensing of the production of fire equipment, including halons in China. It is also responsible for the phase-out programme for the halon sector throughout the country. The Regional MPS authorities directly administer and control manufacturers and service and maintenance workshops in each region.

Through the revision of regulations and change of established practices for the use of halons, licensing the production of halon based fire equipment and phasing out the production of halons in China, the MPS plays a major role in the sector. A phase-out programme is under preparation to implement the country programme for this sector.

PROJECT PLAN

The project will be carried out by the Tianjin Fire Research Institute, which has the necessary expertise and facilities to carry out the activities covered by the project.

The examination of the design pressure and suppression performance for different mixtures of Halon 1211 and CO_2 will be carried out in the Chemical laboratory of the Institute, as it has experience in this field and necessary equipment for carrying out the applications.

Design specification for fire extinguishers will be carried out in cooperation with fire equipment manufacturers. The cost implication for cylinders for different pressure levels will be examined in order to evaluate the overall cost for the production of 1 million extinguishers annually. For the fire rating of the extinguishers however, cylinders for CO_2 extinguishers will be used for the practical fire rating testing.

An evaluation of filling procedures and equipment will be evaluated as part of the project. As recycling and halon banking is a major issue in the rapid phase-out of the production of halons, the possible influence on recycling equipment and recycling of halons will be examined as part of the project. Other potential environmental aspects will be evaluated as part of the project.

TIME SCHEDULE

The following time schedule is envisaged for the project:

ITEMS	1st quarter	2nd quarter	3rd quarter	4th quarter
Mixture data (pressure etc)	XXXXXX	XXXXXX		XX
Design specification			XXXXXX	XXXXXX
Fire rating testing		XXX	XXXXXX	XX
Recycling and other issues		XXXXXX	XXXXXX	XXXXXX

PROJECT COST:

Item	$ US	YUAN
Manpower: - prototype design and specification - recycling issues etc	15,000	10,000
Measurement of pressure and other design parameters	20,000*	25,000
Fire rating and other test - materials, fire extinguishing agents etc - filling equipment for the blend	25,000*	35,000
Miscellaneous	5,000	5,000
Total:	65,000	75,000

* The Tianjin Fire Research Institute has or will have access to facilities necessary for the implementation of the project. Some of the cost includes modification and adaptation of equipment.

FINANCIAL PLAN

The recipient requests the following financing:

Proposed ODS Grant: $ US 65,000
Financed by Ministry of Public Security: Yuan 70,000

PROJECT IMPLEMENTATION

The next step, providing that the result of the project confirms the preliminary studies carried out, will be the introduction of the blend in actual production. In cooperation with a halon fire extinguisher manufacturer, a trial production will be established for additional evaluation of the viability of the approach.

A positive result of the project and confirmation that practical problems concerning recycling etc can be solved will have a significant influence on the demand for halons.

PROJECT COVER SHEET

COUNTRY:	Peoples Republic of China
PROJECT TITLE:	Testing of vacuum insulation panels for domestic refrigerators and freezers
SECTOR COVERED:	Foamed Plastics
ODS USE IN SECTOR:	Foam sector (1991): 17,773 t CFC (= ODP). Subsector (appliance insulation foam): 5,000 t CFC (= ODP). Estimated annual increase 8 % until 1995; after 1995 3 % p.a.
PROJECT IMPACT:	The project contains the potential of reducing the use of ODS for this purpose on a long term basis, and reducing the energy consumption substantially
PROPOSED BUDGET:	USD 50,000
EXECUTING AGENCY:	National Environmental Protection agency (NEPA), via Ministry of Machinery Industry (MMI)
IMPLEMENTING AGENCY:	UNDP

PROJECT SUMMARY

A number of research institutes all over the world are developing insulation panels for domestic refrigerators and freezers, using vacuum technology as a partial replacement of plastic foams. The panels seem promising with regard to the reduction of the use of ODS and with regard to the energy consumption from domestic refrigeration.

The Guangzhou Electric Apparatus Research Institute has developed a new type of vacuum insulation panel. In order to assess the feasibility of the panels, a number of tests of the insulation capability have to be carried out. The objective of this project is to carry out such tests on the panels.

NEPA has confirmed that the technical results of the project will be made available to all intersted Article 5,Para. 1 countries on request.

PROJECT OF THE GOVERNMENT OF CHINA

TESTING OF VACUUM INSULATION PANELS FOR DOMESTIC REFRIGERATORS AND FREEZERS

1. PROJECT OBJECTIVE

The objective of the project is to carry out measurements on recently developed vacuum insulation panels for proposed use in domestic refrigerators and freezers as a substitute of plastic foam insulation.

2. SECTOR BACKGROUND

Several research institutes all over the world (especially in France, Japan, USA etc.) are developing insulation panels for refrigerators and freezers, using vacuum technology instead of plastic foams as now.

The technology is promising in the sense of insulation capability and ozone layer protection. No ODS is needed.

The Guangzhou Electric Apparatus Research Institute (GEARI) under the Ministry of Machinery Industry (MMI) has developed a new type of powder vacuum panel which seems rather promising.

However, a range of technical measurements are needed in order to assess its performance and to test the feasibility for use in refrigerators and freezers.

There are in all 70 production lines for domestic refrigerators and freezers in China with a production capacity on 12 million units (1991). The CFC-11 consumption for the insulation foam is approx. 5,000 t per year (1991).

The annual increase of the production, and hence the consumption of CFC-11, is expected to be 8 % p.a. until 1995 and 3 % p.a. thereafter.

A more detailed description of the foam sector is attached (Annex 1).

3. PROJECT DESCRIPTION

The main objective of the project is to carry out a number of physical and chemical measurements on vacuum panels that have been developed by GEARI. The status of the relevant measurements is descriped in the attached Presentation Paper (Annex 2).

The project will include comparison of the perfomance of these panels with other, similar, panels. Furthermore the project will include considerations of the applicability to the existing designs and production processes for refrigerators in China.

The project can be divided into the following phases:

1. Collection of information on testing standards

2. Testing of panels

3. Evaluation of test results and conclusions

4. Reporting

The different phases include the following activities:

Phase 1: Collection of data on testing standards

The testing consists of both physical and chemical tests. The physical tests include both thermal and mechanical tests.

In order to ensure that the tests carried out in this project include all relevant parameters, and that the test results can be compared to results generated from other similar tests of vacuum panels, there will be a preliminairy collection of test procedures from those institutes which have tested the other panels.

The data collection will also include technical specification of the other types of vacuum panels.

The testing should be carried out on various applications of the panels. This phase will therefore also include considerations of:

- Size and thickness of panels
- Filler and barrier (enclosure) materials
- Adhesives and other materials used in the refrigerator cabinets

This phase will end up with a specified plan for the testing of the panels. Most of the tests will be carried out by GEARI, but other relevant institutes will be included for specific tests. The testing plan will be discussed with these institutes before the next phase is started.

Phase 2: Testing of panels

This phase consists of the testing of the panels. The thermal testing will include measuring of the thermal conductivity under different temperatures, with different panel thicknesses and with different powder and barrier materials.

The mechanical tests will include mechanical strength measurements. Also in this cases different kinds of panels will be tested.

The chemical tests include measurements of the influence on the panel surfaces of different chemicals, among others the adhesives or other chemicals which the panels will be affected by during the manufacture and under operation.

The chemical tests include accelerated tests in order to evaluate long term effects.

Phase 3: Evaluation of test results and conclusions

In this phase all the collected measurement data will be used for calculation of relevant parameters. Furthermore, the data will be used for consideration of the applicability of the panels in refrigerators and in the existing production facilities in the Chinese refrigeratior industry.

This phase also includes comparison of data of these panels with the data of panels developed by other institutes.

Phase 4: Reporting

This phase will include preparation of a report with all the findings of the tests. The report will be published and discussed with representatives of relevant research institutes and industries, e.g. from France, Japan, USA, Denmark and China itself, and presented at international seminars.

4. PROJECT COSTS

The total project cost will amount USD 50,000. The budget can be summarized as follows:

- Materials, equipment etc.:	USD 15,000
- Testing at other institutes:	USD 10,000
- Travel expenses:	USD 5,000
- Fees:	USD 10,000
- Seminar cost:	USD 10,000
- Total project cost:	**USD 50.000**

The project costs are specified in annex 3.

5. FINANCIAL PLAN

The recipient requests a grant to the amount as budgeted.

6. IMPLEMENTATION

MMI with assistance of NEPA will oversee the implementation of this project. It is expected that the project can lead to a better understanding of the possibilities of the performance and applicability of vacuum insulation panel as a substitute for foam plastic insulation.

7. PROJECT IMPACT

This project will have no direct impact on the use of ODS. However, it will contribute to the development of a very promising technology which will have the potential of eliminating the use of CFCs and HCFCs for insulation foam in refrigerators. It also implies the possibilities of reducing the energy consumtion for domestic refrigeration substantially and reducing the emission of greenhouse gases.

THE CHINESE FOAM INDUSTRY

--SECTOR BACKGROUND--

In 1991 the Chinese foam industry consumed 17,773 tons of CFCs (ref. Country Programme for the Phaseout of ODS under the Montreal Protocol). CFC-11 was the dominant substance, followed by CFC-12. No other ODS were used in statistically significant amounts, although some MCF may be used in glue applications. Some MCF and CFC-113 may be used as a mold release agent.

Production is divided between larger state owned enterprises and smaller township or private enterprises. Production and process information from state enterprises is well documented. However information on the rest of the industry is less reliable.

More detailed information is provided in Table 1:

(sub)category	tons ODS	type ODS
Extruded Polystyrene/ethylene	2,173	CFC-12
Flexible Polyurethane	2,000	CFC-11
Rigid Polyurethane	13,600	
Pipe Insulation	600	CFC-11
Sprayed PUR	600	CFC-11
Appliance Foams	5,000	CFC-11
PUF Panels	7,400	CFC-11
TOTAL	17,773	

Table 1. ODS consumption in the foam sector (selected industry data, 1991)

Government and industry are committed to sharply reduce, and ultimately eliminate CFC utilization. MLI is responsible for the phaseout coordination of all foam categories. In addition, other ministries are involved in the refrigeration foams, such as the:

- Ministry of Chemical Industry,
- Ministry of Internal Trade,
- Ministry of Aerospace Industry,
- Ministry of Machinery Industry,

Complete phaseout for non-refrigerating foams is targeted for the year 2000. Refrigerating foams are expected to be CFC free from the year 2005.

The sector involves at least 208 production facilities. Because the information on smaller township facilities is incomplete this figure is assumed to be very conservative. Estimates reach as high as up to 340 individual production units (see table 2). Many companies have combined capabilities, or even multiple capabilities in one category[1].

(sub)category	production (t)	plants(l)	plants(h)
Extruded PS/PE	13,000	30	50
Flexible PUF	50,000	50	100
Rigid PUF	100,000		190
Pipe Insulation	4,000	10	20
Sprayed PUF	4,000	50	200
Appliance Foams	40,000	40	70
PUF Panels	52,000	20	50

Table 2. Estimated number of foam production unit ("l" = low estimate; "h" = high estimate)

The use of foams for domestic refrigeration is expected to increase annually during 1991-1995 by 8 %, and after 1995 by 3%. For other foams, an annual growth rate of 6 % is forecasted.

Beijing, April 21, 1993
Bert Veenendaal

[1] Tianjin Polyurethane plastics Factory for instance has two flexible foam lines, one panel line and facilities for spray foam.

Study Report on Powder Vacuum Insulation Panel

I. Introduction

With the development of refrigerator industry, China has consequently increased its production of rigid polyurethane foamed plastics(RPUF) for the last decade of years. Adverse studies aim to improve the insulation rate and reduce the weight of RPUF manifest that its thermal conductivity, which usually has 0.020-0.024w/mk, is very close to the theoretical value, 0.0182w/mk. Its density also drops to 32+-2kg/m3. So it will be hardly possible to improve the technology of refrigeration and save money and energy through further efforts to raise the insulation rate and keep low density of RPUF with CFC-11(F-11) as its blowing agent.

And what is more important is scientists, after ten years of observation and research, prove that CFCs cause severe depletion on the ozone layer and accelerate the speed of warmhouse phenomenon of the Earth. They destroy and bring disastrous effects to the environment which human beings cannot survive without. To replace them becomes the overwhelming task of environmental protection.
F-11, the blowing agent of RPUF, is one of the limited CFCs. Statistics shows that in 1987 the world's total output of refrigerator is 58,676,000 sets, using up 8,600 tons of CFC-12 and 60,000 tons of CFC-11. In 1988, China manufacturers produced 7,398,600 sets. Consumption of CFC-12 is 2,000 tons. Eight thousand tons of CFC-11 are used as insulation materials,. which take up 17 percents of total consumption of CFC in China. It is a priority to seek alternatives of CFC-11 as insulation material.

For the last two years many countries have made great efforts to replace CFC-11. One method is to use combined poly-ethereal agents. It contains 50-percent water replacement of CFC-11. British ICI Company and German's Bayer Company, for example, have put this method into practice in many European nations and regions. The ICI Co. who introduces its technology to China's Beijing Snowflake Refrigerator Factory and Bayer to Qingdao Refrigerator Factory, make successful experiments in the East. China's Twilight Chemical Research Institute and the 501st Institute of the Ministry of Aerospace and Aeronautics have achieved satisfactory results in this field and planned to put into use in three years.

The research of appliance of CFC-11 alternatives is undertaken at the same time. German's Kali-Chemie Co. use HCFC-123 and HCFC-141b as blowing agent in RPUF foaming experiment to compare the formula and quality of RPUF. Several research centers in China make similar experiment and discover that by using HCFC-123 and HCFC-141b, the insulation rate of RPUF drops to some degree. And HCFC-123 does not fix well to the lining material ABS inside a refrigerator; while HCFC-141b is unfortunately inflammable. To solve these problems it still take a long period of time changing the formula of RPUF and the internal lining material.

Some researchers develop an insulation panel without ODS. This panel, called the Powder Vacuum Insulation Panel, will completely replace CFC and has a rate of insulation three times as high as RPUF. Panasonic Freezer Refrigeration Company began to make PVIP in 80s and they have minimized its thermal conductivity to 0.007w/mk. In 1985 a special panel combining RPUF and PVIP was made to substitute for the insulation panel of refrigeration room. For example, Panasonic NR-314TG refrigerator, which uses this new panel, has 120L of volume, 30% bigger than usual refrigerators and 50.3% raise in capacity. That is a significant progress in the technology of refrigeration.

In consequence, researches on the connecting rigid foam plastic vacuum insulation panel were undertaken. This panel has same insulation rate as

PVIP. U.S. and German have achieved similar thermal conductivity of PVIP to Japan. Another research lately done in U.S. involves stainless steel. In China, Xi'an Pomegranate Technology Co. LTD. and Shaanxi Refrigerator Factory have jointly accomplishzed 0.006-0.0.0093w/mk with PVIP.

PVIP has a fine quality of insulation and doesn't contain any kind of CFCs. But it is regarded as an ideal alternative of CFCs in the long term. In March-October, 1991, my institute undertook a preliminary research of CFC replacement.

2.The Theory of PVIP

An insulator usually have one of the three modes of thermal conductivity: conductivity, radiative conductivity or convective conductivity. Its superficial thermal conductivity(λ)includes the thermal conductivity of its internal vapor(λ_g),of its solid contact(λ_s)and radiative conductivity, convective conductivity of vapor(λ_c).As formula (1) shows:

$$\lambda = \lambda_g + \lambda_s + \lambda_r + \lambda_c$$

PVIP is a kind of panel with extracted vacuum after being filled by powder insulators. The panel could make a vacuum of 1 pa (10^{-2} mmHg).

Under general circumstances an insulator conducts heat by air. And this mode of conductivity will take up over 50% of its total conductivity. The density of the insulator has little influence on the conductivity. The vapor inside PVIP is extremely sparse and the molecules of the vapor have least chances to come into each other. The conductivity of vapor i.e. λ_g is reduced to such a degree that it can be neglected. And the extreme sparseness of cellular powders can also be neglected. Therefore, the thermal conductivity of PVIP λ_o is mainly determined by λ_s and λ_r. But the proportion of these two factors are small. So λ_o will be much lower than λ. Formula (2) shows their relation:

$$\lambda_o = \lambda_{go} + \lambda_{so} + \lambda_{jo} + \lambda_{ro} + \lambda_{co}$$

here λ_{co} is extremely samll and can be neglected. So formula (2) transfers to formula (3):

$$\lambda_o = \lambda_{go} + \lambda_{so} + \lambda_{jo} + \lambda_{rc}$$

From formula (3), we'll find λ_o of PVIP is determined by λ_g, λ_{so}, λ_{jo} and λ_{rc}. Formula (4) explains the λ_g of PVIP vapor:

$$\lambda_{go} = \lambda_{g1} \frac{L_v}{L_v + L}$$

here: λ_{g1} stands for λ_g of vapor of 1 barometric pressure,
Lv for distance between vapor,
L for average free movement of vapor molecules.

Formula (5) shows L value:

$$L = \frac{2.33 \times 10^{-20} T}{P \tau^2}$$

here: T stands for temperature (k),
P for pressure (mmHg),
σ for semi-radius of vapor molecules (cm).

L is inverse to vapor pressure when T and σ is stable. When the vaccuum degree goes up (i.e. the pressure is lower), the L value goes up while λ_{go} drops. As L >> Lv (over fifty times), the TC value of λ_{go} decreases to a level that it can be overlooked. Consequently the quality of the insulation is determined by F, i.e. the solid volume of powder, which affects the value of λ_{so}, λ_{jo} and λ_{ro}. The TC value of solid powder matrix is bigger than that of the air. As F goes up, λ_{so} goes up too. As the powder grains make less contacts, the powder has a great heat resistance. F goes up, λ_{jo} goes down. Formula (6) calculates the value of λ_{ro}:

$$\lambda_{ro} = 4L\mu n^2 d\xi T^3$$

here: n refers to refraction index of the air
d to radiation constant
ξ to blackness of fillers
T to temperature
L to range betwenn the grains.

When the other parameters are set, λ_{ro} is proportionate to L, i.e. λ_{ro} is inverse to F.

According to the above theory, a PVIP can be made through researches in these aspects.

3. Research on PVIP

3.1 Research on the Powder

The quality of powder is most influential factor in making PVIP. These premises determine whether a kind of powder can be used or not:

a. very small TC and λ_{jo} value;
b. under the condition of a low vaccuum degree, the range between grains is so small that λ_{co} can be overlooked;
c. endurance of the outside air pressure, so as to keep the plastic film container apart;
d. light weight;
e. easy to get dry;
f. rich resource to keep its price low.

The best choice is the expansive perlite powder (EPP). However, the varied density of powder, the thickness of liner, the size of grains and the content of impurity will have direct effects on the TC value of PVIP. Experiments on PVIP from various sources show that the TC value of PVIP goes up with the increasing panel density in a certain range and drops when the granularity gets lower. See:

Diagram 1: TC Value of PVIP with Densities

Sample No.	Density (kg/m3)	Vaccuum Degree(pa)	TC(w/mk)
911019-A	300	0	0.0198
911019-B	250	0.1	0.0171
911019-C	200	0.1	0.0165
911019-D	150	0.5	0.0172

Diagram 2: TC Value of PVIP with Granularity

Sample No	Powder Granularity	Panel(kg/m3) Density	VD(pa)	TC(w/mk)
9190-2	coasre grain: fine = 2:1	160	<1	0.0226
9190-3	coarse	160	<1	0.0273
9190-5	coarse	250	<=2	0.0329
9190-6	fine	250	<=2	0.0160

Those data show that to achieve the best value of density between the granular ranges and the panel and of powder and granular sizes, we must do much more experiments.

3.2 Research on Materials of Powder Vaccuum Container
Keep the vaccuum degree of panel steady. These are the required characteristics for the materials:

1) well-maintenance of vaccuum and low gas and air permeability;
2) low solid TC value of the container;
3) mechanical strength for 1 bar;
4) easy sealing, simple craft and suitable for quantity production;
5) light weight.

The best choice at present is PET-Al-PE compiled film. But experiments show it causes 3-5% increase of TC value. See:

Diag 5: TC Value of PVIP with Packings

Sam No	Vaccuum Degree(pa)	TC(w/mk) kraft paper bag PET-Al-PE	kraft paper bag
9010-17-1	101325	0.0556	0.0541
9010-17-2	101325	0.0771	0.0411
9010-17-3	101325	0.0519	0.0505

The reason: TC valuc of aluminium(230w/mk) is 1,000 times bigger than that of plastic film. Data show when the thickness of Al layer is 0.5um, there is almost no effect. But TC value rises when it is 7μm. See below:

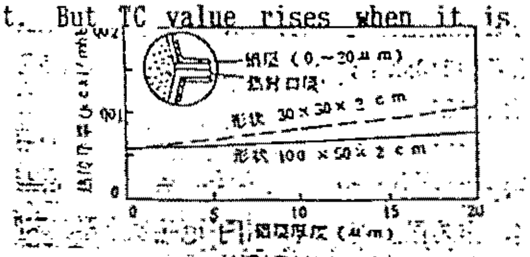

图1. 铝层厚度对真空绝热板的热传导率的

The thickness of Al layer used in present frige is 9-12μm. So TC value rises. We'll have systematic research in this aspect to make the best radiation rate of Al layer in certain thickness so that the TC value is proper.

3.3 Research on Vaccuum Extraction

This technology is critical in determining the perfect insulation rate of

PVIP. Resistance of the extraction is high and the process will take a comparatively long time. So the accessory, the timing and the panel temperature of extraction system must carefully designed. Diagram 6 discloses the relationship between timing and TC value of panel.

Diag 6: TC Value of PVIP with Extraction Time

Sam No	Density(kg/m3)	TC value ext 2/3hr 1pa	ext 4hs 200pa	ext 6hs 1pa	comments
8912-29	160	0.0485	0.0255		
9190-2	160			0.0226	use viscose to stick powder

3.4 Research on Formulation and Craft of PVIP

The gas and humidity will permeate the film of the vaccuum container when a PVIP for a long duration. Vaccuum pressure in PVIP will gradually rise and insulation rate drop. Adding gas absorbing agent(GOA) will prolong the life of PVIP. GOA has these characteristics:

1) large capability of absorbing gas and low balance pressure intensity,
2) stable quality and regenerative,
3) high intensity.

The additive is determined by PVIP duration, permeatiblity of gas and humidity in vaccuum container materials, emission rate of powder material gas, absorbing speed and quatity of the agent.

