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

Thirteenth Meeting
Montreal, 25-27 July 1994

1994 UNDP WORK PROGRAMME AMENDMENTS

This document includes:

- Comments and Recommendations from the Fund Secretariat
- 1994 Work Programme Amendments

COMMENTS AND RECOMMENDATIONS FROM THE FUND SECRETARIAT

1. UNDP is requesting approval of the Executive Committee for US $7,196,292 for 27 amendments to its 1994 Work Programme, including 22 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 $4,719,500 for project costs and US $613,535 for implementing agency's support costs.

Table 1: 1994 UNDP Work Programme Amendments
Activities/Projects and Corresponding Funding Levels

Country	No.	Activity/Project	Amount Requested (US $)	Amount Recommended (US $)
Argentina	1.	Technical assistance to prepare a National Halons Programme	50,000	50,000
China	2.	Elimination of CFC-12 in the manufacture of EPE foam sheet at Danshui Huaya Plastics Industries Co. Ltd.	241,000	241,000
	3.	Elimination of the use of CFC-113 in the electron gun final cleaning processes at the Tianjin Picture Tube Factory	184,000	0[1]
	4.	Elimination of the use of TCA at the Baoshi Electronics Corporation Shjiazhuang Manufacturing Operations	479,000	0[1]
Cuba	5.	Demonstration of alternatives to CFCs and pilot phase of a CFC recovery/recycling programme in the domestic and commercial refrigeration sector	230,000	30,000
	6.	Demonstration of Fire Extinguishing Methods using Alternative Agents	46,900	0[1]
India	7.	Phaseout of CFCs in the manufacture of phenolic foam and foam products at Bakelite Hylam Limited	367,000	367,000
	8.	Phaseout of CFC use in the manufacture of polyurethane foams at U-Foam Private Ltd.	408,500	328,500

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1 Recommend deferral

Country	No.	Activity/Project	Amount Requested (US $)	Amount Recommended (US $)
	9.	Strategy and Action Programme for the elimination of CFCs in the manufacture of foams	270,000	200,000
	10.	Demonstration and evaluation of alternative technology for Halon Fire Protection System and technical assistance for sectoral strategy for ODS phase-out	405,000	299,000
Malaysia	11.	Elimination of CFC-11 in the manufacture of rigid polyurethane foam panels for cold storage at Wong Brothers Electrical and Refrigeration Sdn. Bhd.	299,000	299,000
	12.	Elimination of CFC-11 in the manufacture of commercial refrigerators at Pangkat Refrigeration Industries Sdn. Bhd.	210,000	210,000
	13.	Elimination of CFC-11 in the manufacture of polyurethane foams for pipe insulation at Allied Foam Insulation	276,000	276,000
	14.	Elimination of CFC-11 in the manufacture of cold cure molded flexible polyurethane foams at Eversoft Foam Industries Sdn Bhd.	185,000	185,000
	15.	Elimination of CFC-11 in the manufacture of cold cure molded flexible polyurethane foams at Nian Aik Foams Sdn. Bhd.	245,000	245,000
	16.	Elimination of CFC-11 in the manufacture of flexible polyurethane foam at Phoenix Base	165,000	165,000
	17.	Elimination of CFCs in the manufacture of commercial refrigeration products at Lian Pang	242,000	155,000[2]
	18.	Elimination of CFCs in commercial refrigeration products at United	415,000	280,000[2]
Panama	19.	Elimination of CFC-11 in the manufacture of flexible and rigid polyurethane foams in Plastifoam S.A., Profomsa and Thermofoam S.A.	155,000	155,000
Peru	20.	Project preparation assistance	100,000	100,000
Philippines	21.	Phaseout of CFCs in the manufacture of flexible PUF (slabstock) at Foamcraft	185,000	185,000

[2] Funding for incremental operational costs deferred pending Executive Committee's decision on commercial refrigeration sector