Also, to reduce the effects that radiative conductivity makes to the TC value of the panel, proper types and amount of metal powder will be added in PVIP. We had used water-soluble resin as viscose to make the material into a panel of proper intensity and specifications. The result, however, is that its driness and vaccuum degree are affected. See:

Diag 7: TC Value of PVIP with Panel-making Crafts

Sam No	Density (kg/m3)	Vaccuum Degree(pa)	TC (w/mk) Panel of powder	Of powder with viscose
9010-2	192	1		0.0362
9190-1	207	1	0.0186	

Diag 8: TC Value of PVIP with Viscose

Sam No	Density (kg/m3)	Vaccuum Degree(pa)	TC (w/mk) Powder panel paper bag PET-Al-PE	Powder panel
9140-1	123	1	0.0533	
		101325		0.0513
9140-3	86	1	0.0471	
		101325		0.0448

Further research should be made on the location of gas absorber and metal powder in the panel and the size of the panel.

4. Research on Application of PVIP

It doesn't require any CFC substances to make a PVIP. Therefore, it can replace RPUF insulation material currently used in refrigerators. It is significant for protection of ozone layer, environment that mankind rely on, and will create remarkable social benefits. Its super TC has tackled the problems derived from freezer enlargement such as volume increase, occupying large space, and higher energy consumption. The TC rate of PVIP is 0.007w/mk. Its insulation performance is three times of the current RPUF. The application of PVIP and RPUF compound as refrigerator insulation can not only improve a refrigerator's insulation properties, achieve energy efficiency, improve refrigerator volume, but also reduce 50% of CFC-11 consumption. Current CFC-11 substitution research work proves that the TC value of RPUF with HCFC-123 or HCFC-141b as foaming agent is greater than current RPUF. Adoption of PVIP-RPUF combination will completely replace CFC-11, its insulation performance is identical with existing RPUF. See diagram 9 for details. Therefore, PVIP is a new prospective insulation material used in refrigerator.

Diag 9 TC of PVIP, RPUF and their Compound

Sam No	Density(kg/m3)	TC(w/mk)
HCFC-141b	33	0.0242
1019B	250	0.0165
HCFC141b + 1019B	/	0.0215
HCFC-123	33.8	0.0236
9282	110	0.0162
HCFC123 + 9282	/	0.0227

As people are concerned about the feasibility of actual application of PVIP in refrigerators. Some of the views on this issue presented here are for reference.

1) Long-term Effect of PVIP

Since formulation, technology, vacuum container material, thermo-sealing technology, and vacuum extraction technology can guarantee the vacuum of PVIP and keep vacuum for long time. When used in refrigerator, it can be compounded with RPUF. In this way, RPUF can not only keep the panel from any damage but slow the permeation of the air and humidity - so it'll be more durable.

2) Costs of PVIP

Present researches promise low cost of materials but difficult craft and technology. The total cost is roughly the same as or slightly higer than that of RPUF but lower than that of RPUF with HCFC-123 or HCFC-141b blowing agents. The refrigerator manufacturers will find it quite acceptable.

3) No big change will be made on the present foaming line when PVIP is applied in refrigerators. The only amendment is to add a process in the line to make PVIP into the setup of refrigerators. However, we are in this research right now.

4) A refrigerator with PVIP will be heavier than that with RPUF due to its density which is six times bigger than that of RPUF. But if we make some improvement on its moving sturcture and at same time tell the customers the importance of environmental protection, it won't be a big problem.

5. Conclusion

1) All in all, it is critical to start the research on PVIP.
2) Preliminary study on PVIP has achieved 0.016w/mk TC and 160kg/m3 of density. It provides a serial of critical points which we have to come across in future research, to wit:

a. making expansive perlite powder and best choice with grains' size and range;
b. materials for making powder vacuum container;
c. technology for thermal sealing;
d. accessories for the vacuum extraction system and research on its related technology;
e. research on PVIP formulation, technology.

In future research work, if these issues can be studied more systematically, anticipated objectives can be achieved.

3) Based on the preliminary research work, our idea for the next step is: while PVIP research is being undertaken, the research work should also be made on connected foaming rigid plastic vacuum insulation panel with CFC-11 free foaming agent. Through research, first-class PVIP with comprehensive performance will be selected from vacuum panel made by different kinds of vacuum container material or fillings. Research on RPUF and PVIP compounds technology as refrigerator insulation layer should also be conducted. Objectives such as insulation material used in refrigerators completely free of CFC-11 and insulation technology improvement will be accomplished.

4) Due to large amount and difficulty of research work of the project, it is necessary to have supports in terms that this technology involved many fields of research, manpower, materials and financial aid. I believe, under the auspices of concerned authorities, the research work of the project will be accomplished definitely, creating benefits for the society.

Annex 3

--PROJECT COSTS--

--DETAILED BUDGET--

1. Materials, equipment and apparatus:

1.1. Materials testing:

- Vacuum container performance tests:	USD 3,000
- Perlite powder perfomance test:	USD 3,000
- Absorbent performance tests:	USD 1,000

1.2. Equipments and apparatus:

- Film permeability rate measurer:	USD 1,000
- Vacuum board forming mould:	USD 2,000
- Vacuum container sealing machine:	USD 2,000
- Vacuum pump system:	USD 3,000
Total, materials and equipment:	USD 15,000

2. Testing etc. other institutes:

- Sample and prototype manufacture:	USD 6,000
- Sample and prototype tests:	USD 4,000
Total, testing etc.:	USD 10,000

3. Travel expences:

- Collection of information on other panels:	USD 5,000

4. Seminar costs:

- Discussion of test results with other institutes:	USD 10,000

5. Staff expenditures:

- 1 senior engineer:	USD 4,600
- 2 engineers of USD 2,700:	USD 5,400
Total, staff:	USD 10,000

Total project costs:	**USD 50,000**

PROJECT COVER SHEET

COUNTRY OR REGION:	People's Republic of China
PROJECT TITLE:	Survey on policy and planning measures to promote recycling of CFCs
SECTOR COVERED:	Recovery and Recycle
ODS USE IN SECTOR:	Consumption for total refrigeration sector: 12,869 MT CFC (1991). Estimated recycling potential: 4,500 MT CFC Growth rate of the sector about 15% p.a.
PROJECT IMPACT:	The project has no direct impact, but it is a precondition for implementing other recycling projects within refrigeration and air conditioning
PROPOSED BUDGET:	USD 200,000 MLF Grant; RMB 95,000 Government of China
EXECUTING AGENCY:	National Environmental Protection Agency (NEPA), via the Ministry of Internal Trade (MIT)
IMPLEMENTING AGENCY:	UNDP

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PROJECT SUMMARY

The objective of this project is to establish an infrastructure design and an organizational framework for coordinating a number of recycling projects and evaluating legal and economic measures to promote recycling.

The project will result in the set up of an organization for coordinating the recycling projects, and the design of an infrastructure for a nationwide network for recycling. It will provide for study and follow-up recomendations for legal and economic instruments to promote recycling. The project will also include seminars for communicating and training the organizations involved in recycling.

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PROJECT OF THE GOVERNMENT OF CHINA

Survey on policy and planning measures to promote recycling of CFCs

1. Project Objective

The objective of this project is to develop an organization and on umbrella plan for all the recycling programmes and projects in China, and to evaluate policy and planning measures to promote the recycling activities.

The project will thus form the framework for organizing and evaluating a number of prototype tests projects on the recycling of CFCs.

2. Sector Data

Total ODS consumption in China in 1991 was 48,239 tonnes with a ODP (ozone-depleting potential) value of 60,352 tonnes for all sectors. China has forecast that unconstrained ODS consumption would by year 2010 result in ODS consumption of 229,318 tonnes with a ODP value of 292,714 tonnes with attendant damage to the global ozone layer. Growth will occur in all sectors. Due to the growth and to China's dependency on imports for about half its needs, an urgent key need will be to rapidly develop a recycled supply of CFC's.

3. Background

The recycling of CFCs will play an important role in the Chinese Country Programme to reduce the emission of ODS to the atmosphere.

First, recycling will reduce the consumption of CFCs for the refrigeration and air conditioning areas. Secondly, recycled CFCs help China meet their growing needs as the worldwide production of CFCs is reduced. The recycling of CFCs will thus allow a faster phaseout of CFC production.

The recycling of CFCs in a country as large as China is complex, and requires thorough and comprehensive organizational work, as the recycling has to take place through widespread networks of centres and companies all over the country.

Today, the repair and maintenance of commercial and industrial refrigeration and air conditioning facilities is carried out at 8,000 centres. The repair of refrigerators takes place at 40,000 service centres throughout the country. There are 4,000 service stations undertaking the repair of mobile air conditioners.

Furthermore, repair of defective refrigerators takes place at the production lines of the country's 70 refrigerator factories. Likewise defective mobile air conditioning devices are repaired at production lines in car factories.

For recycling to be successful, the centres and companies have to be aligned and informed, as well as supplied with information and devices for recycling of CFCs. These recycling systems, moreover, will continue to be relevant after substitution to low and non-ODS technology.

4. Project Description

The project will both develop the organizational framework for implementing the prototype recycling projects and provide information for future policy and planning to promote recycling.

The project will include the following components:

1. Organizational set up for implementing and supervising prototype project to recycle CFCs and later projects to disseminate the recycling activities.
2. Data update to evaluate existing and future potentials for recycling of CFCs, and data on the service networks. This will also allow for monitoring progress.
3. A design for nationwide networks for recycling of CFCs
4. Evaluation of various options for legal and economic instruments for promoting the recycling of CFCs
5. Establishment of a plan for training and information dissemination on recycling of CFCs

The components are described in more detail below:

<u>Component 1: Organizational set up</u>

The project begins with the setting up of an organization which will be responsible for both steering this umbrella programme and the implementation of projects for recycling of CFCs.

This also includes coordination of recycling projects with other projects on conversion of refrigeration and air conditioning facilities to non-CFC technology.

The organization will thus include among others: the Ministry of Internal Trade (MIT), Ministry of Machinery Industry (MMI), Ministry of Light Industry (MLI), Ministry of Chemical Industry (MCI) and the executive organization, NEPA.

The task of the organization will be:

- To set up the overall guidelines for coordinating and implementing recycling projects;
- To set up a time schedule for implementing projects on recycling of CFCs;
- To carry out overall monitoring and evaluation of recycling projects

The organization will also evaluate the progress of the recycling projects across China for feedback to NEPA.

<u>Component 2: Updating</u>

There already exists some data on the consumption of CFCs within the field of refrigeration and air conditioning and the service network.

However, there is a need for updating and supplementing that data which are of special interest for recycling activities. In this respect there is a need for data to analyze the true cost effective potential for recycling CFCs within the various fields of recycling:

- Service centres and companies for commercial and industrial refrigeration and air conditioning

- Service stations and companies for mobile air conditioning

- Companies manufacturing refrigeration equipment and mobile air conditioners

- Local service centres for domestic refrigeration and air conditioner units

Projects in all these areas will be submitted subsequent to this project, establishing the initial recycling programme in China.

Further, there will be a need for demographic and social data for the areas where the different centres are operating.

Data will be generated for both existing and estimated future conditions. The data collection will be coordinated with data collection in the prototype projects, so that duplication of work is avoided.

The prototype from projects in each area will primarily provide the basic data from the subsectors, while summarizing and calculation for the whole sector will take place in this project.

Component 3: Nationwide networks

It is important to ensure a close coordination between the involved centres and companies in order to ensure an efficient and cost-effective implementation of recycling activities.

The existing network of service centres and companies operates at different levels and is supplied with different kinds of equipment, and personnel with different skills.

Some centres will have to handle small amounts of ODS, while others will have to handle large amounts. The need for equipment, information and training will therefore be different from centre to centre.

In this phase the logistics and infrastructure of the networks will be analyzed, and improvement recommendations will be developed for future organization and cooperation between them.

The analysis of the networks will include considerations of the capacity, the need for equipment and skills, and the economics of the different types of centres.

The future set up of the recycling activities will be connected with the existing networks of service centres and companies whenever appropriate. The recycling activities can be divided into the following 6 sub-components:

- Recycling of CFCs from commercial and industrial refrigeration and air conditioning facilities

- Recycling of CFCs from mobile air conditioning

- Recycling of CFCs at the refrigerator factories

- Recycling of CFCs at service centres for domestic refrigerators and air conditioning units

- Collection and treatment of CFCs from old refrigerators

There will be a need for recommendations on which networks make sense to set up, as well as recommendations on both the set up of each of the networks and on the appropriate interconnections between the various activities.

The output of this phase will be a recommended design for the future set up of the total network/system for recycling of CFCs in China. The results will be presented at a seminar where representatives from the involved centres and authorities will discuss the recommendations and develop improvements to the design.

<u>Component 4: Legal and economic instruments</u>

Although the prices of CFCs will increase considerably in the coming years, the incentives to recycle CFCs is uncertain in some sectors, as cost effectiveness will vary between subsector and attractiveness to the enterprises.

Therefore, there is a need to identify and analyze different types of legal and economic incentives that can encourage involved companies, organizations and clients to increase recycling of ODS.

At the general level, implementation of the following measures will be evaluated:

- Tax, price and other policies on production and import of CFCs to drive economic incentives

- Legal regulation of ODS use to promote recycling of CFCs

- How to address country savings vs enterprise costs for recycling to assure economically viable results

At the sectoral level the following measures will be evaluated:

- Certification of CFC importers, dealers and end users

- Standard setting of recycled/reclaimed CFCs

- Funding of projects to promote recycling

- Regulation of handling and disposal of used, non-recyclable CFCs
- Establishment of fees for disposal of used CFCs and products/waste containing CFCs
- Registration and monitoring of purchased and installed CFCs

For each of the measures a careful anaylsis will be carried out in order to calculate and evaluate the obtainable reduction in ODS-emission and the consequences to the involved parties.

This phase will result in recommendations for regulatory and economic instruments to be implemented by the relevant authorities in order to promote cost-effective recycling in China.

<u>Component 5: Training and information plan</u>

As the recycling of CFCs will have to take place at so many places and involve so many persons, information and training will be important in order to achieve a good result.

The technicians who will undertake the recycling activities at the centres and in the factories will need both information on the possibilities of recycling, and technical training in the devices for recycling. Guidelines for setting up technical manuals will also be included.

Furthermore, there will be a need for general information both to the public, decision makers within the refrigeration and air conditioning industry, and their customers.

In order to ensure the most efficient dissemination of the information and the training components they should put together into an overall information plan.

This phase will develop a plan for information and training activities that will be needed for the dissemination of recycling activities throughout the country.

The report on legal and economic instruments and the information/training plan will be presented at a national meeting, where representatives from the involved centres, and authorities, will discuss the recommendations.

4. Project Costs

The total of the project is USD 200 000 and RMB 95 000. The costs of each of the above mentioned project components are summarized below. The budget is specified in more detail in annex 1.

	RMB	USD
- **Component 1: Organization set up**	**25 000**	**3 600**
- **Component 2: Updating figures**	**31 000**	**10 500**
- **Component 3: National network**	**15 000**	**53 000**
- **Component 4: Legal Instruments**	**10 000**	**59 350**
- **Component 5: Inf & Training plan**	**12 500**	**73 600**
- **Miscellaneous:**	**1 500**	**4 450**
Total	**95 000**	**200 000**

5. Financial Plan

An amount of $200,000 is requested the Multilateral Fund. The contribution of the Government of China will be RMB 95 000.

6. PROJECT IMPLEMENTATION

The Ministry of Internal Trade (MIT) has been authorized to undertake the implementation of recycling projects. MIT will therefore be responsible for the implementation of this project.

MIT will implement the project under the guidance of UNDP and NEPA. The project will be carried out by the Bureau of Science, Technology and Quality Control under MIT with assistance from national and international experts.

The project will be supervised by a Steering Committee including representatives from NEPA, MIT, MLI, MMI, MCI, WB and UNDP.

The duration of the project is estimated to be 24 months. The project is intended to run very closely in time with the prototype recycling projects, so that experience gathered from the different kinds of project can be exchanged.

7. PROJECT IMPACT

The project will have no direct impact on the use of ODS. It will, however, result in the establishment of a framework and an infrastructure needed for the implementation of all the recycling projects, as well as a framework for evaluating specific issues relating to the promotion of recycling of CFCs, especially at the enterprises.

The potential for recycling of CFCs will exceed 4,500 t CFC per year.

Annex I

DETAILED BUDGET
Survey on policy and planning measurers
to promote recycling of CFCs

	RMB	USD
Component 1: Organizational set up, including guidelines and schedules		
local experts:		
100 mandays @ 250 RMB:	25 000	
National consultants		
80 mandays @ 45 USD:		3 600
Total, component 1:	25 000	3 600
Component 2: Updating		
2.1 Data collection, including survey of sources across China, definition of changes needed, and assembly and reporting.		
local experts:		
100 mandays @250 RMB:	25 000	
Travel expenses:	5 000	
DSA:	1 000	
Computers		5 000
National consultant		
120 mandays @ 45 USD:		5 400
Total, component 2:	31 000	10 000
Component 3: Nationwide networks		
3.1 Analysis of existing infrastructure and networks recommendations for changes on how to implement them.		
local experts		
100 mandays @ 250 RMB:	10 000	

	National consultants 160 mandays @ 45 USD:		7 200
	International consultants 30 mandays @ 600 USD:		18 000
	Travel expenses: (2 trips)		4 500
	DSA		3 000
3.2	Seminar on nationwide recycling networks (100 participants)		
	local experts 20 mandays @ 250 RMB:	5 000	
	National consultants 40 mandays @ 45 USD:		1 800
	Participants from centres Travel expenses:		5 000
	DSA (2 days):		9 000
Total, component 3:		15 000	48 500

Component 4: Legal and economic instruments

4.1	Evaluating options and setting up proposals situational analysis and evaluation of outcomes		
	Local experts 40 mandays @ 250 RMB:	10 000	
	National consultants 200 mandays @ 45 USD:		9 000
	International consultant 50 mandays @ 600 USD		30 000
	DSA		5 000
4.3	Reporting various meetings with local and national Govt officials		
	Local consultant 30 mandays @ 45 USD:		1 350
	International consultant 20 mandays @ 600 USD:		12 000
	DSA		2 000
Total, component 4:		10 000	59 350

Component 5: Training and information plan

5.1	Training plan Local expert 20 mandays @ 250 RMB	5 000	
	National consultant 80 mandays @ 45 USD:		3 600
	International consultant 20 mandays @ 600 USD:		12 000
	Travel expenses:		4 500
	DSA:		1 000
5.2	Information plan Local expert 10 mandays @ 250 RMB:	2 500	
	National consultant 60 mandays @ 45 USD:		2 700
	International consultant 10 mandays @ 600 USD:		6 000
	DSA		1 000
5.3	Seminar on legal instruments and information plan (100 participants) Local expert (preparations) 10 mandays @ 250 RMB:	5 000	
	National consultant (preparations) 40 mandays @ 45 USD:		1 800
	Participants from centres Travel expenses:		5 000
	DSA (2 days):		9 000
5.4	Dissemination of report/pamphlet		
	Translation of report/pamphlet:		1 000
	Layout and printing of the report/ pamphlet 20 000 copies:		20 000
	Mailing of report/pamphlet:		6 000
Total, component 5:		12 500	73 600
Grand Total:		93 500	195 550
Miscellaneous:		1 500	4 450
Total project costs:		95 000	200 000

PROJECT OUTLINE

COUNTRY	:	CHINA
SECTORS COVERED	:	All sectors
NATIONAL ODS CONSUMPTION	:	60,352 ODP tonnes in 1991
PROJECT TITLE	:	Project preparation assistance
DURATION	:	14 months (Nov. 93 - Dec. 94)
PROJECT IMPACT	:	Preparation of technical assistance, demonstration and investment projects in all sectors.
PROPOSED BUDGET	:	US$ 100,000
IMPLEMENTING AGENCY	:	UNDP
NATIONAL COORDINATING AGENCY	:	National Environmental Protection Agency (NEPA)

PROJECT DESCRIPTION

The China Country Programme (CP) was prepared by the Government with UNDP as lead multilateral agency. The CP was presented and approved at the 9th Executive Committee Meeting in March 1993. The CP proposed a 12% phaseout by 1996, a 61% phaseout by year 2000, a 79% phaseout by 2005 and a 100% phaseout by 2010. The aerosols, halons and solvents sectors would have earlier phaseout targets as compared to the refrigeration & foams sectors.

At Government request, the Executive Committee at its 9th Meeting in March 1993 approved $100,000 for UNDP project preparation assistance during 1993. As of end-September 1993, $98,491 had been expended thereby utilizing all available funds. The projects prepared under this activity and approved by the ExCom at its 10th Meeting in June 1993 are:

1) Strategy and action programme for the elimination of CFCs in foam manufacture ($200,000)
2) Tianjin conversion to CFC-free technology in the manufacture of flexible polyurethane foam ($1,080,000)
3) Halons action programme: revision of national codes, education and training ($280,000)
4) Revision of design standards for cold storage ($200,000)
5) Elimination of CFCs in cleaning operations at the Nanjing Wire Works ($409,000)
6) Elimination of CFCs in cleaning operations at the Chengdu Radio Instrument Factory ($394,700).

Six projects will be submitted for approval at the 11th ExCom Meeting comprising two in foams, one in halons, one in recycling, a resubmitted vacuum panel project and a multi-sector project.

The requested funds will be utilized from Dec 1993 through end-1994 for international and national consultants to prepare technical assistance, demonstration and investment projects in the foams, halons, refrigeration, solvents & small-scale usage sectors. These project proposals will be submitted to the Executive Committee for approval at its 12th, 13th and 14th Meetings.

PROJECT COVER SHEET

COUNTRY:	**Egypt**
PROJECT TITLE:	**Conversion to CFC-free Technology in the Manufacture of Rigid Polyurethane Foam at Specialized Engineering Contracting Co.**
SECTOR COVERED:	**Foamed Plastics**
ODS USE IN SECTOR:	**722t CFCs (722t ODP) in 1991**
PROJECT IMPACT:	**Phaseout of the use of 15 tons/year CFC-11 (1993) in the manufacture of rigid polyurethane foam**
PROJECT DURATION:	**Six Months**
PROJECT ECONOMIC LIFE:	**10 years**
TOTAL PROJECT COST:	**USD 85,000 Incremental Capital Cost**
PROPOSED MLF GRANT:	**USD 85,000**
COST EFFECTIVENESS:	**USD 0.55/kg/y (unit abatement cost)**
COORDINATING NATIONAL BODY:	**Egyptian Environment Affairs Agency (EEAA)**
IMPLEMENTING AGENCY:	**UNDP**
APPRAISAL DATE:	**16 September, 1993**

PROJECT SUMMARY

Specialized Engineering Contracting Co. is focussing on spray-applications of rigid PUF for heat insulation.

Under this project the company will convert to non CFC foams through replacement by carbon dioxide and HCFC-141b. The new systems are higher in viscosity and will require replacement of the existing three low pressure foaming units by high pressure systems.

The company realizes that HCFC-141b constitutes a temporary solution and is committed to subsequent replacement, most likely by full water blown systems.

PROJECT OF THE GOVERNMENT OF EGYPT

SPECIALIZED ENGINEERING CONTRACTING CO. CONVERSION TO CFC-FREE TECHNOLOGY IN THE MANUFACTURE OF RIGID PUS (SPRAY)

1. PROJECT OBJECTIVE

The objective of this project is to phaseout the use of CFCs in the production of rigid polyurethane foams for insulation purposes at Specialized Engineering Contracting Co. (SECC)

2. SECTOR BACKGROUND

The CFC consumption in 1991 in the Egyptian foam sector--excluding foams for domestic and commercial appliances--has been established at 722 tons, with an annual growth rate of 15-20% (Egyptian Country Program). Uninhibited growth would lead to an estimated CFC consumption of 1,000 tons in 1993 and 2,050 tons in the year 2000. EEAA, with assistance of UNDP has designed a strategy for this sector, targeting annual consumption reductions beginning 1993. Finalization of the projects submitted so far to the IMLF would bring the actual implementation of this strategy well in line with the target. A complete phaseout of the use of CFCs in the foam sector could be reached in 1998.

3. ENTERPRISE BACKGROUND

SECC started in 1991 as a company specialized in heat insulation using polyurethane foam (PUF).

The company works on site for either spraying PUF on roofs, walls or tanks, or pouring PUF in pipelines, vessels or tanks.

The spraying applications require subsequent coating with a UV protective cover. Pouring applications require cladding with spacers assuring the required thickness after which the cavities are filled.

The company possesses three PU machines, all low pressure. Two have fixed ratio's. Current employment is 3 engineers, 3 foremen and 15 skilled workers. Annex-A provides more detailed information.

4. PROJECT DESCRIPTION

SECC will use about 50 t/y PUF containing 15t CFC-11 in 1993. Current growth rate is in excess of 20%.
The company is committed to phaseout CFCs in its product. Carbon dioxide, generated from the water/isocyanate reaction is selected as the desired permanent replacement technology. The current status of this technology does, however, not allow universal application, and HCFC-141b will be needed as interim technology.

To allow the higher viscosities that come with water blown systems and to allow different component ratio's, it is mandatory to replace the current equipment by high pressure variable ratio ones.

The new systems will be more expensive. The company believes, however, that the individual character of the jobs makes these difficult to calculate in advance. It also believes that price changes can be passed on and does not request inclusion in this project.

5. TECHNOLOGY

5.1 OVERVIEW

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

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

In addition, compounds such as perfluoroalkanes, HCFC 123, fluorinated ethers and 2-chloropropane have been suggested, but are immature in technology, limited in availability 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 commercially introduced in Germany. Its flammable character requires safety conditions and limits its use.

5.2 SELECTION

SECC has decided for the water/HCFC-141b solution with most likely subsequent replacement of the HCFC by a fully water blown system. HFC 134a remains another option. In SECC's case, the use of cyclopentane would be cost prohibitive and most likely unacceptable from a safety standpoint.

5.2 IMPACT ON PRODUCTION PROCESS

The existing three foaming units will have to be replaced by high pressure units with variable gear ratio's.

Some trials and product testing will be needed to assure suitable product quality.

6. PROJECT COSTS

6.1 CAPITAL COSTS

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

o	3 Low output HP foaming unit incl. freight, installation, start-up............	USD 70,000
o	Trials, training, testing........................	USD 5,000
o	Contingency and rounding.........................	USD 7,500
	TOTAL INCREMENTAL CAPITAL COSTS..................	**USD 82,500**

Prices originate from phone information from Gusmer and Glass-Mate.

6.2 OPERATING COSTS

As stated before, the company does not request reimbursement of incremental recurrent costs. Consequently no calculation of these costs has been made.

6.3 UNIT ABATEMENT COSTS

a)	Incremental Capital Costs.......................	USD 82,500
b)	Incremental Recurrent Costs	USD -
c)	Project Life Time................................	10 years
d)	CFC Consumption (1993)..........................	kg 15,000
	UNIT ABATEMENT COSTS [(a/b)/d]................	**USD/kg/y 0.55**

It should be pointed out that these abatement costs are incomparable with other projects because no IRCs are included.

7. FINANCING PLAN

The company requests

USD 85,000

representing the eligible incremental capital costs.

8 PROJECT IMPLEMENTATION

8.1 MANAGEMENT

UNDP will be the implementing agency for the project and will work with the company (SECC) on project execution, under the guidance of the Government (Egyptian Environment Affairs Agency).

8.2 PROCUREMENT

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

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				
3. Start-up,						
Machine Start-up		x				
Trials, Training		x				
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 about 20% annually in subsequent years. The project employs commercially available and environmentally acceptable technology.

11. ANNEXES

Annex-A: Company Profile

PROJECT COVER SHEET

COUNTRY:	Egypt
PROJECT TITLE:	Elimination of CFC-12 in the manufacture of extruded polystyrene foam sheet at Arab Packaging Products Co.
SECTOR COVERED:	Foamed Plastics
ODS USE IN SECTOR:	722 CFCs (722 tons ODS) in 1991
PROJECT IMPACT:	120 TONS CFC-12 per year, based on 1993 consumption
PROJECT DURATION:	One year from approval
PROJECT ECONOMIC LIFE:	10 years
TOTAL PROJECT COST:	USD 435,000 Incremental Capital Cost USD 83,000 Incremental Recurrent Benefits
PROPOSED MLF GRANT:	USD 362,000
COST EFFECTIVENESS:	USD 0.17/kg/y (unit abatement cost)
COORDINATING NATIONAL BODY:	Egyptian Environment Affairs Agency (EEAA)
IMPLEMENTING AGENCY:	UNDP
APPRAISAL DATE:	September 16, 1993

PROJECT SUMMARY

Arab Packaging Products Co., is one of Egypt's three manufacturers of extruded polystyrene foam sheet (EPS). Its products are aimed at the food service market. The company is a private sector enterprize.

CFC-12 is currently used in the production process. Under this project, Arab Packaging will eliminate the use of CFCs in this process through replacement by butane, resulting in an annual reduction of 120 tons ODS, based on current (1993) consumption. The project contains adequate safety features to address the hazards generated by the use of a flammable substance.

PROJECT OF THE GOVERNMENT OF EGYPT

ELIMINATION OF CFCs IN THE MANUFACTURE OF EXTRUDED POLYSTYRENE FOAM SHEET AT ARAB PACKAGING PRODUCTS CO.

1. PROJECT OBJECTIVE

The objective of this project is to phase out the use of CFCs in the manufacture of extruded polystyrene foam sheet (EPS) at Arab Packaging Products Co (Arab).

2. SECTOR BACKGROUND

The CFC consumption in 1991 in the Egyptian foam sector--excluding foams for domestic and commercial refrigerators and freezers-- has been established at 722 tons, with an annual growth rate of 15-20% (re: Egypt Country Programme). Uninhibited growth would lead to an estimated CFC consumption of 1000 ton in 1993 and 2050 ton in 2000. EEAA, with assistance of UNDP, has designed a strategy for this sector, targeting annual consumption reductions of 100 tons, beginning mid- 1992. Finalization of the approved and submitted projects as scheduled would bring the actual implementation of this strategy well in line with the target. A complete phase out of the use of CFCs in the production of extruded polystyrene foams--plank and sheet--could be reached in 1994.

3. ENTERPRISE BACKGROUND

Arab Packaging Products Co.was established in 1987 by a group of private investors. Capital is about USD 3 million. The company produces and markets:

- Thermo-formed products such as meat trays, egg trays, etc made from extruded polystyrene foam sheet (EPS),
- EPS sheet laminated kraft paper boxes for vegetables, fruit, pizza's etc.,
- EPS foam sheet for roof and wall insulation.

The company produces in a modern facility in 6th of October City, utilizing state of the art equipment from Battenfeld Gloenco Ltd, England, employing about 85 employees.

4. PROJECT DESCRIPTION

Arab currently utilizes about 120 yt CFC-11 in the manufacture of EPS foam sheet. The company is committed to phase out the use of CFCs, and has identified butane as the replacement of choice. Butane technology is available through original equipment manufacturers; however, for cost-effectiveness, UNDP may engage the services of a team of specialists (technology/process and machinery) to implement and oversee the whole conversion operation. In addition, to minimize fire hazards, it is necessary to relocate existing extruder to a production room next door. It will necessitate slight building modification and some light construction works. Safety related modifications in the production environment will also be implemented to mitigate fire and exposure hazards from the use of butane. Finally, extensive production and safety training is also foreseen to ensure effective transfer of technology related to the new process and a smooth and safe operation.

5. TECHNOLOGY

5.1 SELECTION

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

- o Nitrogen gas,
- o CO2 gas,
- o Hydrocarbons,
- o "Berstorff" technology (nitrogen with alcohol),
- o HCFC-22,
- o HCFC-142b,
- o HFC-134a,
- o HFC-152a,
- o Liquified petroleum gases (LPG).

A summary of these technologies, their potentials and their limitations is provided in annex A. Butane is selected by the company as an alternative that is:

- o Proven technology in processing and product performance,
- o Environmentally acceptable,
- o Low in toxicity,
- o Adaptable to the existing equipment,
- o Cost effective.

Butane is locally produced, and therefore readily available. It is distributed through government enterprises, subsidized, and therefore attractively priced. The government has indicated its intentions to withdraw price regulations in the near future, but even considering international price levels, butane technology will be economically viable. A significant draw back of butane is its high flammability, requiring stringent safety precautions.

The use of butane is not regulated in Egypt, nor are restrictions expected in the foreseeable future.

5.2 PRODUCTION PROCESS

The use of butane 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 additive injection systems,
  - 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 butane vapors,
  - Monitoring and alarm systems for butane vapors,
  - Extra fire extinguishers.

The production process and the aging area will have to be separated from the rest of the working area, and should be sprinkled or otherwise protected against fire and explosion hazards. To achieve this with the most economical means, Arab will have to rearrange the plant lay-out and relocate the extruder; a separate aging area from the in-house storage area will also be erected. (see plant lay-out, annex B).

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

Start-up trials will be necessary to adjust for the different foamant volume and permeability. The start-up, to be supervised by qualified and experienced consultant(s), will also include formulation trials under the new process. Testing of the resulting product on residual butane will also be ensured to avoid hazards in the subsequent manufacturing process (thermo-forming, heat laminating).

6. PROJECT COSTS

6.1 Capital Costs

The following is a summary of the expected costs of investment and related activities (the numerical identification system indicates the various relevant UNDP budget lines):

ITEM	DESCRIPTION	SUBTOTAL (USD)	TOTAL (USD)
1151	Technology transfer		50,000
2101	Production equipment		
	Auxiliary equipment needed for conversion		15,000
	Equipment relocation		5,000
	Preparatory works (civil and electrical)		30,000
2102	Building modifications		
	Fire safety & alarm system		30,000
	Ventilation system		25,000
	Sprinkler systems		90,000
	Civil works at tank storage area		40,000
	Building improvement/additions		30,000
	Supply & installation of industrial blow-down fans		10,000
3300	In service training		10,000
4201	Equipment		
	2 Butane gas tanks		40,000
	Safety equipment/gas detectors		30,000
5300	Contingency		40,000
9906	**TOTAL**		**445,000**

This information is compiled through a UNDP-assigned process specialist through information from local firms and comparison with previous projects (Al-Sharif/Egypt, Jumaya/Malaysia).

6.2 OPERATING COSTS

The price of butane is considerable lower than CFC-12 (CFC-12: USD 2.20; Butane: USD 0.50).

These prices reflect the status at February 1993. Prices fluctuate significantly, and are slightly different for individual companies. The price of butane is currently regulated by the government, and artificially low. Deregulation is expected. EEAA indicated, after researching the issue, a price after deregulation of USD 1.50 /kg. (Annex C)

The use of butane requires addition of an anti-shrinkage and a static-dissipative agent. Costs are assumed at USD 25/ton resin, or --given a forecasted resin use of 720 tons for 1993--USD 0.15 per kg blowing agent. Taking this in consideration, and assuming a one to one replacement, the price difference between CFC-12 and butane is established at USD 0.55 per kg blowing agent used. This amounts to an expected annual decrease in material costs of (120,000 x 0.55):

USD 66,000

This has to be held against higher costs in maintenance, energy, safety monitoring, ongoing safety training and insurance. Balance shows USD 24,000/y savings, resulting in a net present value (4y, 10% discount) of (Annex D):

USD 83,000

6.3 UNIT ABATEMENT COST

a)	Incremental Capital Costs	USD 445,000
b)	Incremental Recurrent Savings	USD 24,000
c)	Project Useful Life	10 years
d)	ODS reduction/y	kg 120,000
	Unit Abatement Costs [(a/c + b)/d]	**USD/kg/y 0.17**

7. FINANCING PLAN

Requested are the complete project costs as calculated under 6.1 & 6.2:

Requested Grant	**USD 362,000**

8. PROJECT IMPLEMENTATION

8.1 MANAGEMENT

UNDP will be the implementing agency for the project and will work with the company (Arab Packaging Products Co.) on project excution, under the guidance of the Government (Egyptian Environment Affairs Agency).

8.2 SCHEDULE

TASK	TIME FOR COMPLETION Q1	Q2	Q3	Q4
Procurement preparations				
Project management	x			
design, specifications	x			
preparation bid lists	x			
tenders/selection of contractors	xx			
purchase orders	x			
Site preparation				
Building modifications		xx		
Civil works		xx		
Tank installation		x		
Installation sprinkler system		x		
Arrival of equipment/customs clearing		xx		
Installation of equipment				
Safety & alarm systems		xx		
Ventilation system		xx		
Extruder relocation			x	
Start-up training			x	
Formulation trials			x	

Total implementation time: nine months.

8.3 PROCUREMENT

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

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 10-15% annually in subsequent years. The project employs commercially and environmentally acceptable technology.

10. ANNEXES

Annex A: Overview of CFC Phase out Technologies in the Manufacture of Polystyrene and Polyolefine Foams

Annex B: Plant lay-out

Annex C: Butane Price Confirmation

Annex D: Recurrent Incremental Costs calculation

Annex E: Conversion Specifications

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Annex - A

CFC REPLACEMENT IN THE MANUFACTURE OF POLYSTYRENE AND POLYOLEFINE FOAMS

CFCs in polyurethane foams function generally only as auxiliary blowing agents. This is not the case in polystyrene (PS), polyethylene (PE) or polypropylene (PP) foams. These foams use solely physical blowing agents. Criteria for such blowing agents are:

- solubility in the resin,
- worker safety (flammability, toxicity),
- consumer safety (toxicity),
- thermal and chemical stability,
- diffusivity,
- environmental impact.

CFC-11, CFC-12, CFC-114 and hydrocarbons have been traditionally used as blowing agents (1), with CFC-12 being in most cases the agent of choice. Significant non (thermal) insulation varieties of these foams include:

- extruded sheet,
- extruded plank,
- moldable beads.

A wide variety of options have been proposed so far to replace CFCs in PE/PP and PS foams. They can be categorized as follows:

- Atmospheric gases,
- Hydrocarbons,
- HCFCs, and
- HFCs.

1. ATMOSPHERIC GASES

Nitrogen Gas

Inert, nontoxic and noncombustible, but asphyxiant. The use is burdened by a low solubility in the resin and a relatively high density of the end product. New resin developments may make the use of nitrogen a more viable option in the future.

The Berstroff Technology is based on a mixture of nitrogen and alcohol. This technology exhibits undefined risks in toxicity and fire. The resulting product has also a higher density. So far as known, it has only been applied in extruded PS sheet.

Carbon dioxide gas

An asphyxiant, high energy consuming and moderately toxic gas. Carbon dioxide is a reportedly proven technology in polystyrene foam sheet (2). The poor solubility in polyolefine resins restricts the use in PE/PP foams at this time. Certain uses of CO_2 in extruded PS sheet are patented, and require licensing.

2. Hydrocarbons

N-pentane, butane, isopentane and isobutane are proven replacements, in polystyrene and polyolefine products (1,3). The technology is cost effective and results products of acceptable quality. However, the flammability of hydrocarbons requires stringent safety precautions in the manufacturing process. This results in sizable investments in retrofitting. In addition, hydrocarbons are photochemically reactive and contribute to the formation of atmospheric ozone (smog).

Liquified petroleum gases (LPG) have also been proposed as replacement for CFCs in PE/PP and PS foams. LPG is,however toxic, flammable and not accepted for food packaging.

3 HYDROCHLOROFLUOROCARBONS

HCFC-22

Non-flammable, low in toxicity, high thermal and chemical stability, HCFC-22 has been proven effective (3,4) as a sole replacement (extruded PE/PS sheet) or in combination with HCFC-142b (extruded PS board). The compound has however an ODP, and only qualifies as an interim replacement.

HCFC-142b

Alone or in combination with HCFC-22, this compound represents a preferred option in thick sheet and plank applications (1,5). The price penalty is, however, considerable and equipment has to be modified to cope with the moderate flammability and the modified diffusivity of the compound.

4 HYDROFLUOROCARBONS

HFC-134a

Non-flammable, low toxicity and with no ODP, HFC-134a is just recently introduced in the market. The current pricing will prevent utilization in the very cost sensitive food serving and packaging applications. The utilization of HFC-134a in foams competes with the utilization as a refrigerant in appliances and automotive air conditioners.

HFC 152a

HFC-152a is low in toxicity, moderately flammable and possesses no ODP. It appears to be a likely long term alternative for CFCs in extruded polystyrene sheet (1,5). In polyolefine applications poor solubility and diffusivity has to be overcome before such a statement could be made. The compounds flammability will require extensive modifications of production equipment.

In summary, it can be concluded that technologies allowing immediate replacement of CFCs in polystyrene and polyolefine foams are available. Some of these technologies have an interim character. Others show promise as long term solutions, but are currently cost prohibitive for highly competitive applications such as food packaging.

5. REFERENCES

1. Montreal Protocol, "1991 Assessment, Flexible and Rigid Foams, Technical Options Committee.
2. Welsh, Gary C., European Patent Application, Date of filing: January 8, 1990>
3. "HCFC-22 as a Blowing Agent for Polystyrene Foam Packaging," Summary from Du Pont, Wilmington, USA, 1992.
4. Du Pont, Bulletin E-95698, "manufacture of Polystyrene Foam Sheet Using Formacel S-Food Grade Blowing Agent," 1990.
5. Du Pont, Bulletin ABA-5, "Alternative Blowing Agents for Thermoplastic Foams," 1990.

THE RESOURCE POOL

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

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ARAB PACKAGING PRODUCTS CORPORATION

SCOPE

The project is concerned with the replacement of CFC 12 in the manufacture of extruded polystyrene foam sheets.

RECOMMENDATIONS

The project is supported.

RELEVANCY AND ADEQUACY OF INFORMATION

From direct information from through UNDP it is understood that the capital costs are calculated with help of an external process expert. This, because of the original costs were almost one million dollars. The process expert has drawn comparison with other projects - specifically Malaysia - and had arrived to a much more economical solution. This cost reduction, through feedback from previous projects should be seen as a very constructive element to cost containment.

TECHNICAL SOUNDNESS

The chosen route of CFC 12 replacement by butane is one of the recommended options for non-insulating foams provided that adequate safety precautions are taken.

COMPARISON WITH OTHER PROJECTS

This project can be compared with previous ones in Venezuela, China, Malaysia and Egypt. From this comparison it can be learned that it is now possible to implement CFC replacement in extruded polystyrene foam sheet more economically than in the initial projects. It is commendable that this project built on this experience.

ENVIRONMENTAL ISSUES

Zero ODP option chosen. Butane is photochemically active and generates low level ozone (smog). The low dissemination rate will, however, avoid any practical impact.

SAFETY ISSUES

The safety related modifications and training appear to be adequately addressed. Closed monitoring by the implementing agency is recommended.

COST EFFECTIVENESS

Overall cost effectiveness is excellent.

OTHERS

It should be addressed on how to calculate cost effectiveness. Although in this project the unit abatement costs are clearly defined, other projects are calculated differently, which does not facilitate comparison.

J. L. Pool

PROJECT COVER SHEET

COUNTRY:	Egypt
PROJECT TITLE:	Elimination of CFC-11/12 in the manufacture of extruded polystyrene foam sheet at Interfood Packaging
SECTOR COVERED:	Foamed Plastics
ODS USE IN SECTOR:	722 CFCs (722 tons ODS) in 1991
PROJECT IMPACT:	80 TONS CFC-11/12 per year, based on 1993 consumption
PROJECT DURATION:	Nine months from approval
PROJECT ECONOMIC LIFE:	10 years
TOTAL PROJECT COST:	USD 450,000 Capital Costs
PROPOSED MLF GRANT:	USD 450,000
COST EFFECTIVENESS:	USD 0.56/kg/y (unit abatement cost)
COORDINATING NATIONAL BODY:	Egyptian Environment Affairs Agency (EEAA)
IMPLEMENTING AGENCY:	UNDP
APPRAISAL DATE:	September 16, 1993

PROJECT SUMMARY

Interfood, a subsidiary of Qaliubia National Food Packaging Co., is one of Egypt's three manufacturers of extruded polystyrene foam sheet (EPS). Its products are aimed at the food service market. The company is a private sector enterprize.

A mixture of CFC-11 and CFC-12 (50/50) is currently used in the production process. Under this project, Interfood will eliminate the use of CFCs in this process through replacement by butane, resulting in an annual reduction of 80 tons ODS, based on current (1993) consumption. The project contains adequate safety features to address the hazards generated by the use of a flammable substance.

PROJECT OF THE GOVERNMENT OF EGYPT

ELIMINATION OF CFCS IN THE MANUFACTURE OF EXTRUDED POLYSTYRENE FOAM SHEET AT INTERFOOD PACKAGING

1. PROJECT OBJECTIVE

The objective of this project is to phase out the use of CFCs in the manufacture of extruded polystyrene foam sheet (EPS) at Interfood Packaging.