Country	No.	Activity/Project	Amount Requested (US $)	Amount Recommended (US $)
	22.	Phaseout of the use of CFCs in the manufacture of polyurethane insulated building elements at Metal Forming Corporation	305,000	305,000
	23.	Elimination of the residual use of CFCs in the manufacture of extruded polystyrene foam sheets at Styrotech Corporation	60,000	60,000
Thailand	24.	Elimination of the use of CFCs in the manufacture of extruded polystyrene foam sheet at Ponsri	340,000	340,000
Uruguay	25.	Conversion to CFC-free technology in the manufacture of flexible polyurethane foam	200,000	200,000
	26.	Project preparation assistance	30,000	30,000
	27.	Technical assistance for the implementation of the National Programme for the Management and Banking of Halon 1211	272,000	14,000
		PROJECT TOTAL	6,365,400	4,719,500
		PROJECT SUPPORT COSTS (13%)	827,502	613,535
		TOTAL	7,192,902	5,333,035

General Comment

3. Although the projects being submitted as amendments were within the category of projects below US $500,000, substantial information was provided to facilitate their review. Where necessary, the Secretariat had consultations with UNDP, or on the advice of UNDP, with the 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.

The following projects are presented on a sector-by-sector basis, however, project numbers in Table 1 are retained:

Project N° 15: **Malaysia: Elimination of CFC-11 in the manufacture of cold-cure molded flexible polyurethane foams at Nian Aik Foam Sdn., Bhd (US $245,000). Cost effectiveness: US $8.17/kg.**

Project N° 14: **Malaysia: Elimination of CFC-11 in the manufacture of cold cure molded flexible polyurethane foams at Eversoft Industries Sdn, Bhd (US $185,000). Cost effectiveness: US $6.19/kg.**

1. These two companies are producing flexible polyurethane foam for mattresses and cushions. These projects will eliminate 30 tons each of CFC-11 through conversion to a water-blown process using additional MDI (methylene biphenyl diisocyanate) in order to chemically generate the blowing agent.

2. High pressure machines will be purchased in order to treat high-viscosity materials.

3. Incremental operational costs are balanced. By not using CFC-11, savings are offset by the additional use of MDI.

4. It is therefore recommended to approve funding of US $245,000 for Nian Aik and US $185,000 for Eversoft.

Project N° 21: **Philippines: Phase-out of CFCs in the manufacture of flexible PUF (slabstock) at Foamcraft (US $185,000). Cost effectiveness: US $2.06/kg.**

Project N° 16: **Malaysia: Elimination of CFC-11 in the manufacture of flexible polyurethane foam at Phoenix Base (US $165,000). Cost effectiveness: US $2.70/kg.**

Project N° 25: **Uruguay: Conversion to CFC-free technology in the manufacture of flexible polyurethane foam (US $200,000). Cost effectiveness: US $11.5/kg.**

1. These three projects will phaseout 90 tons of CFC-11 at Foamcraft (Philippines), 61 tons at Phoenix (Malaysia) and 17.4 tons at five companies in Uruguay (covering all of Uruguay) through conversion to MC (methylene chloride).

2. Capital costs are related to MC metering systems and ventilation systems. Operational savings due to the use of the cheaply priced blowing agent MC, instead of CFC-11, will be offset by the high rate of scrappage during the first two years.

3. The cost-effectiveness for the Uruguay project is poor when compared to other projects.

4. It is recommended to approve funding of US $185,000 for Foamcraft, US $165,000 for Phoenix and US $200,000 for the Uruguay project.

Project N° 19: Panama: Elimination of CFC-11 in the manufacture of flexible and rigid polyurethane foams in Plastifoam S.A., Profomsa and Thermofoam S.A. (US $155,000). Cost effectiveness: US $5.96/kg.

1. The project consists of three companies covering all foam sectors (excluding insulation foam for refrigerators) in Panama.

2. This project will phaseout 26 tons of CFC-11 consumption in the manufacture of flexible polyurethane foam through conversion to MC technology, and rigid polyurethane spray foam through conversion to HCFC-141b technology.

3. The capital costs relate to a ventilation system for MC and rigid foam spraying machine. Operational savings are offset by high scrappage rate during the first two years and high price of HCFC-141b.

4. It is recommended to approve funding of US $155,000 for this project.

Project N° 11: Malaysia: Elimination of CFC-11 in the manufacture of rigid polyurethane foam panels for cold storage at Wong Brothers Electrical and Refrigeration Sdn., Bhd (US $299,000). Cost effectiveness: US $8.54/kg.

Project N° 12: Malaysia: Elimination of CFC-11 in the Manufacture of Commercial Refrigerators at Pangkat Refrigeration Industries Sdn. Bhd (US $210,000). Cost effectiveness: US $10.5/kg.