2. SECTOR BACKGROUND

The CFC consumption in 1991 in the Egyptian foam sector--excluding foams for domestic and commercial refrigerators and freezers-- has been established at 722 tons, with an annual growth rate of 15-20% (re: Egypt Country Programme). Uninhibited growth would lead to an estimated CFC consumption of 1000 ton in 1993 and 2050 ton in 2000. EEAA, with assistance of UNDP, has designed a strategy for this sector, targeting annual consumption reductions of 100 tons, beginning mid- 1992. Finalization of the approved and submitted projects as scheduled would bring the actual implementation of this strategy well in line with the target. A complete phase out of the use of CFCs in the production of extruded polystyrene foams--plank and sheet--could be reached in 1994.

3. ENTERPRISE BACKGROUND

Interfood Packaging was established in 1988 as a subsidiary of Qaliubia National Food Packaging Co., SAE. The company is majority owned by its Managing Director, Eng. Hussien Bastawisi (60%). Other shareholders include the Development National Bank (25%). The company manufactures and markets food packaging products, such as trays and laminated cardboard, utilizing extruded EPS foam sheet. Annual sales amount to about USD 2 million. (1992/93), with annual increases of 20-25% (see annex A).

The company produces in a modern facility in 10 Ramadan, utilizing state of the art equipment from Hermann Berstorff GmbH, Germany.

4. PROJECT DESCRIPTION

Interfood currently utilizes about 80 yt CFC-11 and CFC-12 (50/50) in the manufacture of EPS foam sheet. The company is committed to phase out the use of CFCs, and has identified butane as the replacement of choice. Butane technology is available through the original equipment supplier; however, for cost-effectiveness, UNDP may engage the services of a team of specialists (technology/process and machinery) to implement and oversee the whole conversion operation.

The conversion will involve light construction works, replacement of equipment and installation of additional equipment. Safety related modifications in the production environment will also be implemented to mitigate fire and exposure hazards from the use of butane.

5. TECHNOLOGY

5.1 SELECTION

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

- o Nitrogen gas,
- o CO_2 gas,
- o Hydrocarbons,
- o "Berstorff" technology (nitrogen with alcohol),
- o HCFC-22,
- o HCFC-142b,
- o HFC-134a,
- o HFC-152a,
- o Liquified petroleum gases (LPG).

A summary of these technologies, their potentials and their limitations is provided in annex B. Butane is selected by the company as an alternative that is:

- o Proven technology in processing and product performance,
- o Environmentally acceptable,
- o Low in toxicity,
- o Adaptable to the existing equipment,
- o Cost effective.

Butane is locally produced, and therefore readily available. It is distributed through government enterprises, subsidized, and therefore attractively priced. The government has indicated its intentions to withdraw price regulations in the near future, but even considering international price levels, butane technology will be economically attractive. The only significant drawback of butane is its high flammability, requiring stringent safety precautions.

The use of butane is not regulated in Egypt, nor are restrictions expected in the foreseeable future.

5.2 PRODUCTION PROCESS

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

Required equipment modifications and additions may include:

- o Storage
  - o Separate, explosion proof storage of the butane tank.
- o Feeding systems
  - o More additive injection systems,
  - o Replacement of the foamant metering pump and injection system,
  - o New gaskets and seals.
  - o New pressure gauges
- o Extrusion system
  - o Replacement or modification of the screw,
  - o Replacement or modification of the extrusion die.
- o Electrical systems
  - o Installation of spark arresters,
  - o Sealing of electrical control cabinets,
  - o Explosion proof motors and switches.
- o Auxiliary safety devices
  - o A ventilation system has to prevent the accumulation of butane vapors,
  - o Monitoring and alarm systems for butane vapors,
  - o Extra fire extinguishers.

The production process and the aging area will have to be separated from the rest of the working area, and should be sprinkled or otherwise protected against fire hazards.

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

Start-up trials will be necessary to adjust for the different foamant volume and permeability. The start-up, to be supervised by qualified and experienced consultants will also include formulation trials under the new process. Testing of the resulting products of residual butane will also be ensured to avoid hazards in the subsequent manufacturing process (thermo-forming, heat laminating).

6. PROJECT COSTS

6.1 Total Project Costs

The existing high pressure pump is not suitable to operate the butane gas and needs to be replaced. In addition, the existing CFC-12 tank has to be removed and be replaced by 2 butane gas tanks, one is to be used for backup storage purpose. A safer location for the butane storage tank has been identified since the present location of the CFC-12 tank poses great hazards and is not large enough to accommodate two butane gas tanks needed. A shelter for the tank area will be erected (plant layout and proposed location for the tank refers - Annex - C).

It is also proposed to erect a shelter to be used as storage area for the polystyrene foam sheet to age before transfer to the warehouse for storage. Finally, extensive production and safety training is foreseen to ensure effective transfer of technology related to the new process and operation.

The following is a summary of the expected costs of investment and related activities (the numerical identification system indicates the various relevant UNDP budget lines):

ITEM	DESCRIPTION	SUBTOTAL (USD)	TOTAL (USD)
2101	Technology transfer and all auxiliary equipment related to the conversion	80,000	
2102	Building modifications		
	Fire safety & alarm system	30,000	
	Ventilation system	25,000	
	Sprinkler systems	90,000	
	Civil works in tank area	40,000	
	Fire safety walls	25,000	
	Building improvement/additions	30,000	
	Supply & installation of industrial blow-down fans	10,000	330,000
3300	In-service training	10,000	**10,000**
4201	Equipment		
	2 Butane gas tanks	40,000	
	Safety equipment/gas detectors	30,000	70,000
5300	Contingency and rounding		40,000
9000	**TOTAL**		**450,000**

Project costs are established by an UNDP-appointed process specialist through calls to local companies and comparison with previous projects (Al-Shariff, Jumaya).

6.2 OPERATING COSTS

Butane is considerable lower in price than CFC11/12 (CFC-11/12: USD 2.20; Butane: USD 0.50).

These prices reflect the status at December 1992. Prices fluctuate significantly, and are slightly different for individual companies. The price of butane is currently regulated by the government, and artificially low. Deregulation is expected soon and will bring prices to international level.

For the purpose of the analysis of operational consequences, an "economic cost" approach is selected, i.c. no taxes, but also no subsidies are taken into consideration. This is consistent with current considerations made by all implementing agencies. This would increase the price of butane to USD 1.50/kg (information from EEAA, Annex D).

The use of butane requires addition of an anti shrinkage and a static dissipative agent. This amounts to an expected annual decrease in material costs of:

USD 33,600

This has to be held against higher costs in maintenance, energy, safety monitoring, ongoing safety training and insurance. Consequently, an annual increase of

USD 3,400

in operating costs is expected. (Annex E provides detailed calculations.) These costs are negligeable and not considered for reimbursement.

6.3 UNIT ABATEMENT COST

a)	ODS Reduction Project Costs	USD 450,000
b)	Annual Incremental Benefits	USD -
c)	Project Useful Life	10 years
d)	ODS reduction/y	kg 80,000
	Unit Abatement Costs [(a/c + b)/d]	**USD/kg/y 0.56**

7. FINANCING PLAN

Requested are the complete project costs as calculated under 6.1:

Requested Grant USD 450,000

8. PROJECT IMPLEMENTATION

8.1 MANAGEMENT

UNDP will be the implementing agency for the project and will work with the company (Interfood Packing) on project execution, under the guidance of the Government (Egyptian Environment Affairs Agency).

8.2 SCHEDULE

TASK	TIME FOR COMPLETION Q1	Q2	Q3	Q4
Procurement preparations				
Project management	x			
design, specifications	x			
preparation bid lists	x			
tenders/selection of contractors	xx			
purchase orders	x			
Site preparation				
Building modifications		xx		
Civil works		xx		
Tank installation		x		
Installation sprinkler system		x		
Arrival of equipment/customs clearing		xx		
Installation of equipment				
Safety & alarm systems			xx	
Ventilation system			xx	
Extruder relocation			x	
Start-up training			x	
Formulation trials			x	

Total implementation time: nine months.

8.3 PROCUREMENT

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

9. PROJECT IMPACT

This project will eliminate the use of at least 80 tons of CFCs in the first year of implementation. market and company growth indicates that this may increase by 15-25% annually in subsequent years. the project employs commercially and environmentally acceptable technology.

10. ANNEXES

Annex A: Company Information

Annex B: Overview of CFC Phase out Technologies in the Manufacture of Polystyrene and Polyolefine Foams

Annex C: Conversion specifications

Annex D: Butane Price Confirmation

Annex E: Calculation of Incremental Recurrent Costs

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ANNEX - E

INTERFOOD
RECURRENT INCREMENTAL COSTS CALCULATION

ASSUMPTIONS

- o Prices from February 1993 (date of project submission by Interfood)
- o Butane price from EEAA
- o Butane use identical to CFC-12
- o Required extra additives: USD 25/t of resin or USD 0.28/kg blowing agent
- o Preventive maintenance: 5% of equipment related project costs
- o 1 USD = 3 Egyptian Pounds

1) MATERIAL

```
o    Before: 80 t CFC-12 @ 2.20 ...............USD 176,000
o    Future: 80 t Butane @ 1.50 =  120,000
o            additives .............22.400.....USD 144,400
```

2) OTHER RECURRING INCREMENTAL COSTS

```
o    Recurrent training/monitoring
     costs........................ 10,000
o    Extra maintenance & utility... 20,000
o    Extra insurance .............  5,000.....USD  35,000
```

3) TOTAL ANNUAL RECURRING INCREMENTAL COSTS.......USD 3,400

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In view of the small difference, no incremental recurrent costs are considered in this project.

Annex F

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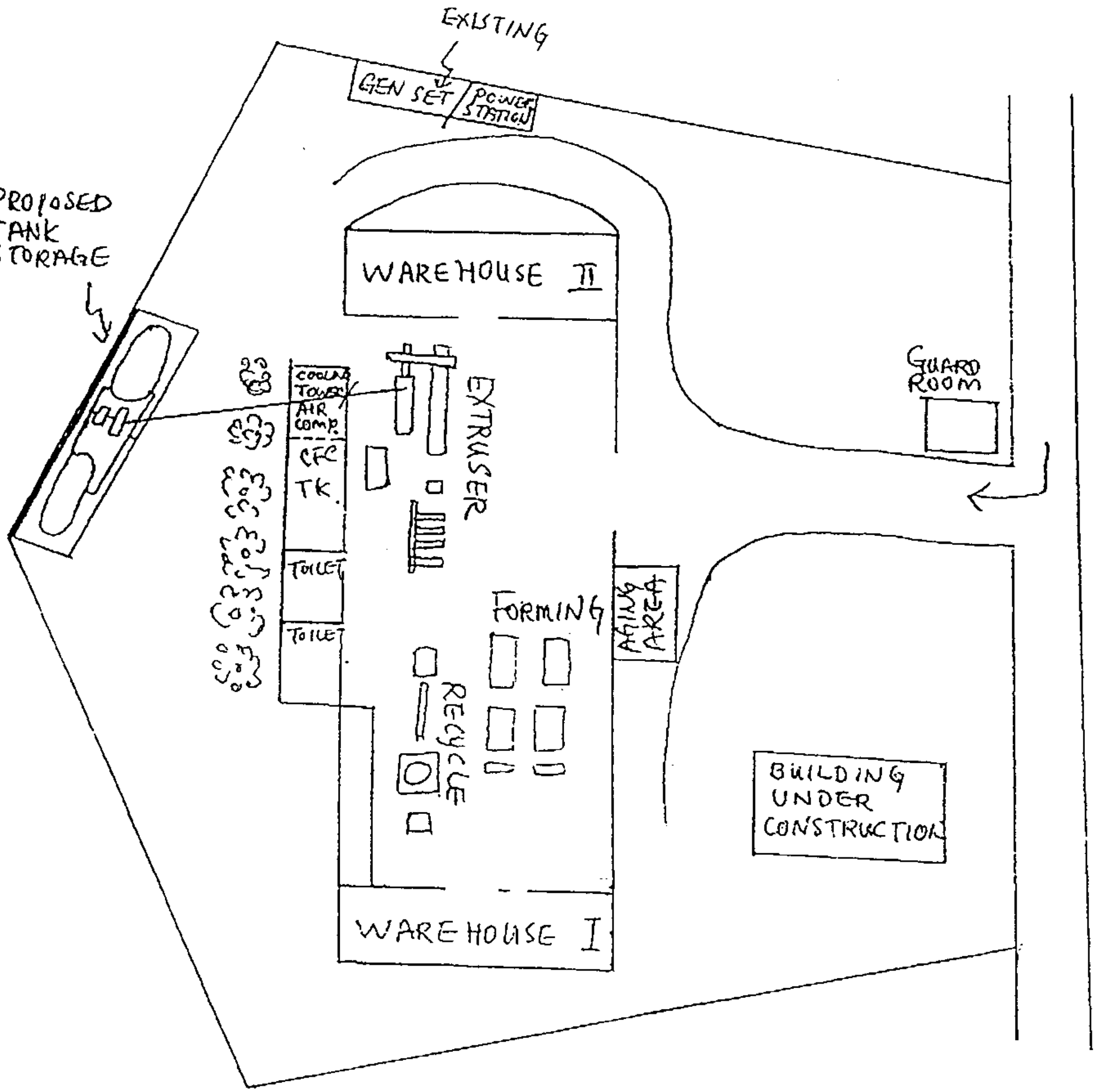

INTERFOOD PACKAGING CO

PLANT LAYOUT

THE RESOURCE POOL

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

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INTERFOOD PACKAGING

SCOPE

The project is concerned with the replacement of CFC 11/12 in the manufacture of extruded polystyrene foam sheets.

RECOMMENDATIONS

The project is supported.

RELEVANCY AND ADEQUACY OF INFORMATION

Good. The same comment as under Arab Food Packaging apply.

technical SOUNDNESS

CFC 11/12 replacement by isobutane is one of the recommended options for non-insulating foams provided that adequate safety precautions are taken.

LESSON FROM EXPERIENCE

There are many other projects already approved that concern extruded polystyrene foam. The implementing agency seems to be aware of that and by using a process expert that has implemented one of the previous projects, taken full advantage of this.

ENVIRONMENTAL ISSUES

Zero ODP option chosen. Isobutane is a hydrocarbon and is photochemically active, causing low level ozone or smog. The rate of dissemination is however so that no practical impact can be expected.

SAFETY ISSUES

The safety related modifications and training appear to be adequately addressed. It is recommended that the implementing agency should closely monitor these during and after completion.

COST EFFECTIVENESS

Overall cost effectiveness is good although not as good as Arab, based on lower production. The project costs are essentially the same.

OTHERS

None

J. L. Pool

PROJECT COVER SHEET

COUNTRY:	Egypt
PROJECT TITLE:	HORSE FOAM COMPANY Conversion to CFC-free Technology in the Manufacture of Flexible Polyurethane Foam
SECTOR COVERED:	Foamed Plastics,
ODS USE IN SECTOR:	722t CFCs (722t ODP) in 1991
PROJECT IMPACT:	Phaseout of the use of 120 tons/year CFC-11 (120t ODP; 1993)
PROJECT DURATION:	Nine Months
PROJECT ECONOMIC LIFE:	10 years
TOTAL PROJECT COST:	USD 385,000 Incremental Capital Cost
PROPOSED MLF GRANT:	USD 385,000
COST EFFECTIVENESS:	USD 0.32/kg/y (unit abatement cost)
COORDINATING NATIONAL BODY:	Egyptian Environment Affairs Agency (EEAA)
IMPLEMENTING AGENCY:	UNDP
APPRAISAL DATE:	September 16,1993

PROJECT SUMMARY

Horse Foam is one of Egypt's leading manufacturers of flexible polyurethane foam (slabstock and molding). The company uses currently CFCs as auxiliary blowing agent. Industrial trials with methylene chloride are already made and the company wants to pursue complete replacement of CFCs in the manufacture of slabstock foams by this substance. This will require improved process encapsulation and venting in addition to some minor process modifications. Replacement of CFCs in molded PUF by water blown formulations will require the replacement of the current low pressure foaming unit by a high pressure one.

PROJECT OF THE GOVERNMENT OF EGYPT

HORSE FOAM COMPANY CONVERSION TO CFC-FREE TECHNOLOGY IN THE MANUFACTURE OF FLEXIBLE POLYURETHANE FOAM

1. PROJECT OBJECTIVE

The objective of this project is to phaseout the use of CFCs in the manufacture of flexible PUF at Horse Foam Company.

2. SECTOR BACKGROUND

The CFC consumption in 1991 in the Egyptian foam sector--excluding foams for domestic and commercial appliances--has been established at 722 tons, with an annual growth rate of 15-20% (Egyptian Country Program). Uninhibited growth would lead to an estimated CFC consumption of 1,000 tons in 1993 and 2,050 tons in the year 2000. EEAA, with assistance of UNDP has designed a strategy for this sector, targeting annual consumption reductions beginning 1993. Finalization of the projects submitted so far to the MLF would bring the actual implementation of this strategy well in line with the target. A complete phaseout of the use of CFCs in the foam sector could be reached in 1998.

3. ENTERPRISE BACKGROUND

Horse Foam is one of the main manufacturers of flexible PUF in Egypt with an annual production of about 1,500t and related use of auxiliary blowing agents (ABAs) of 120t/y. The company employs about 200 workers.

Horse Foam's main activity is the manufacture of slabstock foams. The company operates a low pressure "Laader Berg" production unit (commonly regarded as a hybrid between single block technology and continuous processing). In addition molded polyether and single block polyester foams are produced on a low pressure Cannon unit. 110 yt are related to the slabstock operation with the remaining 10yt used on the Cannon machine.

4. PROJECT DESCRIPTION

Horse Foam will utilize in 1993 120t ABA in the production of flexible PUF.
Under this project, the company will phaseout the use of CFCs through conversion to full water blown systems (molded foams) and methylene chloride (slabstock foams).

The company has attempted to change to methylene chloride before with limited success because of processing problems and insufficient safeguards regarding plant safety.

Under this program, the slabstock line will be encapsulated, ventilation in production and curing area's will be improved and additional metering systems will be installed.

To be able to use CFC-free systems in molded foams, the existing low pressure foaming unit will be replaced by a high pressure one.

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 in general applied where process, industrial hygienic and regulatory conditions allow.

Water blown foams in combination with chemical modifications are generally utilized in flexible molded, where it is more difficult to maintain acceptable workplace concentrations.

5.2 SELECTION

The enterprise intends to phaseout CFCs in the slabstock production through replacement by methylene chloride and the use of a softening additive where methylene chloride fails in performance.

It has selected the use of 100% water-blown high resilience polyol systems as replacement technology in the flexible molding systems.

5.3 REQUIRED MODIFICATIONS

In all area's where methylene chloride and isocyanate are processed, adequate process containment and ventilation will have to be installed to assure safe workplace conditions. Regular check-ups should be performed to assure continued compliance.

The slabstock line will need additional metering systems for the use of a softening agent/amine catalyst and for methylene chloride.

Because of higher viscosities, high pressure manufacturing equipment is required in the molded area. Higher isocyanate concentration require monitoring to assure acceptable workplace concentrations.

6. PROJECT COSTS

6.1 SUMMARY OF PROJECT COSTS

The total project incremental cost of USD 385,000 is based on the incremental capital costs. The net incremental recurrent costs are expected to be insignificant.

6.2 CAPITAL COSTS

The following capital costs are expected related to this project:

o	Upgrading of ventilation and encapsulation systems	USD 95,000
o	Additional metering systems	USD 25,000
o	High pressure molding unit	USD 200,000
o	Trials, training, IH survey	USD 20,000
o	Miscellaneous safety equipment	USD 11,400
o	Contingency and rounding	USD 33,600
	TOTAL INCREMENTAL CAPITAL COSTS	**USD 385,000**

Annex-A provides more detailed information.

6.2 OPERATING COSTS

In the production of Molded foams, recurrent incremental costs based on higher prices for polyol as well as from formulation changes are anticipated.

Methylene chloride is lower priced than CFC-11, resulting in lower material costs. To be held against that are higher costs of catalysis, softening agent, annual training and maintenance. These costs are not exactly to calculate in advance as individual formulation modifications will result from the trials later on. However, annual expected savings on slabstock will match approximately the extra costs in the molded area. This project will therefore consider no recurrent incremental costs. Annex-B provides more detailed information.

6.4 UNIT ABATEMENT COSTS

a)	Incremental Capital Costs	USD	385,000
b)	Project Life Time		10 years
c)	Incremental Recurrent Costs	USD	-,-
d)	CFC Consumption	kg	120,000
	UNIT ABATEMENT COSTS [(a/b + c)/d]	**USD/kg/y**	**0.32**

7. FINANCING PLAN

The company requests an MLF grant, representing all eligible incremental costs in the amount of

USD 385,000

8. PROJECT IMPLEMENTATION

8.1 MANAGEMENT

UNDP will be the implementing agency for this project and will work with the recipient on project execution under the guidance of the Government (EEAA).

8.2 PROCUREMENT

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

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 /Bld 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 120 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 calculation of Incremental Recurrent Costs

ANNEX-B

RECURRENT INCREMENTAL COSTS

Horse Foam employs two distinct different manufacturing processes requiring different ODS phaseout technologies and impacting differently operating costs.

In the first process 110 yt CFC-11 is replaced by 110 yt methylene Chloride. In addition, the catalysis has to be changed and softening additive, recurrent safety training and increased maintenance will be needed. This will impact the operating costs as follows:

ITEM	BEFORE	AFTER
110 yt CFC-11 @ 2500	USD 250,000	-,-
110 yt Methylene Chloride @ 1500	-,-	USD 150,000
Softening Additive 5 yt @ 3000	-,-	USD 15,000
Amine catalyst 2yt 2 yt @ 7500	-,-	USD 15,000
Training, Maintenance	-,-	USD 20,000
TOTAL	**USD 250,000**	**USD 200,000**

In the second process CFC-11 is replaced by carbon dioxide generated from the water/isocyanate reaction ("water blown" foam). Horse Foam's chemical suppliers have indicated a 15% increase in formulation costs based on more isocyanate and a different polyol. This will impact the operation costs as follows:

ITEM	BEFORE	AFTER
100 yt Foam Compounds @ 4000	USD 400,000	-,-
100 yt Foam Compounds @ 4600	-,-	USD 460,000
TOTAL	**USD 400000**	**USD 460,000**

On the balance, a slight increase in incremental recurrent costs appears to exist. it should, however, be considered that these figures are approximations. Individual formulation modifications will result from the process trials and may differ somewhat from the predicted costs. The overall predicted difference of USD 10,000 /y is insubstantial on the total raw material costs and therefore not taken into account.

THE RESOURCE POOL

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

Jerry S. Pool, President

3609 Huntingridge Drive
High Point, NC 27265
phone: 919-869-5712
fax: 919-869-5712

HORSE FOAM COMPANY

SCOPE

The project is concerned with the replacement of CFC 11 in the production of flexible polyurethane foam (slabstock and molded).

RECOMMENDATION

The project is supported.

RELEVANCY AND ADEQUACY OF INFORMATION

The document provides adequate information.

TECHNICAL SOUNDNESS

The chosen route of CFC 11 replacement by water (molded foams) and methylene chloride (slabstock foams) are recommended options by the UNEP Technical Committee and standard recommendations in other projects.

All comparable projects in flexible molded foam utilize the same technology as proposed in the this case. Flexible foam projects can be divided in Vertifoam Technology - in which accelerated curing is generally promoted, and conventional technology in which methylene chloride is promoted wherever feasible in conjunction with softening additive. This project follows the same guidelines.

ENVIRONMENTAL ISSUES

Zero ODP option is chosen. Carbon Dioxide and methylene chloride have very low GWPs and a negligible photochemical activity.

SAFETY ISSUES

A key issue is to maintain acceptable workplace concentrations for isocyanates and methylene chloride. The project appears adequately to address these issues. The implementing agency should monitor these during and after completion of the project.

COST EFFECTIVENESS

Overall cost effectiveness is very good.

OTHERS

It is recommended to contact a halon expert in view of the most economic and most adequate replacement of the halon system. The project is now based on replacement by a carbon dioxide system. If powder would suffice about USD $40,000 could be saved.

PROJECT OUTLINE

COUNTRY	:	EGYPT
SECTORS COVERED	:	Foam sector and industrial/ commercial foam in refrigeration
ODS CONSUMPTION (FOAMS)	:	722 ODP tonnes in 1991
PROJECT TITLE	:	Project preparation assistance
DURATION	:	14 months (Nov. 1993 - Dec. 1994)
PROJECT IMPACT	:	Preparation of foam investment projects and TA/demo/investment project preparation on foam used in industrial/commercial refrigeration.
PROPOSED BUDGET	:	US$ 75,000
IMPLEMENTING AGENCY	:	UNDP
NATIONAL COORDINATING AGENCY	:	Egyptian Environmental Affairs Agency (EEAA)

PROJECT DESCRIPTION

The Egypt Country Programme (CP) was presented and approved at the 8th Executive Committee Meeting in October 1992, and proposes an ambitious ODS phaseout schedule. UNDP has been allocated the foams sector and industrial/commercial foam in refrigeration.

At Government request, the ExCom at its 6th Meeting (Feb. 92) approved $100,000 for UNDP project preparation assistance. As of end-Sept. 1993, $100,319 had been expended thereby utilizing all available funds. Projects prepared under this activity and approved by the ExCom at its 8th, 9th and 10th Meetings were:

1) Phaseout of 121 tonnes of CFC-11 in flexible PUF at Misr Foam Factory ($497,000, Oct. 92)
2) Phaseout of 55 tonnes of CFC-11 in moulded PUF at Technopol Company ($645,000, Oct. 92)
3) Phaseout of 50 tonnes of CFC-11 in flexible, semi-rigid and rigid PUF at Taki-Vita Factory ($352,500, Oct. 92)
4) Phaseout of 18 tonnes of CFCs in refrigeration at Koldair Company ($272,000, Oct. 92)
5) Phaseout of 28 tonnes of CFC-11 in moulded PUF at Misr Foam Factory ($275,000, March 93)
6) Phaseout of 75 tonnes of CFC-12 in extruded polystyrene foam at Al-Sharif Plastic Factories ($498,000, March 93)

In addition, four foam projects under $500,000 and one foam project over $500,000 will be submitted for approval at the 11th ExCom Meeting in November 1993.

The requested funds will be utilized (Nov. 93 - Dec. 94) to prepare additional foams sector investment projects as well as TA, demonstration and investment projects covering foam use in industrial/commercial refrigeration. These projects would be submitted to the ExCom for approval at its 12th, 13th and 14th Meetings. It is also proposed that the $75,000 come from funds remaining with UNDP following completion of its 1991 activities in Egypt. No additional funding would be required for this activity.

PROJECT OUTLINE

COUNTRY	:	GUATEMALA
SECTORS COVERED	:	All sectors
NATIONAL ODS CONSUMPTION	:	284.9 tonnes ODP in 1991
PROJECT TITLE	:	Project preparation assistance
DURATION	:	Six Months
PROJECT IMPACT	:	Preparation of projects in the refrigeration, MAC, foams, halons and recovery/recycling sectors.
PROPOSED BUDGET	:	US$ 30,000
IMPLEMENTING AGENCY	:	UNDP
NATIONAL COORDINATING AGENCY	:	Governmental Ozone Commission (COGO)

PROJECT DESCRIPTION

Guatemala's Country Programme (CP) for the reduction 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/July 1993. While approving the CP, the Executive Committee recommended that UNDP be designated implementing agency for the projects identified in the CP with the exception of the "Institutional Strengthening" project which was approved and funded for UNEP implementation.

Accordingly, this request would cover project preparation assistance for the following projects and technical assistance activities:

a) Reduction of CFC use in foams
b) Reduction of CFC use in industrial refrigeration
c) Servicing/Recharging of Mobile Airconditioning
d) CFC recovery during recharging processes
e) Determination of essential halons uses.

The US$ 30,000 preparatory assistance funds will be utilized over a six-month period to recruit international/regional/national consultants to work with national staff in the preparation of project proposals in these sectors. The completed project proposals will form part of UNDP's 1994 work programme that will be submitted for Executive Committee approval at its 12th and 13th Meetings.

PROJECT OUTLINE

COUNTRY	:	INDIA
SECTORS COVERED	:	Small-scale and informal sectors
NATIONAL ODS CONSUMPTION	:	13,122 ODP tonnes in 1991
PROJECT TITLE	:	Survey of ODS use in the small-scale (including tiny) & informal sectors, data base generation and ODS transition management planning
DURATION	:	Six months after receipt of funds
PROJECT IMPACT	:	Assessment of needed ODS transition management covering ODS use in aerosols, refrigeration/AC, foams, halons and solvents in the chemical and engineering industries, and estimation of financial requirements from the Multilateral Fund.
PROPOSED BUDGET	:	US$ 120,000
IMPLEMENTING AGENCY	:	UNDP
EXECUTING AGENCY	:	Office of the Development Commissioner for Small Scale Industries, Department of Small Scale Agro and Rural Industries, Ministry of Industry
NATIONAL COORDINATING AGENCY	:	Ministry of Environment and Forests (MOEF)

PROJECT DESCRIPTION

During the national workshops in July and August 1993 for preparation of the India Country Programme (CP) under the Montreal Protocol, the key role of the small-scale and informal sectors was emphasized. There are around 2 million small-scale units in India employing 13 million workers and double that number of units in the informal sector. A significant proportion of these units use ODS in their operations.

Rough initial estimates obtained by the Government from industry sources suggest that small-scale industry (SSI) and informal sector enterprises account for two-thirds of India's total ODS consumption. The estimated percentage of these SSI units that use ODS in their operations are:

- Room airconditioning (70%)
- Deep freezers and bottle coolers (80%)
- Aerosols sector (nearly 100%)
- Fire-extinguishing (80%).

The number of SSI units in the various chemical and engineering sectors that use ODS have been reported as follows: aerosols sector (200), foam sector (275), electronics sector (6,000), chemical sector (500), electrical sector (1,200) and the mechanical sector (over 2,000).

In addition to the above, a significant percentage of users are in the informal or household sectors.

The SSI sector is a free enterprise sector. As a result it has developed in a widely dispersed manner and poses complex and diverse technological and administrative problems. The product-specific technology spectrum is wide with varied levels of investment in similar product categories. No single technology model fits the needs of all SSIs in specific product areas due to cost, availability and adaptability of technology and the markets they serve.

Due to the above, the strategies for ODS transition management in the SSI and informal sectors would have to be qualitatively different from those adopted for medium and large-scale enterprises.

The requested survey to be managed by the Office of the Development Commissioner for Small Scale Industries and conducted through the central and state-level offices of the National Small Industries Corporation (NSIC), would utilize a large number of national technical staff to gather detailed information on exact ODS consumption, technologies used, investment levels, technician skill levels, employment levels and other data on the 11,000 units detailed above. A specific questionnaire and technical evaluation system will be developed for the purpose. The survey will assist the Government in the introduction of direct and indirect measures to facilitate the transition to non-ODS substances, thereby helping develop an institutional framework for ODS phaseout management in these sectors.

This project proposal, including most of the specific text elaborated above, was approved by India's National Steering Committee for Implementation of the Montreal Protocol, at its meeting on 21 August 1993 chaired by the Secretary, MOEF. UNDP is the requested implementing agency. It is expected that the survey results would be presented to the Executive Committee at its 13th Meeting in mid-1994.

PROJECT OUTLINE

COUNTRY	:	INDONESIA
SECTORS COVERED	:	Foams, Halons and Refrigeration
NATIONAL ODS CONSUMPTION	:	3,839 metric tonnes in 1992
PROJECT TITLE	:	Project preparation assistance
DURATION	:	14 Months (Nov. 1993 - Dec. 1994)
PROJECT IMPACT	:	Preparation of technical assistance, demonstration and investment projects in the foams, halons and refrigeration sectors.
PROPOSED BUDGET	:	US$ 100,000
IMPLEMENTING AGENCY	:	UNDP
NATIONAL COORDINATING AGENCY	:	Technical Committee on Ozone Layer Protection and ODS Phase Out, Ministry for Environment

PROJECT DESCRIPTION

ODS consumption in Indonesia has increased rapidly over the recent past due to the expansion of the national economy. This has resulted in higher demand for ODS-containing products. Indonesia's 1992 ODS consumption by sector has been estimated at 3,839 tonnes, and the percentages of consumption by sector are as follows:

Sector	ODS %age Share	ODP %age Share
Refrigeration/AC	63.2%	44%
Aerosols	19.4%	23%
Foams	7.9%	10%
Halons	4.4%	22%
Others	5.1%	1%
Total	100.0%	100%

The Government has identified several potential projects in the above sectors. A first batch of investment project proposals have been submitted or are in the process of being submitted through the World Bank to the Executive Committee for approval.

During the sectoral group meetings in August 1993 for the preparation of the Country Programme for which UNDP is lead agency, the Technical Committee requested UNDP's assistance in the formulation of technical assistance, demonstration and investment projects in the foams, halons and refrigeration sectors.

The funds will be utilized over the period November 1993 through December 1994 to recruit international and national consultants to prepare project proposals in these three sectors, for submission to the Executive Committee for approval at its 12th and future Meetings.

PROJECT COVER SHEET

COUNTRY:	Malaysia
PROJECT TITLE:	Elimination of CFC-12 in the manufacture of extruded polystyrene and polyethylene foam sheet at Associated Air-Pack Industries SDB. BHD.
SECTOR COVERED:	Foamed Plastics
ODS USE IN SECTOR:	600t CFCs (722t ODS) in 1991
PROJECT IMPACT:	50 TONS CFC-12 per year
PROJECT DURATION:	Nine months
TOTAL PROJECT COSTS:	USD 260,000 Incr. Capital Cost USD 26,000 Incr. Recurrent Benefits
PROPOSED MLF GRANT;	USD 234,000
COST EFFECTIVENESS:	USD 0.59/kg/y
NATIONAL COORDINATING BODY:	Malaysia Department of Environment (DOE)
IMPLEMENTING AGENCY:	UNDP
APPRAISAL DATE:	July 22, 1993

PROJECT SUMMARY

Associated Air-Pack Industries SDN. BhD. ("Air-Pack") 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, Air-Pack will eliminate the use of CFCs in this process through replacement by iso-pentane, 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 not suited for the use of a highly flammable substance. The company plans therefore to move the production of foam and separate it from other activities. The company will absorb these costs as they are related to the expansion of floor space available. A grant covering all other project related costs is requested.

PROJECT OF THE GOVERNMENT OF MALAYSIA

ELIMINATION OF CFCs IN THE MANUFACTURE OF EXTRUDED POLYSTYRENE AND POLYETHYLENE FOAM SHEET AT ASSOCIATED AIR-PACK INDUSTRIES SDB BDH

1. PROJECT OBJECTIVE

The objective of this project is to phase out the use of CFCs in the manufacture of EPS/EPE foam sheet at Associated Air-Pack Industries SDN BDH ("Air Pack").

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

Associated Air-Pack Industries S/B and the wholly owned subsidiary Extro-Pack S/B were established in 1979. The 100% locally owned companies are specialized in the production of extruded polystyrene (EPS) and polyethylene (EPE) foam sheet. The companies are located in Ipoh. Main markets are the food industry (lunch boxes meat and meat trays from EPS) and the electronic industry (EPE).

4. PROJECT DESCRIPTION

Air-Pack utilizes annually about 50 t CFC-12 in the manufacture of EPS and EPE foam sheet. Iso-pentane is selected as the ODS-replacement of choice, as butane--the usual replacement candidate--is not locally available. Pentane technology is available through original equipment manufacturers and independent process consultants. 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 exposure hazards from the use of pentane. Finally, extensive production and safety training is needed to guarantee a smooth and safe operation and to conform to the strict fire safety standards in Malaysia.

The company will move the production line to a new structure, as appropriate fire safety will be difficult to establish in the existing multi-purpose building.

5. TECHNOLOGY

5.1 OVERVIEW AND SELECTION

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

- o Nitrogen gas,
- o CO2 gas,
- o Hydrocarbons (butane, isobutane, pentane, isopentane),
- o "Berstorff" technology (nitrogen and alcohol),
- o HCFC-22,
- o HCFC-142b,
- o HFC-134a,
- o HFC-152a,
- o Liquified petroleum gases (LPG).

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

Iso-pentane is selected by the company as an alternative that is:

- o Proven technology in processing and product performance,
- o Environmentally acceptable,
- o Low in toxicity,
- o Adaptable to the existing equipment,
- o Cost effective,
- o Available in the Malaysian market (contrarily to butane, another viable candidate) through imports from Europe.

A draw back of hydrocarbons 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 hydrocarbons is not regulated in Malaysia, nor are restrictions expected in the foreseeable future.

5.2 PRODUCTION PROCESS

The use of iso-pentane 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 pentane 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 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.

The production process at Air-Pack is currently not separated from other working areas. Additional space is constructed to accommodate a separate and enlarged production and aging area. Hydrocarbon gas and temperature alarm systems will be installed throughout this building. The tank area will be sprinklered. 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 foamant volume and permeability. The start-up will be supervised by an outside 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		SUBTOTAL	TOTAL
o	Storage Tanks		70,000
	Purchase	20,000	
	Testing	2,000	
	Installation	48,000	
o	Equipment Modification		80,000
	Parts	70,000	
	Installation	10,000	
o	Fire Safety Systems		60,000
o	Training		5,000
o	Technology Transfer		20,000
o	Contingency and Rounding		25,000
	TOTAL		260,000

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, iso-pentane:

CFC-12	2.09 USD/kg
Pentane	0.80 USD/kg

Prices are documented in annex-A. They can fluctuate significantly.

The use of hydrocarbons requires addition of an anti-shrinkage and a static-dissipative 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. 1 : 1 replacement of CFC-12 by pentane 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/y and specified in annex-B.

The resulting annual cost saving of USD 7,500 translates in a net present value (4y/10%) of:

USD 26,000

6.3 UNIT ABATEMENT COST

a)	ODS Reduction Project Costs	USD 260,000
b)	Annual Incremental Benefits	USD 7,500
c)	Project Useful Life	7 years
d)	ODS reduction/y	kg 50,000
	Unit Abatement Costs [(a/c + b)/d]	USD/kg/y 0.59

7. FINANCING PLAN

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

USD 234,000

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 project and will end after monitoring has confirmed that at no place on the machine or in the working area unsafe levels of hydrocarbons can be detected.

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 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 oversee the procurement. UNDP expects at the about the same time to procure 3-5 similar projects, resulting in procedural and cost efficiencies. Assistance will be provided by the local UNDP office 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: Price documentation
Annex B: Detailed calculation of recurrent incremental costs

AIRPACK.MAY
10-05-93/03

ANNEX-B

AIR-PACK INDUSTRIES
RECURRENT INCREMENTAL COSTS CALCULATION

1) ASSUMPTIONS

- Prices from July 1993 (date of project submission by Air-Pack),
- Iso-pentane use identical to CFC-12,
- Required extra additives: USD 30/t of resin; USD 0.24/kg blowing agent,
- Preventive maintenance: 5% of equipment costs,
- 1 USD = 2.58 M$ - 1.62 S$,
- USD 400/container transportation surcharge for reclassification of material.

2) MATERIAL

o	Before: 50t CFC-12 @ 2,090		USD 104,500
o	Now: 50t Iso-pentane @ 800	40,000	
	Additives	12,000	USD 52,000

3) OTHER RECURRENT INCREMENTAL COSTS

o	Recurrent monitoring & training	28,000	
o	Extra Maintenance	10,500	
o	Extra insurance	15,000	
o	Surcharge Transportation	12,400	USD 44,900

4) TOTAL ANNUAL RECURRING INCREMENTAL COSTS....USD 7,600

5) NET PRESENT VALUE (4 years; 10% discount) USD 26,000

PROJECT COVER SHEET

COUNTRY:	Malaysia
PROJECT TITLE:	Insafoam Insulation (Malaysia) SDN BHD elimination of CFCs in the manufacture of rigid polyurethane insulation foam.
SECTOR COVERED:	Foamed Plastics
ODS USE IN SECTOR:	600 MT CFCs (722 tons ODS) in 1991
PROJECT IMPACT:	30 Tons CFC-11 per year
PROJECT DURATION:	One year, after approval
PROJECT USEFUL LIFE:	10 Years
TOTAL PROJECT COSTS:	USD 175,000 Incremental Capital Cost USD 135,000 Incremental Recurrent Cost
PROPOSED MLF GRANT:	USD 310,000
COST EFFECTIVENESS:	USD 1.92 (unit abatement cost)
NATIONAL COORDINATING BODY:	Malaysia Department of Environment (DOE)
IMPLEMENTING AGENCY:	UNDP
APPRAISAL DATE:	August 10, 1993

PROJECT SUMMARY

Insafoam Insulation (Malaisia) SDN BHD produces pre-insulated pipe, panel and slabstock polyurethane foam. Its products are aimed at the building industry. The company is a Malaysian owned private sector enterprise. CFC-11 is currently used in the production process. Under this project, Insafoam will eliminate the use of CFCs in its production process through reduced CFC technology, combined with replacement of the residual CFC by HCFC 141b, resulting in an annual reduction of 30 tons of ODS, 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_2 and HCFCs as they mature. The Company expects an increase of recurrent incremental cost of about 12% of the system value. These costs will be partly offset by lower losses in the preparations of blends.

PROJECT OF THE GOVERNMENT OF MALAYSIA
INSAFOAM INSULATION S/B ELIMINATION OF CFCs IN THE MANUFACTURE OF RIGID POLYURETHANE INSULATION FOAM

1. PROJECT OBJECTIVE

The objective of this project is to phase out the use of CFCs in the manufacture of pre-insulated pipe, panel and slabstock polyurethane at Insafoam Insulation (Malaysia) Sdn Bhd ("Insafoam").

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

Insafoam was established in 1992. It is a 100% Malaysian owned private enterprise. The factory is located in Selangor, manufacturing pre-insulation pipe, panel and slabstock polyurethane foam. The company is currently operating with a low pressure dispensing machine. The products are mainly used in the building industry for air-conditioning insulation, cold room panels etc. The products sell to local and overseas markets.

4. PROJECT DESCRIPTION

Insafoam utilizes annually about 30t CFC-11 in the manufacture of rigid PUF in pre-insulation pipe, panel and slabstock.
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 additional cost for trials will occur. In addition to equipment changes, recurring incremental operating cost will occur, 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:

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

In addition, compounds such as methylene chloride, HCFC 123, and water blown technologies have been suggested, but are immature in technology, limited availability 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 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.

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

- o Proven technology in processing and product performance,
- o Environmentally acceptable,
- o 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 economically preferrable, but has to be evaluated on its retention in the foam. It is not feasible for slabstock without significant deteriation of insulation properties.

5.2 IMPACT ON PRODUCTION PROCESS

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

	DESCRIPTION	SUBTOTAL	TOTAL
o	FOAM EQUIPMENT		
	1 high pressure foaming unit	120,000	
	- Freight	10,000	
	- Installation	10,000	
	- Spare Parts	10,000	150,000
o	TRIALS, START-UP		10,000
o	CONTINGENCY, ROUNDING		15,000
	TOTAL		175,000

Equipment price from Cannon (Asia), Singapore.

6.2 OPERATING COSTS

Chemical suppliers have indicated an overall price increase for the new formulations of 12%:

o	Current costs 200yt @ 2,500	USD	500,000
o	12% Price increase	USD	60,000
o	Savings on ABA	USD	15,000
o	Savings on cleaning agent	USD	5,000
o	RECURRENT INCREMENTAL COSTS	USD	40,000

o	Net Present Value (4y; 10 % discount)..USD	135,000

6.3 UNIT ABATEMENT COST

a)	ODS Reduction Project Costs	USD 175,000
b)	Annual Incremental Costs	USD 40,000
c)	Project Useful Costs	10 Years
d)	ODS Reduction/Year	kg 30,000

Unit Abatement Costs [(a/c + b)/d] USD/kg/y 1.92

7. FINANCING PLAN

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

USD 310,000

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 detected.

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 Modifications			X	XX		
Tank Installation				X		
Safety Devises				XX		
3. Start-up, Training						
Machine Start-Up				X		
Safety Training				X		

9. PROJECT IMPACT

This project will eliminate the use of at least 30 tons of CFCs in the first year of implementation. The Project employs commercially and environmentally acceptable technology.

INSAFOAM
93-10-06/02

RAPPA Inc.
Consultants

Bert Veenendaal
Chemist
Certified Environmental Trainer

INSAFOAM INSULATION SDN BHD

SCOPE

The project is concerned with the elimination of CFCs in the manufacturing of rigid polyurethane foam for insulation purposes.

RELEVANCY AND ADEQUACY OF INFORMATION

The information is satisfactory. It should be pointed out that the original project was based on reduced CFC in combination with HCFC 22. After discussion with the technical reviewer this is changed to HCFC 141b. This made the project considerably more cost effective while providing better insulation efficiency.

TECHNICAL SOUNDNESS

The chosen route of CFC 11 replacement by HCFC 141b is one of the recommended options for insulating foams.

COMPARISON WITH OTHER PROJECTS

This project can be compared with Olympic, Egypt. Because of the much smaller size of the company it was recommended not to use in-house blending equipment, but to rely on outside blending.

ENVIRONMENTAL ISSUES

HCFC 141b has a residual ODP. The technology is therefore an interim technology most likely to be replaced by HFC or a water based system.

SAFETY ISSUES

The project includes monitoring on HCFC 141 air concentrations. This serves as well the industrial hygienic conditions in the plant as the fire safety.

104 Fieldstone Drive, LaPorte, IN 46350 USA, Phone: 219-362-4450, Fax: 219-326-6047

COST EFFECTIVENESS

Overall cost effectiveness is acceptable.

OTHERS

None.

RECOMMENDATIONS

The project is supported.

PROJECT COVER SHEET

COUNTRY:	Malaysia
PROJECT TITLE:	Elimination of CFC-11 in the manufacture of integral skin polyurethane foam at ISLAND RESOURCES SDN BHD
SECTOR COVERED:	Foamed Plastics
ODS USE IN SECTOR:	600 CFCs (722 tons ODS) in 1991
PROJECT IMPACT:	15t CFC-11 and 15t MCF/y (16.5t ODP), based on 1993 consumption
PROJECT DURATION:	One year, after approval
TOTAL PROJECT COSTS:	USD 145,000 Incremental Capital Cost USD 85,000 Incremental Recurrent Cost
PROPOSED MLF GRANT;	USD 230,000
COST EFFECTIVENESS:	6.03 USD/t/y
NATIONAL COORDINATING AGENCY:	Malaysia Department of Environment (DOE)
IMPLEMENTING AGENCY:	UNDP
APPRAISAL DATE:	July 23, 1993

PROJECT SUMMARY

Island Resources SDN. BHD. ("Island") is a manufacturer of polyurethane integral skin foam (ISF). Its products are aimed at the furniture market. CFC-11 is currently used in the production process. Under this project, Island will eliminate the use of CFCs in its production process through the introduction of a fully water-blown system, resulting in an annual reduction of 15 tons ODP, based on 1993 consumption. The company will also phaseout the use of methylchloroform (MCF) as a degreasing agent, resulting in an additional phaseout of 1.5t ODP. The company expects an increase of recurrent incremental operating costs of about 12% of the system value.

PROJECT OF THE GOVERNMENT OF MALAYSIA

ELIMINATION OF CFC-11 IN THE MANUFACTURE OF INTEGRAL SKIN POLYURETHANE FOAM AT ISLAND RESOURCES SDN BHD

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 Island Resources 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 polyethylene foam sheet) are the dominant substances in this sector, with much smaller usage of MCF, CFC-114 and CFC-115.

3. ENTERPRISE BACKGROUND

Island Resources is a privately owned Malaysian company, specialized in designer type of structural (rigid) integral skin polyurethane foams. The company produces chairs, bed-boards, mirror frames of very high quality. most of the production is aimed at export.

The company operates a facility in Pekan Nesas, Johore (West Malaysia), employing about 25 workers.

4. PROJECT DESCRIPTION

Island Resources will utilize in 1993 about 15t CFC-11 in the manufacture of PU-ISF. The company is committed to phaseout the use of this substance and has selected water-blown foam technology as the replacement of choice. To this purpose, an existing low pressure machine has to be replaced by high pressure machinery. Some additional costs for trials are expected. In addition to equipment changes, the company expects recurring incremental operating costs, mainly related to the higher use of isocyanate. The recurrent costs will be partly offset by the elimination of losses of blowing agent in the blending operation, elimination of the need of a cleaning solvent for the mixing head and the proceeds from obsolete equipment.

The company is already in the process of replacing a degreasing unit that employs methylchloroform as active agent. This will lead to additional phaseout of 15 t/y MCF or 1.5t ODP. The higher costs of the new degrasing agent will be offset by lower usage (reduced evaporization).

5. TECHNOLOGY

5.1 OVERVIEW AND SELECTION

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

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

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.

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

The company has selected the use of a fully water-blown system. Such systems are:

- o Environmentally acceptable,
- o Available in the Malaysian market,
- o Proven technology for systems requiring post treatment.

As such systems are only recently introduced, it is anticipated that extensive trials will be needed to assure proper performance. This will iitially be done at the chmical supplier, followed by on line trials.

5.2 IMPACT ON THE PRODUCTION PROCESS

The use of all water blown systems require the employment of high pressure foam production equipment to handle the higher viscosities with the required precision. The new equipment will, as a side effect, allow the elimination of the use of a solvent to clean the mixing head, thus partially offsetting higher raw material costs.

As skin building is a critical performance factor of the blowing agent, in addition to the foam building function, extensive trials will be needed to assure performance as close as possible to the existing quality. This will be performed initially at supplier location--to adjust the chemical composition--followed by local trials--to test under ambient conditions on production scale.

6. PROJECT COSTS

6.1 CAPITAL COSTS

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

DESCRIPTION	TOTAL(USD)
One High pressure Foaming Unit including freight, installation..100,000 (value old equipment).............(5,000)..........	95,000
One ODS- free Cleaning System...........................	16,000
Trials...	20,000
Contingency and Rounding................................	14,000
TOTAL INCREMENTAL CAPITAL COSTS	**145,000**

Price information is based on verbal price indications from OMS, Italy (foam equipment) and from Westech, Kuala Lumpur (degreasing equipment).

6.2 OPERATING COSTS

Based on indications from chemical manufacturers, a 12% increase in formulation costs is assumed. However, this is to be reduced by about 20% lower use of blowing agent, related to the elimination of ABA losses based on inefficient blending:

200t Chemicals @ USD 2,800..........................USD	280,000
12% Price increase..	33,500
Saving of 3t CFC-11/y @ 3,000...........................	9,000
Annual increase in chemical costs...................USD	24,500
Net Present Value of Incremental Recurrent Costs....USD	**85,000**

The new degreasing agent will not lead to recurrent incremental costs as higher costs of the chemical are offset by lower volatisation losses.

6.3 UNIT ABATEMENT COST

a)	ODS Reduction Project Costs	**USD 145,000**
b)	Annual Incremental Costs	**USD 85,000**
c)	Project Useful Life	**10 years**
d)	ODS reduction/y	**kg 16.500**
	Unit Abatement Costs [(a/c + b)/d]	**USD/kg/y 6.03**

7. FINANCING PLAN

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

USD 230,000

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 MLF approval of the project and will end after trials have confirmed that acceptable product can be made in the new configuration.

The following time table will apply:

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

8.3 PROCUREMENT

UNDP will oversee the procurement of this project, following UNDP guidelines and regulations.

9. PROJECT IMPACT

This project will eliminate the use of at least 15t CFCs and 15t MCF in the first year of implementation. The project employs commercially available and environmentally acceptable technology.

ISLREC.MAY
93-10-06/03

COUNTRY:	Malaysia
PROJECT TITLE:	Conversion of Metal Cleaning Process from 1,1,1, Trichloroethane (TCA or Methyl Chloroform) Solvents to Non-ozone Depleting Organic Solvents at Ngai Cheong Metal industries Sdn Bhd.
SECTOR COVERED:	Solvent Cleaning
ODS USE IN SECTOR:	23 metric tons (MT) of TCA in 1992 Total ODP-weighted consumption -2.3 MT/yr
PROJECT IMPACT:	Eliminate annual consumption of 23 MT of TCA, based on 1992 consumption
PROJECT DURATION:	1 year
PROPOSED BUDGET:	ODS Reduction Investment Cost: US$30,005 NPV of 4 years operating Cost: US$33,475 Total Project Cost: US$63,480
IMPLEMENTING AGENCY:	UNDP
NATIONAL COORD-INATING AGENCY:	Department of Environment (DOE), Malaysia

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PROJECT SUMMARY

Ngai Cheong Metal Industries Sdn Bhd ("Ngai Cheong") is one of Malaysia's larger metal stamping companies. The products are supplied to the manufacturers of electrical appliances, air conditioners and automatic components. The company is a private sector enterprise.

TCA is used as part of the production process for the degreasing of light stamping oil from electrical and electronic metal sheets/parts. Under this project, Ngai Cheong aims to phase out the use of TCA through initial replacement by trichloroethylene followed by hydrocarbon based ACTREL as soon as the conveyor cleaning machine is available. This will result in an annual ODS reduction of 23 MT, based on the consumption in 1992. The project is to include safety features to address the potential hazards expected through the use of a flammable substance.

The company expects a change in the incremental cost. The switch from the current manual dipping method using a non-flammable solvent (TCA) to using a conveyor cleaning machine for flammable hydrocarbon solvent (ACTREL) requires an investment cost for machinery.

PROJECT OF THE GOVERNMENT OF MALAYSIA
ELIMINATION OF TCA IN CLEANING METAL PARTS
IN NGAI CHEONG

1. Project Objective

The objective of this project is to phase out the use of TCA in cleaning metal parts at Ngai Cheong.

2. Sector Data (Use Port Klang Section)

3. Enterprise Background

Ngai Cheong was established in 1967 with a paid-up capital of US$ 240,000. Sited in the vicinity of a major industrial estate, Shah Alam, the company is well located to service clients using stamped metal parts. Ngai Cheong is commited to completely phasing out of ODS.

4. Project Description

4.1 Description

Ngai Cheong consumed 23 MT of TCA in 1992. The company expects that its cleaning requirements will remain constant over the next few years.

For this project, Ngai Cheong will eliminate its use of TCA by removing the existing manual dipping set-up and replacing it with a conveyor-type vapour cleaning machine. This machine has to be retrofitted to suit for the use of hydrocarbon solvents. The capacity of the machine to be purchased is approximately the same as the existing manual dip tank system. The conversion to non-ozone depleting technology consists of the following elements:

- Process development and material compatibility test
- Replacement technology
- Recurring activities (including electricity, waste disposal, etc.)

Prior to the purchase of the conveyor cleaning machine, Ngai Cheong will perform material compatibility and process development tests to select the optimal cleaning equipment and cleaning solvents. The company will evaluate items such as changes in worker function and compatibility of materials with the new solvents. Solvents that have been used effectively as substitutes for TCA in cleaning include trichloroethylene, perchloroethylene, methylene chloride and other organic solvents. After the cleaning machine has been purchased, installed and retrofitted, additional tests may have to be performed to optimize the cleaning process.

In order to accommodate the new technology, Ngai Cheong will make several process changes in its degreasing practices. these will include re-training of workforce, electricity consumption, material cost and engaging the services of a waste disposal company.

Ngai Cheong is submitting a project proposal in August 1993 to the DOE.

4.2 Funding Need

This funding is essential for Ngai Cheong to phase-out its use of ozone depleting solvents. Unlike many of the other solvent-using companies in Malaysia, Ngai Cheong is 100% Malaysian-owned. Therefore, it has no multinational parent company from whom it can obtain technical assistance or funding to aid in the phaseout of ODS. Furthermore, many of Ngai Cheong's customers now insist that their suppliers (Ngai Cheong inclusive), eliminate the use of ODS due to new laws in the U.S., Europe, and elsewhere (countries who are signatories of the Montreal Protocol). Therefore. without this funding, it is possible that the company will be forced either to continue using ODS (to the detriment of the environment) or to reduce production, resulting in lost revenue, profits, and jobs.

5. Alternative Technology Selection

There are several alternatives to the use of TCA in metal cleaning-

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

The primary consideration in selecting an alternative process is to maintain a sufficiently high level of cleanliness, while meeting customer specifications. Ngai Cheong has considered each alternative and selected the hydrocarbon solvent for degreasing (ACTREL cleaning fluids from Exxon Chemical) to meet its cleaning needs. This is because ACTREL:

- is non-ozone depleting
- has low volatility grades available for VOC companies
- is non-carcinogenic
- has low acute toxicity
- has high cleaning efficiency
- provides high worker comfort
- is compatible with more plastics and elastomers
- is non-corrosive to metals
- is safe to operate at low or higher temperatures with the appropriate equipment

6. Project Costs

6.1 Total Project Costs[1]

As described below, and detailed in the relevant annexes, the total project cost is US$ 63,480. Because there are no non-ODS project investment costs associated with this project, the total project cost is also the incremental cost. It is important to note that this project will not provide Ngai Cheong with any incremental revenues.

6.2 Investment Costs

As detailed in Annex 1, the total investment cost is US$ 30,005. A breakdown of this cost would include the purchase and installation of a conveyor cleaning machine (US$ 21,245), safety systems (US$ 1,946), transportation (US$ 1,500), as well as engineering and training costs (US$ 1,400).

6.3 Operating Costs

Prior to the project, the annual operating cost exclusive of tax works out to be US$ 36,619. After the implementation of the project, the annual operating cost will be US$ 47,178, resulting in an incremental operating cost of US$ 10,559. Given 4 years at a discount rate of 10 percent the net present value of the incremental operating cost is US$ 33,475. A more detailed breakdown of operating costs is provided in Annex 2.

[1] *Unless otherwise noted, all costs in this section are economic, rather than financial costs. As such, taxes, duties and other financing are not reflected.*

6.4 Unit Abatement Cost (UAC)

As detailed in Annex 3, the UAC for this project is US$ 7.27 per ODP-weighted kilogram of TCA phased-out per year. this number is derived from annualized incremental capital costs of US$ 56,174 annual incremental operating costs of US$ 10,559 and savings of 23 MT (weighted) of TCA per year. Note that off setting savings have been included in incremental operating costs.

7. Environmental Impacts

The environmental impacts associated with this project are discussed in Annex 4.

8 Project Impact

This project will eliminate 23 Tonnes/year of TCA emmisions corresponding to 23 tonnes/year of ODS and approximately 2 tonnes/year of ODP.

ANNEX 1

BREAKDOWN OF INVESTMENT COSTS

Estimated Costs in US Dollars

Training and Engineering:			$ 1,400
Material Compatibility, Safety and Process Development[1] (500 hours)	$ 400		
Equipment Training[1] (500 hours)	$ 400		
Equipment Installation[1] - Staff (250 hours) - supplier staff	$ 200		
Consulting Engineering Support (Material compatibility testing, installation assistance and follow-up[2]	$ 400		
Conveyor Cleaning Machine:			$21,245
One Unit used conveyor cleaning machine[3]		$ 11,673	
Machine retrofit	$ 5,837		
Storage Area for machine	$ 3,735		
Improvements to Safety Systems:[4]			$ 1,946
Transportation:			$ 1,500
Contingency and Rounding:			$ 3,914

TOTAL: $30,005

1/ These activities are to be carried out by Ngai Cheong's staff.
2/ This support is meant for consultants' and suppliers's advise, etc.,
3/ The cost of separate dryer unit is included in this conveyor cleaning machine.
4/ This include the installation of exhaust fans, fire extinguishers and a safe storage area for the flamable solvent.

ANNEX 2

BREAKDOWN OF INCREMENTAL OPERATING COSTS/SAVINGS

Estimated Costs in US Dollars

	Pre-Project	Post Project
Solvents Costs per Year:		
23,000 TCA ($1.45/kg)	$ 33,350	
17,800 litres ACTREL ($2.01/litre)		$ 35,785
Taxes on Chemicals (10%)	$ 3,335	$ 3,579
Electrical Costs per year:		
Current System (0 KWH)	- 0 -	
1 Conveyor Degreaser[1] (10 KWH)		$ 2,335
Manpower Costs per Year:		
Current System (1 worker)	$ 3,269	
Conveyor Degreasing Process[2] (2 workers)		$ 6,538
Disposing Costs per Year	- 0 -	$ 2,520

Summary Table:

	Without Taxes
TOTAL PRE-PROJECT COSTS PER YEAR	$36,619
TOTAL POST-PROJECT COSTS PER YEAR	$47,178
TOTAL INCREMENTAL COSTS PER YEAR	$10,559
TOTAL INCREMENTAL COSTS OVER 4 YEARS	$42,236
NPV OF 4 YEARS' OPERATING COSTS	$33,475

1/ This cost is calculated as 8 H/day x 25 days month x 12 months/year x 10 kw x $0,0973/kwH.

2/ Two (2) workers are needed where one is in-charge of feeding the metal parts onto the conveyor machine while the other retreive the parts at this end of the process, which is now slower due to longer cleaning cycle.

ANNEX 3

CALCULATION OF UNIT ABATEMENT COST

Estimated Costs in US Dollars

A. ODS SAVINGS

Average Use of TCA per Year: 23,000 Kg
ODP of TCA: 0.1
ODP Weighted Savings: 2,300 Kg

B. INCREMENTAL CAPITAL COST:

Total from Annex 1: $30,005
Equipment Life: 7 years
Discount Rate: 10% per year
Annualized Capital Cost: $6,174

C. NET INCREMENTAL OPERATING COSTS: $ 10,559

D. UNIT ABATEMENT COST:

	Cost per year	Unit Cost per ODP Saved
Incremental Annualized Capital Cost:	$ 6,174	$ 2.68
Incremental Annual Operating Cost:	$10,559	$ 4.59
Operating Cost: Unit Abatement Cost ($/kg)		$ 7.27

ANNEX 4

ENVIRONMENTAL ASSESSMENT

Under the current proposal, Ngai Cheong will use a hydrocarbon based solvent to clean stamped metal parts. Because this solvent has flammability concerns, Ngai Cheong will buy a used vapour cleaning machine which will be retrofitted for cold cleaning applications only. Safety features such as explosion-proof electrical equipment, temperature sensors, temperature gauge. safety alarms, etc. will be installed.

When cold cleaning with hydrocarbon solvent, the cleaning solvent must be replaced regularly to maintain cleaning effectiveness. The spent solvent is to be disposed of, via incineration to recover its calorific value,at a cost of US$ 39.37/drum. (a clay product factory has agreed to use the spent solvent by blending with their fuel oil for drying their product)

Per year, a total of 13,350 litres of spent ACTREL will have to be disposed. This figure is based of 75% of the product being contaminated and 25% being evaporated, thus resulting in 64 drums @ 209 litres drum. Therefore, total cost to dispose of 64 drums of spent ACTREL will be $2,520. This cost has been included in the operating costs in ANNEX 2.

It is unlikely that the project will have an adverse impact towards the environment because it has very low volatility (minimal VOC) and the waste is being consummed as fuel.

Malaysia.1/bb

COUNTRY:	Malaysia
SECTOR COVERED:	Solvents
ODS CONSUMPTIONS IN AFFECTED SECTOR:	800 metric tonnes of CFC 113 2829 metric tonnes of TCA
PROJECT TITLE:	"PROJECT 2"-Elimination of the use of 1,1,1, TCA in Home Appliance parts manufacturing at MATSUSHITA ELECTRIC CO., (M) Bhd. - MAIN PLANT (MELCOM - Main Plant)
PROJECT DURATION:	1 year. The equipment is currently fabricated and installed. It is being tested on production. By year end, this could become retroactive.
TOTAL PROJECT COST:	US$ 199,600 (RM 506,972.74)
PROPOSED MLF GRANT:	US$ 113,570 (RM 288,467.49) (based on 56.9% of local public listed share, which excludes the ownership of transnational corporation, Matsushita Electric Industrial Co. Ltd., Japan 43.1%)
PROJECT IMPACT:	Elimination of the use of 9.7 tonnes of Ozone Depleting Substance (ODS) annually
IMPLEMENTING AGENCY:	UNDP
NATIONAL COORDINATING AGENCY	Department of Environment (DOE), Malaysia
IMPLEMENTING ENTERPRISE:	MATSUSHITA ELECTRIC CO., (Melcom) BHD
PLANT LOCATION:	Lot No.3, Jalan Sesiku 15/2, Section 15, Shah Alam Industrial Site, 40000 Shah Alam,Selangor D.E.

PROJECT SUMMARY

This project, for the Matsushita Home Appliance Products of MATSUSHITA ELECTRIC CO, is designed to completely eliminate the use of ODS 1,1,1 trichlorethane (TCA). A vapor degreasing system for cleaning processing wax from rice cooker lids, and a second vapor degreaser for cleaning contaminated oil from home shower tanks, will both be replaced by converting to a single, aqueous cleaning process.

With the successful completion of this project, it is expected

that approximately 9.7 Tonnes of Ozone Depleting Substances (ODS) will be phased out at MELCOM-Main Plant.

PROJECT OF THE GOVERNMENT OF MALAYSIA

ELIMINATION OF THE USE OF 1,1,1, TCA IN HOME APPLIANCES PARTS MANUFACTURING AT MATSUSHITA ELECTRIC CO., (M) BHD. MAIN PLANT (MELCOM - MAIN PLANT)

1. PROJECT OBJECTIVE

The project's objective is to eliminate the use of 1,1,1 TCA in home appliances parts manufacturing, thereby producing parts in an ODS free process.

2. SECTOR BACKGROUND

In 1992, Malaysia's consumption of ODS (excluding HCFC 22) exceeded 6000 metric tonnes, of which solvents exceeded half the consumption. On an ODP basis, the total was 5600 tonnes, with the solvents sector consuming 1200 tonnes or 21% of the total. This is the third largest sector on an ODP basis.

3. ENTERPRISE BACKGROUND

The Matsushita operation (MELCOM) is a 56.9% locally owned enterprise engaged in the manufacture of parts for electric irons and for rice cookers. In the 1992 fiscal year, MELCOM - Main Plant produced 400,689 units of home appliances products (Rice Cooker and Home Shower) comprising 12 major models. In producing the home appliances parts, MELCOM - Main Plant consumed approximately 9.7 Tonnes of 1,1,1 TCA. The figure represents 0.2% of Malaysia's ODS consumption at that time.

4. PROJECT DESCRIPTION

In order to accomplish the objective of the project, a number of directly related and peripheral activities are required, such as the strengthening of the Environmental Protection Promotion Committee, appointment of a person responsible for Environmental Protection, testing to determine the appropriate Home Appliances components cleaning system and verification of the quality of home appliances products that are cleaned with the new process.

MELCOM - Main Plant currently uses TCA in two operations as a cleaning agent in the manufacture of its product lines. The company is committed to phase out the use of ODS. It has selected a single aqueous cleaning system to replace the two TCA Vapour degreasing systems now in use. The process chosen is based on expected advantages over other, solvent based systems investigated (e.g., petroleum based solvents), such as compatibility with downstream treatment facilities.

5. TECHNOLOGY

5.1 PRESENT SYSTEM

Before the introduction of the aqueous type system, there were two types of cleaning machine in use at the Main Plant:

a) Vapour degreasing System and chain conveyor system whereby using 1,1,1 TCA as the solvent to remove the wax from "lid cover" of Rice Cooker.

b) Vapour degreasing system (manual dipping system) whereby using 1,1,1 TCA s the solvent to remove contaminated oil from the home Shower tank.

5.1 PROPOSED SYSTEM

With the introduction of the aqueous type system, the above two processes are combined into one. Some advantages of an aqueous system compared to alternatives such as HCFC, or petroleum based, are as follows:

a) The Company's current waste water treatment plant is capable of treating the aqueous system's waste water.

b) Aqueous cleaning is a proven technology accepted worldwide and in this case is unlikely to have any adverse impact to the employee and consumer.

c) Aqueous system is totally ODS free: it therefore provides for easier long term planning.

5.3 CAPACITY

	1.1.1 TCA SYSTEM	AQUEOUS SYSTEM
1.	1200pcs/day (8.8 hours) for Rice Cooker	2200pcs/day (8.8 hours)
2.	1700pcs/day (8.8 hours)	
Total	2900pcs/day	2200pcs/day
System	Vapourize System	Cleaning -> Rinsing -> Drying System

The capacity of the aqueous system is slightly less than the total capacity of TCA for Rice Cooker lids and home Shower tanks.

5.4 ENVIRONMENTAL ASSESSMENT

Waste water from the aqueous cleaning system is treated by the waste water treatment plant and the final discharge shall be within the requirements of the Department of Environment (DOE) vis. Environment Quality Act of Malaysia.

6. PROJECT COSTS

The detail of the investment cost is described in Attachment B. The investment cost of the project has been determined to be US $134,560 (RM 341,783.75) .

The detail of the incremental operating cost is described in Attachment C. The incremental operating cost and benefits for up to 4 years have been discounted to net present value at 10%, and amount to US$ 65,040 (RM 165,188.95).

The total project cost estimates amounts to US$ 199,600 (RM 506,972.74)

7. FINANCING PLAN

7.1	Total Project Cost	$199,600
	From Multilateral Fund	$113,570
	From Matsushita	$ 86,030

The total project cost estimate amounts to US $199,600 of which US$ 113,570 is proposed for Multilateral Fund financing. The financing is calculated by multiplying the total project cost by the percentage of local public listed share (56.9%), which excludes ownership of Matsushita Electric Industrial Co. Ltd., Japan (43.1%)

8. PROJECT TIMEFRAME

The project began in September, 1992 and it is scheduled for completion by the end of 1993. The aqueous system has been installed in the plant and is in the process of startup testing on the production line, performing as expected. The timeframe of the project is described in Attachment A.

9. PROJECT IMPACT

It is expected that with the successful implementation of the project, 9.73 Tonnes of ODS would be eliminated annually at MELCOM -Main Plant. Along with the ODS saved, additional benefits are expected, such as

1. the Environmental Protection Promotion Committee at the main plant will gain added experience as the new process is implemented, thereby strengthening this plant organization;

2. employees at the site will increase their environmental awareness;

3. the site will advance in knowledge regarding aqueous cleaning systems, and be in a position to help other plants.

Details of the ODS elimination are as follows:

Substance	Consumption in 1992 fiscal year (tonnes)	ODP	Consumption (Tonnes x OPD)
1,1,1, TCA	9.7	0.1	0.97

IMPLEMENTATION ARRANGEMENTS

UNDP would be undertaking the project with the supervision of Department of Environment, Ministry of Science, Technology and the Environment. The actual implementation of the project, comprised of training, meetings, installation, startup, evaluation, monitoring, and production is under the full responsibility of MELCOM Main Plant.

The general supervision of the project implementation would be handled by the Department of Environment whereas the supervision of the financial implementation would be carried out by the UNDP.

ATTACHMENT A

6

MELCOM MAIN PLANT NON CFCs PLAN

03-08-93

MELCOM - Main Plant

PRESENT	NEW	USAGE	SUBJECTS OF ACTION		'92	'93
1,1,1 TCE	WATER BASED	CLEANING OF LID COVER AND HOME SHOWER TANK	1. PROJECT STUDY	BASIC SCHEDULE	SEPT	
			2. TRIAL TESTING			JAN
			3. INSTALLATION OF NEW WATER BASED CLEANING SYSTEM			APRIL
			4. IMPLEMENTATION ON PRODUCTION			MAY

PROJECT2\SAIPLAN2

ATTACHMENT B

SUMMARY OF NON CFCs CLEANING SYSTEM INVESTMENT

MELCOM – MAIN PLANT 03-08-93

ITEM	'93	TOTAL
1. WATER BASED SPRAY TYPE AUTOMATIC WASHING & DRYING SYSTEM	US$ 122,814.87 (RM 311,949.75)	US$ 122,814.87 (RM 311,949.75)
2. MACHINE SHIFTING AND WATER SUPPLY PIPING	US$ 5,659.06 (RM 14,374.00)	US$ 5,659.06 (RM 14,374.00)
3. CONVEYOR SYSTEM	US$ 5,889.77 (RM 14,960.00)	US$ 5,889.77 (RM 14,960.00)
4. WIRING	US$ 196.85 (RM 500.00)	US$ 196.85 (RM 500.00)
GRAND TOTAL		US$ 134,560.55 (RM 341,783.75)

Note :
Exchange Rate : US$ 1.00 = RM 2.54

PROJECT2:\SA1COST2

5

ATTACHMENT C

ODS PHASE–OUT PROJECTS = OPERATING COST

ANNUAL OPERATING COST (PROJECT 2 – MELCOM MAIN PLANT)

No.	ITEMS	PRESENT SYSTEM	REMARKS	PROPOSED NON–CFC SYSTEM	REMARKS
1.	SOLVENT/CHEMICAL COST	US$13,748.03 (RM 34,920.00)	TCE 111 9.7 ton/year Cost factor US$1.42 (RM3.60)/ kg	US$ 340.16 (RM 864.00)	P3–T5177 @ US$3.15(RM 8.00)/lit
2.	LABOUR COST	US$12,283.46 (RM 31,200.00)	2M/P @ US$511.81 (RM1,300.00)/month	US$12,283.46 (RM 31,200.00)	2m/p @ US$511.81(RM 1,300.00)/month
3.	ENERGY COST	US$ 99.21 (RM 252.00)	1hp @ 8 hrs/day	US$ 31,022.36 (RM 78,796.80)	24 hrs @ machine on to heat the solvent [US 6 cent (RM 0.16) per kWh], motor 57 KW to maintain the temperature of the chemical because this machine takes a long time to restart (to maintain the solvent temperature at 70 °C).
4.	WATER CONSUMPTION	US$ 2.36 (RM 6.00)	400 l/mth @ US$0.47(RM1.20)/ m^3	US$ 907.09 (RM 2,304.00)	8 m^3 /day @ US$0.47 (RM1.20)/ m^3
5.	MAINTENANCE COST	US$ 141.73 (RM 360.00)	Grease chain and cleaning system	US$ 373.23 (RM 948.00)	o Water filter [monthly change @ US$14.17 (RM36.00) each] o Bag filter [monthly change @ US$16.14 (RM 41.00) each]
		US$26,274.80 (RM 66,738.00)		US$44,926.30 (RM 114,112.80)	

Incremental of operating cost : US $ 18,651.50 (RM 47,374.81)

project2/ocost1

Total Incremental Cost (up to 4 years NPV 10%) : US$ 65,035.02 (RM 165,188.95)

Note :

Exchange rate : US$ 1.00 = RM 2.54

PROJECT 2 (MAIN PLANT)
INCREMENTAL COST

Incremental of operating cost = US $ 18,651.50
(RM 47,374.81)

Benefit during up to 4 years with the net present value (NPV) discounted benefit at 10 %.

Year	Calculation
1.	US $ 18,651.50 (RM 47,374.81)
2.	US $ 16,955.91 (RM 43,068.01)
3.	US $ 15,414.46 (RM 39,152.73)
4.	US $ 14,013.15 (RM 35,593.40)
Total (4 years)	US $ 65,035.02 (RM 165,188.95)

ATTACHMENT D

TECHNICAL EVALUATION

GLOBAL CENTRE FOR PROCESS CHANGE

P.O. Box 553
Montchanin, DE
19710-0553 USA

W. G. Kenyon
Tel: 302-652-5597
Fax: 302-652-5701

FAX TO: C. J. Norris
COMPANY: UNDP
FAX NUMBER: 633-0440
DATE: 27 Sept., 1993
FROM: W. G. KENYON

SUBJECT: **COMMENTS ON MALAYSIA PROJECTS #2 &3**

MESSAGE:

Mr. Norris: As requested, here are the technical comments on the subject projects submitted for UNDP support.

In summary, it appears that important information on materials, materials compatibility, future product compatibility with the UNDP funding cleaning processes and waste stream analysis & treatment are missing from the project proposals. In addition, the reviewer is concerned that cleaning agent suppliers may not be knowledgeable concerning the proper use of rust inhibitors, thus may be making the conversions more complex and expensive for the UNDP than actually needed.

PROJECT #2: RICE COOKER & HOME SHOWER.

The goal is to replace two 1,1,1-trichloroethane (aka methyl chloroform or MCF) processes with a single aqueous process. It would appear feasible to make the conversion, since aqueous cleaning is well established for the cleaning of industrial goods. However, from a technical standpoint, the following issues need to be addressed to optimize the processes:

- What are the materials of construction of the rice cooker lid and the home shower?
- Is the cleaning solution compatible with these materials?
- Has the waste stream been tested for dissolved metals ?
- Are they within the limits allowed by the Dept. of Envir.?
- Are there plans to introduce new rice cooker and home shower products
- If so, will they use new materials which will not be compatible with the UNDP funded cleaning process and will react adversely with the cleaning agent, causing an adverse environmental impact?
- Is the wax from the rice cooker lid soluble in cold water ?

ATTACHMENT E

TECHNICAL EVALUATION RESPONSE

United Nations
Development Programme

World Development

TO W.G. KENYON
GLOBAL CENTER FOR PROCESS CHANGE

FROM C.J. NORRIS 27 SEPT, 1993
UNDP CONSULTANT

SUBJECT TECHNICAL EVALUATIONS - MALAYSIA PROJECTS

DEAR DR KENYON,

MANY THANKS FOR YOUR PROMPT RESPONSE ON SUCH SHORT NOTICE REGARDING THE 2 MATSUSHITA PROJECTS. I HAVE SPOKEN WITH MR JEE, LOCAL MALAYSIAN CONSULTANT, AND TOLD HIM THAT, WHILE MENTIONING THE ACCEPTABILITY OF THE TECHNOLOGIES, YOU HAVE ALSO INCLUDED SOME PROCESS OPTIMIZATION SUGGESTIONS. MR JEE STATED THAT SOME OF THE SUGGESTIONS HAVE BEEN ADDRESSED, BUT WERE SIMPLY NOT INCLUDED IN THE PROJECT WRITEUP. OTHERS, HOWEVER, ARE VERY WELCOME SUGGESTIONS FOR THEM TO FOLLOW UP AS THEY BRING THEIR NEW SYSTEMS ON LINE AND BEGIN THEIR OPTIMIZATION WORK. A BRIEF SUMMARY OF THE DISCUSSION FOLLOWS (SOME OF IT APPEARS IN THE HANDWRITTEN FAX ENCLOSED)

PROJECT 2 -MAIN PLANT

* MATERIALS: ALUMINUM AND COPPER. MATSUSHITA FORESEES NO AQUEOUS COMPATIBILITY PROBLEMS BASED ON THEIR NUMEROUS TESTS TO DATE.

* MR JEE WRITES THAT THE AQUEOUS WASTE WILL GO TO THE WASTE WATER TREATMENT SYSTEM. HE SAID THAT MATSUSHITA'S STANDARD IS TO DISCHARGE WASTES AT FAR BETTER PURITY LEVELS THAN THE DOE STANDARD, WHICH HOLDS TRUE FOR THIS CASE. DOE HAS ALREADY GIVEN APPROVAL, BASED ON THE DATA, ACCORDING TO MR JEE.

* NO FORESEEABLE PLANS TO INTRODUCE NEW MATERIALS IN NEXT GENERATION'S PRODUCTS.

* REGARDING YOUR CAUTION RE WAX DEPOSITION, THEY WILL RUN TESTS TO SEE IF WAX SEPARATES IN THE DISCHARGE STREAM AND COULD, THEREFORE, CAUSE SIMILAR PROBLEMS TO THE ONES YOU DESCRIBED. IF SO, THEY WILL MODIFY THE PROCESS TO INCLUDE A TRAP.

One United Nations Plaza • New York, NY 10017 • Telephone (212) 906 5000 • Cable UNDEVPRO NEW YORK

PROJECT 3 -PORT KLANG

* ULTRASONIC POWER - BASED ON NUMEROUS TESTS, THEY BELIEVE THAT THEY HAVE OPTIMIZED VIA DESIGN OF CARRIER, ETC. THEY WILL HAVE TO CONFIRM, HOWEVER, AFTER STARTUP ON ROUTINE PRODUCTION, AND AFTER IMPURITIES REACH STEADY STATE.

* MR JEE SAID THAT THEY CURRENTLY NEED TO USE TWO CLEANING LINES DUE TO PHYSICAL PLANT LAYOUT, AND HOPE TO MINIMIZE THE USE OF RUST INHIBITOR. HE DISCUSSES IN HIS ATTACHED FAX SEVERAL FINDINGS FROM THE WORK DONE TO DATE, BUT PLANS TO EVALUATE RUST INHIBITION PER YOUR COMMENTS, DURING THE PROCESS OPTIMIZATION WORK.

* MR JEE STATED THAT BOTH CLEANLINESS AND WASTE STANDARDS ARE BEING ACHIEVED. ACCORDING TO HIS ATTACHED NOTE, DOE HAS CONFIRMED THE WASTE MEETS STANDARDS. AGAIN, THIS IS IN LINE WITH MATSHUSHITA'S GOAL AS STATED ABOVE.

AS YOU CAN SEE, YOUR QUESTIONS HAVE BEEN THOUGHT PROVOKING TO THOSE WHO WILL BE "RUNNING IN" THE NEW PROCESS AND DOING THE OPTIMIZATION WORK THAT FOLLOWS.

ONCE AGAIN, THANK YOU FOR YOUR RAPID RESPONSE, AND YOUR INPUTS ON OPTIMIZATION!

SINCERELY,

Clinton Norris

CLINTON NORRIS

COUNTRY:	Malaysia
SECTOR COVERED:	Solvents
ODS CONSUMPTIONS IN AFFECTED SECTOR:	800 metric tonnes of CFC 113 2829 metric tonnes of TCA
PROJECT TITLE:	"PROJECT 3"-Elimination of the use of 1,1,1, TCA in Home Appliance parts manufacturing at MATSUSHITA ELECTRIC CO., (M) Bhd. - PORT KLANG PLANT (MELCOM - PK Plant)
PROJECT DURATION:	2 1/2 years from initial concept. Part of the system is currently and is being tested. After year end, part of this could become "retroactive".
TOTAL PROJECT COST:	US$ 304,540 (RM 773,516.84)
PROPOSED MLF GRANT:	US$ 173,280 (RM 440,131.07) (based on 56.9% of local public listed share, which exclude the ownership of transnational corporation, Matsushita Electric Industrial Co. Ltd., Japan 43.1%)
PROJECT IMPACT:	Elimination of the use of 10.3 tonnes of Ozone Depleting Substance (ODS) annually
IMPLEMENTING AGENCY:	UNDP
NATIONAL COORDINATING AGENCY	Department of Environment (DOE), Malaysia
IMPLEMENTING ENTERPRISE:	MATSUSHITA ELECTRIC CO., (M) BHD
PLANT LOCATION:	Lot No. 46/73. Persiaran Raja Lumu, Pandamaran Industrial Site, 42008 Port Klang, Selangor D.E.

PROJECT SUMMARY

This project, for the Matsushita Home Appliance Parts Manufacturing Company, is designed to completely eliminate the use of ODS by converting its two cleaning operations away from 1,1,1 trichlorethane (TCA).

This project is divided into two subcomponents. The first is to replace the use of 1,1,1, TCA, the cleaning solvent for the sole plates of home appliances parts, with a water based cleaning system. The second is to totally eliminate the use of 1,1,1, TCA in parts manufacturing at MELCOM PK Plant by installing a CFC-free cleaning system for the cleaning of heater pipes. Owing to the complex shapes of these parts, ultrasonic devices will be used in both cleaning processes.

With the successful completion of this project, it is expected that approximately 10.3 Tonnes of the use of Ozone Depleting Substances (ODS) will be phased out at MELCOM PK Plant.

PROJECT OF THE GOVERNMENT OD MALAYSIA

ELIMINATION OF THE USE OF 1,1,1, TCA IN HOME APPLIANCES PARTS MANUFACTURING AT MATSUSHITA ELECTRIC CO., (M) BHD. PORT KLANG PLANT (MELCOM - PK PLANT)

1.PROJECT OBJECTIVE

The project's objective is to eliminate the use of 1,1,1 TCA in home appliances parts manufacturing, thereby producing parts in an ODS free process.

2.SECTOR BACKGROUND

In 1992, Malaysia's consumption of ODS (excluding HCFC 22) exceeded 6000 metric tonnes, of which solvents exceeded half the consumption. On an ODP basis, the total was 5600 tonnes, with the solvents sector consuming 1200 tonnes. This is 21% of the total, and is the third largest sector on an ODP basis.

3.ENTERPRISE BACKGROUND

The Matsushita operation (MELCOM) is a 56.9% locally owned enterprise engaged in the manufacture of parts for electric irons and for rice cookers. In the 1992 fiscal year, MELCOM - PK Plant produced 2,381,016 units of home appliances parts comprised of 17 major models. In producing the home appliances parts, MELCOM - PK Plant consumed approximately 10.3 Tonnes of 1,1,1 TCA. The figure represented 0.2% of Malaysia's ODS consumption.

4.PROJECT DESCRIPTION

MELCOM - PK Plant currently uses TCA as a cleaning agent in the manufacture of its product lines. The company is committed to phase out the use of ODS. It has selected an aqueous cleaning system for those parts not adversely affected by water and a petroleum solvent based cleaning system for water sensitive parts. The aqueous based system has included in its design, a particulate removal filtration system. The processes chosen are based on cleaning tests run by Matsushita in Branson Ultrasonic equipment. These initial tests showed positive results and the ODS-free cleaning systems are being fabricated in Hong Kong. More detailed process descriptions are given under the Technology Section of this project.

5. TECHNOLOGY

5.1 PRESENT SYSTEM

Technologies currently in use are:

a) Ultrasonic 1,1,1 TCA vapour degreasing on chain conveyors system (the cleaning process of the sole plate)

b) Ultrasonic 1,1,1 TCA vapour degreasing - basket system (cleaning process of heater pipes)

5.1 PROPOSED SYSTEM

This project is divided into two components:

a) Aqueous system with ultrasonic and chain conveyors system (cleaning process of sole plate)

b) Petroleum based "cold cleaning",with ultrasonics, system (cleaning process of heater pipe)

The rationale for having two types of washing systems within one factory is based on the following facts:

a) Use of an Aqueous system for the sole plate washing process because the base material of the sole plate is Aluminum Alloy and therefore will not face any problem of "Rusting" of parts.

b) In the case of washing the heater pipe tube, tips and heating element (for heater manufacturing), the said parts are made of carbon steel and nichrome respectively. Since these materials are very prone to rust, a water based cleaning is not suitable. Hence, the choice for a petroleum based system. (If rust occurs internally in the heater tubes after manufacture, electrical shock could occur on the finished product.

c) The dual production line layout would require significant and costly changes in the plant to accommodate a single cleaning system.

Note: Test washing of the steel tube in Aqueous system resulted in excessive rusting on the surface compared to petroleum based cleaning where surface rust appearance was minimal.

The Chain conveyor System is necessary for the transfer purpose of the washed parts from one tank to another. (The present system is also installed with chain drive conveyor system). Our intention of stating 'Chain Conveyor System' on our project report is only to itemize the constituents of the project cost. Actually, the total cost is a package cost.

5.3 CAPACITY

a) Part 1

ITEM	CAPACITY	FUNCTION
i) 1,1,1 TCA vapour degreasing	4200 pcs/day 8 hours)	
ii) Ultrasonic cleaning tank system	6 tank system on chain conveyor - 6000 pcs/day (8 hours)	<u>Tanks</u> - contain alkaline solution for cleaning <u>Conveyor</u> - for parts moving from tank to tank
iii) D.I.1 Water Generator (Deionised Water)	4 gal / min	D. I. water is necessary in the final rinse tank to achieve clear finishing without water spot marks

b) Part 2

ITEM	CAPACITY
i) 1.1.1 TCA vapour degreasing	9000 pcs / day (8 hours)
ii) New System	9000 pcs / day (8 hours)

5.4 ENVIRONMENT ASSESSMENT AND FIRE SAFETY

Waste discharge will meet the requirement of the Department of Environment (Environment Quality Act of Malaysia) as the new ultrasonic equipment is equipped with a system to trap particulates before water is discharged.

Fire detection and auto-extinguisher system will be installed within the proposed cleaning system. The personnel in charge will also be trained to handle the petroleum based chemical. The chemical will be used in the cold cleaning process, and hence it will be kept at temperatures well below the chemical's flash point.

The company, therefore, has taken actions necessary to minimize adverse impact to the environment or employee safety.

6. PROJECT COSTS

The detail of the investment cost is described in Attachment B. The investment cost of the project has been determined to be US$ 276,860 (RM 703,204.90).

The detail of the incremental operating cost is described in Attachment C. The incremental operating cost and benefits for up to 4 years have been discounted to net present value at 10%, and amount to US$ 27,680 (RM 70,312.05).

The total project cost estimates amounts to US$ 304,540 (RM 773,516.84).

7. FINANCING PLAN

7.1 Total Project Cost $304,540

From Multilateral Fund $173,280

From Matsushita $131,260

The total project cost estimate amounts to US$ 304,540 (RM 773,516.84) of which US$ 173,280 (RM 440,131.07) is proposed for Multilateral Fund financing. The financing is calculated by multiplying the total project cost by the percentage of local public listed share (56.9%), which excludes ownership of Matsushita Electric Industrial Co. Ltd., Japan (43.1%)

8. PROJECT TIMEFRAME

The project began in January 1992 and it is scheduled for completion by June of 1994. Some equipment has been fabricated. It is currently in the start up and testing phase, and the system is performing according to expectations. The timeframe of the project is described in Attachment A.

9. PROJECT IMPACT

It is expected that with the successful implementation of the project, 10.3 Tonnes of ODS would be eliminated annually at MELCOM - PK Plant.

A detail of the elimination of ODS is described as per the following breakdown:

Substance	**consumption in 1992 fiscal year (Tonnes)**	**ODP**	**consumption (Tonnes x ODP)**
1,1,1 TCA	10.3	0.1	1.03

ATTACHMENT A

ATTACHMENT B

SUMMARY OF NON CFCs CLEANING SYSTEM INVESTMENT

MELCOM – PK PLANT

03-06-93

ITEM	'93	TOTAL
PART 1		
1. WATER BASED AND ULTRASONIC CLEANING SYSTEM	US$ 177,482.25 (RM 450,804.90)	US$ 177,482.25 (RM 450,804.90)
2. D.I. WATER GENERATOR	US$ 5,472.44 (RM 13,900.00)	US$ 5,472.44 (RM 13,900.00)
3. EQUIPMENT INSTALLATION & PIPING AND MECHANICAL WORKS	US$ 4,133.86 (RM 10,500.00)	US$ 4,133.86 (RM 10,500.00)
4. ELECTRICAL WORKS	US$ 1,377.96 (RM 3,500.00)	US$ 1,377.96 (RM 3,500.00)
5. PARTITION & SLIDING DOOR MODIFICATION	US$ 1,574.81 (RM 4,000.00)	US$ 1,574.81 (RM 4,000.00)
6. MISCELLANOUS	US$ 1,181.11 (RM 3,000.00)	US$ 1,181.11 (RM 3,000.00)
7. 1ST TRAINING, TESTING AND PROJECT DISCUSSION AT HONG KONG	US$ 2,952.76 (RM 7,500.00)	US$ 2,952.76 (RM 7,500.00)
8. 2ND TESTING AND TRAINING ON USAGE AT HONG KONG	US$ 3,937.01 (RM 10,000.00)	US$ 3,937.01 (RM 10,000.00)
SUBTOTAL		US$ 198,112.20 (RM 503,204.90)
PART 2		
1. EQUIPMENT – BASIC TANK WITH ULTRASONIC	US$ 62,992.13 (RM 160,000.00)	US$ 62,992.13 (RM 160,000.00)
2. TRANSFER SYSTEM	US$ 11,811.03 (RM 30,000.00)	US$ 11,811.03 (RM 30,000.00)
3. INSTALLATION	US$ 1,968.51 (RM 5,000.00)	US$ 1,968.51 (RM 5,000.00)
4. TESTING & TRAINING EXPENSES	US$ 1,968.51 (RM 5,000.00)	US$ 1,968.51 (RM 5,000.00)
SUBTOTAL		US$ 78,740.18 (RM 200,000.00)
GRAND TOTAL		US$ 276,852.38 (RM 703,204.90)

Note :

Exchange rate : US$ 1.00 = RM 2.54

PROJECT3\PKCOST2

ATTACHMENT C

ODS PHASE-OUT PROJECTS = OPERATING COST

PART 1 - ANNUAL OPERATING COST (PROJECT 3 - PORT KLANG PLANT)

No.	ITEMS	PRESENT SYSTEM	REMARKS	PROPOSED NON-CFC SYSTEM	REMARKS
1.	SOLVENT/CHEMICAL COST	US$ 10,346.48 (RM 26,280.00)	TCE 111 9.7 ton/year, 7.3 ton / year Cost factor US$ 1.42 (RM3.60) / kg	US$ 16,766.93 (RM 42,586.00)	BC Chem : 2970 lit @ US$ 3.93 (RM9.97)/lit Triton X-100 : 1474 lit @ US$ 3.46 (RM8.80)/lit
2.	LABOUR COST	US$ 8,503.94 (RM 8,503.94)	2M/P @ US$354.33 (RM900.00)/month	US$ 8,503.94 (RM 21,600.00)	2m/p @ US$354.33 (RM900.00)/month
3.	ENERGY COST	US$ 13,429.13 (RM 34,110.00)	70.5 kW @ 8 hrs/day x US 8 cent(RM 0.21)/kWh	US$ 10,096.67 (RM 25,643.00)	53.0 kW @ 8 hrs / day x US 8 cent(RM 0.21)/kWh
4.	WATER CONSUMPTION	NIL	Closed circuit chiller circulation system (very negligible)	US$ 503.54 (RM 1,279.00)	3.7 m^3 / day @ US$ 0.47 (RM1.20) /m^3
5.	MAINTENANCE COST	US$ 7,508.66 (RM 19,072.00)	•Drive chain - US$ 4,330.00 (RM 11,000.00) •Sproket shaft - US$ 566.93 (RM 1,440.00) •Bearing - US$ 170.08 (RM 432.00) •5 kW heaters - US$ 1,181.10 (RM 3,000.00) • Maintenance labour cost - US$ 1,259.84 (RM 3,200.00)	US$ 9,243.31 (RM 23,478.00)	•Translator - US$ 1,023.62 (RM 2,600.00) •Strainer/ gasket etc - US$ 542.52 (RM 1,378.00) •3 kW heaters - 3 pcs - US$ 1,688.98 (RM 4290.00) •15 kW heaters - US$ 1,996.06 (RM 5070.00) •pump 1 - US$ 511.81 (RM 1,300.00) •pump 2 - US$ 409.45 (RM 1040.00)
		US$ 39,788.19 (RM 101,062.00)		US$ 45,113.39 (RM 114,588.00)	

project3\opcost

Incremental of operating cost : US$ 5,325.20 (RM 13,526.01)

Note :

Exchange rate : US$ 1.00 = RM 2.54

(12)

ODS PHASE–OUT PROJECTS = OPERATING COST

PART 2 – ANNUAL OPERATING COST (PROJECT 3 – PORT KLANG PLANT)

No.	ITEMS	PRESENT SYSTEM	REMARKS	PROPOSED NON–CFC SYSTEM	REMARKS
1.	SOLVENT/CHEMICAL COST	US$ 4,251.97 (RM 10,800.00)	3000 kg @ US$ 1.42 (RM 3.60) / kg	US$ 4,653.54 (RM 11,820.00)	3000 kg @ US$ 1.55 (RM 3.94)/ kg
2.	LABOUR COST	US$ 4,251.97 (RM 10,800.00)	1M/P @ US$354.33 (RM 900.00) /month	US$ 4,251.97 (RM 10,800.00)	1m/p @ US$354.33 (RM 900)/month
3.	ENERGY COST	US$ 571.26 (RM 1,451.00)	3.0 kW @ 8 hrs/day	US$ 1,523.62 (RM 3,870.00)	8.0 kW @ 8 hrs / day
4.	WATER CONSUMPTION	NIL		NIL	
5.	MAINTENANCE COST	US$ 787.40 (RM 2,000.00)	* Appropriation per year	US$ 2,047.24 (RM 5,200.00)	• Conveyor chain system – US$ 590.55 (RM 1,500.00) • Filter Cartridges – US$ 590.55 (RM 1,500.00) • Heaters – US$ 629.92 (RM 1,600.00) • Fan motor – US$ 236.22 (RM 600.00)
		US$ 9,862.60 (RM 25,051.00)		US$ 12,476.34 (RM 31,690.00)	

project3\locost2

Incremental of operating cost (Part 2) : US$ 2,613.74 (RM 6,638.90)

Total Incremental Cost (Part 1 + Part 2) : US$ 27,681.91 (RM 70,312.05)
(up to 4 years with NPV 10%)

Note :
Exchange rate : US$ 1.00 = RM 2.54

(13)

PROJECT 3 (PORT KLANG PLANT)
INCREMENTAL COST

1. Incremental of operating cost (Part 1)	US $ 5,325.20 (RM 13,526.01)
1. Incremental of operating cost (Part 2)	US $ 2,613.74 (RM 6,638.90)
1. Incremental of operating cost for project 3	US $ 7,938.94 (RM 20,164.91)

Benefit during up to 4 years with the net present value (NPV) discounted at 10 %.

Year	Calculation (US $)
1.	7,938.94 (RM 20,164.91)
2.	7,217.22 (RM 18,331.74)
3.	6,561.11 (RM 16,665.22)
4.	5,964.64 (RM 15,150.19)
Total (4 years)	US $ 27,681.91 (RM 70,312.05)

PROJECT OUTLINE

COUNTRY	:	PANAMA
SECTORS COVERED	:	All sectors
NATIONAL ODS CONSUMPTION	:	233 tonnes ODP in 1991
PROJECT TITLE	:	Project preparation assistance
DURATION	:	Six Months
PROJECT IMPACT	:	Preparation of projects in the aerosols, refrigeration/AC, MAC, foams, and halons sectors.
PROPOSED BUDGET	:	US$ 30,000
IMPLEMENTING AGENCY	:	UNDP
NATIONAL COORDINATING AGENCY	:	Governmental Ozone Commission (COGO), Department of Environmental Health, Ministry of Health

PROJECT DESCRIPTION

Panama's ODP consumption in 1991 was 233 tonnes comprising refrigeration at 135 tonnes (58%), airconditioning at 56 tonnes (24%), foams at 32 tonnes (13.7%), halons at 6 tonnes (2.6%) and aerosols at 4 tonnes (1.7%).

Panama's Country Programme (CP) for the reduction of ODS was prepared with the assistance of UNEP, and was approved at the 10th Executive Committee Meeting held in Montreal in June 1993. The CP proposed to reduce ODS by 34% over the next three years. In the absence of this programme, ODS use would grow 4% per annum and would reach 492 ODP tonnes by year 2010.

UNDP has been designated as implementing agency for industrial sector projects identified in the CP. Accordingly, this request would cover project preparation assistance for the following projects and technical assistance activities:

a) Propellant conversion (aerosols)
b) CFC recovery during maintenance (domestic refrigeration)
c) Conversion of mobile airconditioning to non-CFC use
d) Reduction of CFC use in foams
e) Creation of a halons bank.

The US$ 30,000 preparatory assistance funds will be utilized over a six-month period to recruit international/regional/national consultants to work with national staff in preparation of the above project proposals. The completed project proposals will form part of UNDP's 1994 work programme that will be submitted for Executive Committee approval at its 12th and 13th Meetings.

PROJECT OUTLINE

COUNTRY	:	PHILIPPINES
SECTORS COVERED	:	All sectors
NATIONAL ODS CONSUMPTION	:	2,651 ODP tonnes in 1991
PROJECT TITLE	:	Project preparation assistance
DURATION	:	9 Months
PROJECT IMPACT	:	Preparation of technical assistance, demonstration and investment projects in the foams, halons, refrigeration, solvents and small-scale usage sectors.
PROPOSED BUDGET	:	US$ 50,000
IMPLEMENTING AGENCY	:	UNDP
NATIONAL COORDINATING AGENCY	:	Department of Environment and Natural Resources (DENR)

PROJECT DESCRIPTION

The Philippines Country Programme (CP) for the Phaseout of Ozone Depleting Substances (ODS) under the Montreal Protocol was prepared by the Government with UNDP as lead agency and the World Bank as associated agency. The CP was presented and approved at the 10th Executive Committee Meeting held in Montreal in June/July 1993.

The ODS consuming sectors are refrigeration/AC/MAC (45%), electronics and metal cleaning (21%), foams (16%), tobacco expansion (13%), halons (4%) and aerosols (1%). Several projects were approved at the 9th Executive Committee Meeting for World Bank implementation that would phaseout an estimated 743 ODP tonnes.

The Government's strategy is the early phaseout of all ODS in the country. CFC-113, carbon tetrachloride and methyl chloroform used in the electronics industry are to be phased out by 1996. All other ODS will be phased out by 1998 with the exception being continued use of CFC-11 and CFC-12 in the refrigeration servicing industry to avoid the high costs of early equipment retirements and retrofits.

The requested funds will be utilized over the period November 1993 through August 1994 to recruit international and national consultants to prepare demonstration and investment projects in the foams, halons, refrigeration, solvents & small-scale usage sectors. These project proposals will be submitted to the Executive Committee for approval at its 12th and future Meetings.

PROJECT COVER SHEET

COUNTRY:	Thailand
PROJECT TITLE:	THERMAFLEX INSULATION ASIA CO.,LTD. Elimination of CFC-114 in the manufacture of extruded polyethylene foam sheet and profiles
SECTOR COVERED:	Foamed Plastics
ODS USE IN SECTOR:	1510 t CFCs in 1991
PROJECT IMPACT:	30t CFC-114 per year (1992)
PROJECT DURATION:	10 years
TOTAL PROJECT COST:	USD 530,000 Incremental Capital Cost USD 572,000 Incremental Recurrent Cost
PROPOSED MLF GRANT:	USD 220,000 (reflecting the local ownership's share)
COST EFFECTIVENESS:	USD 4.16/kg/y (unit abatement cost)
NATIONAL COORDINATING BODY:	Ministry of Industry, Department of Industrial Works (DIW)
IMPLEMENTING AGENCY:	UNDP

PROJECT SUMMARY

Thermaflex Insulation Asia Co., Ltd. is one of Thailand's three manufacturers of extruded polyethylene foam sheet and profiles for insulation purposes. The company is 20% Thai owned. CFC-114 is currently used in the production process as a blowing agent. Under this project, Thermaflex will eliminate the use of CFCs in this process through replacement by isobutane, resulting in an annual reduction of 30 tons ODS, based on 1992 consumption. The use of this substance is based on in-house development. The project contains safety features to address the hazards generated by the use of a flammable substance. Isobutane is not locally available and has to be imported. The company expects an increase in operating costs, mainly related to an increase in insulation thickness that is required to maintain the insulation value . Thermaflex' mother company has been informed of the limited eligibility of this project and has agreed to provide the additional funds needed to implement this project.

PROJECT OF THE GOVERNMENT OF THAILAND

THERMAFLEX INSULATION ASIA CO., LTD. ELIMINATION OF CFCs IN THE MANUFACTURE OF EXTRUDED POLYETHYLENE FOAM SHEET AND PROFILES

1. PROJECT OBJECTIVE

The objective of this project is to phase out the use of CFCs in the manufacture of extruded polyethylene foam sheet and profiles at Thermaflex Insulation Asia Co., Ltd.("Thermaflex").

2. SECTOR BACKGROUND

The Government of Thailand is currently finalizing preparations for the submittal of a National Phaseout Programme to the Executive Committee of the Multilateral Fund of the Montreal Protocol. Preliminary information estimates the use of ODS in the Foams Sector on 1,510 tons.

The flexible foam sub-sector has already substantially phased out the use of CFCs through replacement by methylene chloride.

In other sub-categories CFC is as before the blowing agent of choice and replacement efforts were so far restricted to investigations and trials.

3. ENTERPRISE BACKGROUND

Thermaflex Isolatie B.V. commenced in 1976 with the production of polyethylene tube insulation, initially thermo-formed from sheet strips. Te production was in 1985 coverted to direct extrusion. The company offers in also a wide range of related products and electrical heating cables. The manufacturing facility in Thailand was acquired in 1989. This subsidiary serves mainly the airconditioning and cooling market in S.E. Asia. Thermal conductivity and vapor resistance are the crucial properties of the product.

4. PROJECT DESCRIPTION

Thermaflex Thailand utilized in 1992 about 30 t CFC-114 in the manufacture of EPE foam sheet and profiles. Current annual growth rate is a around 20%. The company is committed to phaseout the use of CFCs, and has identified isobutane as the replacement of choice. Isobutane technology is available through its mother company, Thermaflex Isolatie B.V., Waalwijk, Netherlands, who also will source the necessary equipment.

In general, it is possible to adapt existing equipment for this purpose. In addition to equipment changes, safety related modifications in the production environment have to be implemented, to mitigate fire and exposure hazards from the use of butane. Finally, extensive production and safety training is needed to guarantee a smooth and safe operation and to conform to the fire safety standards in Thailand.

The project will result in higher material costs related to thicker insulation requirements and the price of (imported) isobutane. The company has already begun with the project and expects completion before the end of the year.

5. TECHNOLOGY

5.1 SELECTION

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

- o Atmospheric gases (nitrogen, carbon dioxide),
- o Hydrocarbons (LPG, butanes, pentanes),
- o "Berstorff" technology (nitrogen and alcohol),
- o HCFCs (-22, -142b),
- o HFCs (-134a, -152a).

Isobutane, a hydrocarbon, was selected by the company after extensive and expensive evaluation of several alternatives. It is an alternative that is:

- o Proven technology in process and product performance,
- o Environmentally acceptable,
- o Low in toxicity,
- o Adaptable to the existing equipment,
- o Cost effective.

Annex-A, prepared by the company summarizes the advantages and disadvantages that the company found in isobutane during its evaluation process.

Isobutane is not locally available, and the company will have to arrange for imports.

One draw back of isobutane is the high flammability, requiring stringent safety precautions. Users of hydrocarbons are subject to stringent fire regulations. The emission of isobutane is currently not regulated in Thailand, nor are restrictions expected in the foreseeable future.

5.2 PRODUCTION PROCESS

The use of isobutane will require substantial changes in the production process and storage facilities. Required equipment modifications and additions may include:

- Storage
  - Separate, explosion proof storage tank for isobutane.
    Separate storage and packing/degassing space.

- Feeding systems
  - More injection systems for additives,
  - Replacement of the foamant metering pump and injection system,
  - New gaskets and seals.
  - New pressure gauges
  - transport belt to packing/degassing area.

- Extrusion system
  - 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 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 Total Project Costs

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

	DESCRIPTION	TOTAL(USD)
1	Dosing unit	4,870
1	Cutting device	47,950
1	Switch board	34,360
2	Gas pumps and motors	15,400
1	Gas detector system	9,000
7	Ventilators	14,870
1	Transport belt	6,150
1	Inkjet printer	21,540
1	Tank and equipment	36,000
1	Freight, installation	26,150
1	Technology transfer	180,070
	Material for test runs	25,640
1	Packing/de-gassing space	48,000
1	Set of dies	11,000
	Contingency & rounding	49,000
	Total incremental capital costs	**530,000**

The cost of equipment and services is based on an identical implementation in the Dutch Thermaflex plant--in the mean time successfully completed. It is the intention to purchase all equipment except the tank in Holland and have the project supervised by engineers from the mother company.

The mother company invested USD 462,000 in developing the process for this technology. Based on the relative use of CFCs in the two plants, USD 154,000 is charged in this project to the Thai plant. The entire technology transfer can be broken down as follows:

Process development (about 30% of total)	USD 154,000
Training, supervision	12,800
Travel, lodging	8,170
Miscellaneous	5,100
Total Technology transfer Cost	**USD 180,070**

Most costs are developed in Dutch Guilders (1 USD = 1.85 HFL). Some are in Baht (25 Baht = 1 USD).

6.2 OPERATING COSTS

Isobutane is not locally available in Thailand and has to be imported by the company. The company states the cost as approximately 100% more than CFC-114 (130 Baht/kg), due to extremely high transportation costs. However, due to the lower density of isobutane, only about 50% is needed, eliminating any direct effect from the change in blowing agent. However, other related changes in recipe, such as anti static agent, cause a 4% increase in material costs. In addition, to compensate for the reduction in thermal conductivity, an increase in raw material of about 15% is required.

Also, production costs will increase based on more start-up time (0.75 h/run; USD 180/machine hour). This leads to the following incremental operating costs (000 USD):

	1994	1995	1996	1997	Total
Material Costs	81	96	116	139	432
Other Production Costs	45	53	64	77	293
Total costs	126	149	180	216	725
Discount factor	1.0	0.909	0.826	0.751	
Net Present Value	126	135	149	162	572

The NPV of the incremental recurrent costs is so with

USD 572,000

6.3 UNIT ABATEMENT COST

a)	ODS Reduction Project Costs	USD	530,000
b)	Annual Incremental Costs	USD	126,000
c)	Project Useful Life	10	years
d)	ODS reduction/y	kg	43,000
	Unit Abatement Costs [(a/c + b)/d]	**USD/kg/y**	**4.16**

7. FINANCING PLAN

The company requests the reimbursement of 20% of the complete project costs, amounting to

USD 220,000

This corresponds with the Thai share of ownership. Thermaflex-Netherlands has agreed to provide the remaining funds if company liquidity would not suffice (annex-B). The mother-company's financial disclosure shows its ability to do so (annex-C).

8. PROJECT IMPLEMENTATION

8.1 MANAGEMENT

The project is already started and will be substantially finalized before review at the EC. It will be therefore subject to retroactive reimbursement. UNDP will audit the implementation of this project and provide technical assistance.

8.2 SCHEDULE

The project started already in mid-1993 with the installation of storage tank and the packing/degasing room.
Additional equipment will be shipped from Holland late September.
Installation is foreseen in November.
Machine training and safety training will start during installation and be completed before the end of 1993.

9. PROJECT IMPACT

This project will eliminate the use of at least 43 tons of CFCs in the first year of implementation (1994). Market and company growth indicates that this may increase by 20% annually in subsequent years. The project employs commercially and environmentally acceptable technology.

10. ANNEXES

Annex-A: "Why Isobutane"
Annex-B: Confirmation of financial commitment
Annex-C: Financial disclosure on Thermaflex Isolatie BV

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10-05-93/03

THE RESOURCE POOL

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THERMOFLEX INSULATION ASIA CO. LTD

SCOPE

The project is concerned with the replacement of CFC 114 in the manufacture of extruded polyethylene sheets, pipes and tubes.

RECOMMENDATION

The project is support.

RELEVANCY AND ADEQUACY OF INFORMATION

The information provided is acceptable. Cost information originates from the Dutch mother company. This is considered to be acceptable as this company is purchasing and installing the equipment.

TECHNICAL SOUNDNESS

The replacement by isobutane is a technology that is developed by Thermoflex itself. It is a technical sound solution provided that adequate safety precautions are taken.

COMPARISON WITH OTHER PROJECTS

The only comparable project is Mic-cell in Thailand. The Thermoflex technology is more economic, however not applicable to Mix-cell as the technology is proprietary and will not likely be shared with a direct competitor in the market.

Another project that is more or less comparable is Advechen in Egypt, although based on polystyrene instead of polyethylene. Comparison with Advechen did not provide any suggestions for improvement.

ENVIRONMENTAL ISSUES

Zero ODP option chosen. Isobutane is photochemically active and therefore a source for low level ozone (smog). However, the very slow dissemination of the gas will avoid any significant environmental impact from this application.

SAFETY ISSUES

From the project document it appears clear that safety is a key issue in the implementation. All safety related issues are adequately addressed. The implementing agency should monitor isobutane concentrations during the project commission and assure that future monitoring will be done.

COST EFFECTIVENESS

The unit abatement costs are favorably compared to the only other comparable project (Mix-Cell).

OTHERS

The company is requesting only 20% of the project costs, based on the Thai share in the corporation. A letter providing financial commitment from the 80% partner is part of the project.

J. A. Pool