Project N° 13: Malaysia: Elimination of CFC-11 in the manufacture of polyurethane foams for pipe insulation at Allied Foam Insulation (US $276,000). Cost effectiveness: US $11.0/kg.

Project N° 22: Philippines: Phase-out of the use of CFCs in the manufacture of polyurethane insulated building elements at Metal Forming Corporation (US $305,000). Cost effectiveness: US $6.1/kg.

1. These four companies are manufacturing insulation panels and spray foams. The projects will eliminate 35 tons of CFC-11 at Wong Brothers, 20 tons at Pangkat, 25 tons at Allied Foam and 50 tons at Metal Forming through converting to partially water/HCFC-141b technology.

2. Capital costs are related to high pressure foaming machines and spray foaming machines. Incremental operating costs are borne by the high price of HCFC-141b and additional use of MDI.

3. Cost effectiveness of the Allied project is poor when compared to other projects.

4. It is recommended to approve funding of US $299,000 for Wong Brothers, US $210,000 for Pangkat, US $276,000 for Allied Foam and US $305,000 for Metal Forming.

Project N° 8: India: Phase-out of CFC use in the manufacture of polyurethane foams at U-Foam Private Ltd. (US $408,500). Cost effectiveness: US $11.67/kg.

1. Under this project, U-Foam will phase-out the use of 35 tons of CFC-11 in the production of flexible polyurethane foam through the use of methylene chloride and rigid polyurethane foam by using partially water and HCFC-22 technology.

2. The project will require upgrading of existing ventilation systems, due to the use of methylene chloride and the replacement of a low pressure foaming unit by a high pressure foaming unit. The use of HCFC-22 constitutes an interim solution and the company intends to replace this by HFCs as soon as such technology is economically viable.

3. Higher production costs for rigid PUF are partially offset by savings through the use of methylene chloride in the slabstock process.

4. Regarding the production of rigid polyurethane foams, the company is purchasing a ready formulated mixture now and incremental operational costs are calculated as the differences of costs between new system (HCFC-22) and old system (CFC-12). Therefore, the Secretariat cannot support premixing station (to prepare mixture of polyol and blowing agent) as incremental costs.

5. It is recommended to approve US $328,500 for the project.

Project N° 7: India: Phase-out of CFCs in the manufacture of phenolic foam and foam products at Bakelite Hylam Limited (US $367,000). Cost effectiveness: US $6.3/kg.

1. The company is producing rigid phenolic foam for the insulation of buildings, cold storage, false ceilings, by using 58 tons of CFC-11 and CFC-113 blend as blowing agents.

2. Under the project, the company will eliminate CFCs through normal pentane technology.

3. Because of pentane's flammable nature and less solubility, capital costs are related to adequate safety measures and mixing and metering system to incorporate high-viscosity materials. Operational savings generated by using less expensive normal pentane use are offset by increased use of materials to keep same thermal insulation function.

4. It is recommended to approve US $367,000 for the project.

Project N° 24: **Thailand: Elimination of the use of CFCs in the manufacture of extruded polystyrene foam sheet at Ponsri (US $340,000). Cost effectiveness: US $2.72/kg.**

Project N° 2: **China: Elimination of CFC-12 in the manufacture of EPE foam sheet at Danshui Huaya Plastic Industries Company (US $241,000). Cost effectiveness: US $3.01/kg.**

Project N° 23: **Philippines: Elimination of the residual use of CFCs in the manufacture of extruded polystyrene foam sheets at Styrotech Corporation (US $60,000).**

1. The objective of these three projects is to phaseout the use of CFC-12 in the manufacture of extruded polystyrene foam sheet through conversion to butane technology. Ponsri will eliminate 100 tons of CFC-12; Danshui Huaya, 160 tons; Styrotech 25 tons.

2. Danshui Huaya plans to relocate its plant outside of Shanghai, but direct relocation costs are not requested. The company is 50 per cent owned by a Singapore company, therefore the grant is adjusted for 50 per cent local ownership. Styrotech has already eliminated 25 tons of CFC-12; therefore, this company has only requested the costs of safety equipment.

3. Capital costs relate to butane tank, modifications of extruder and safety equipment and training. Operational savings are generated by using less price of butane as compared to CFC-12.

4. It is recommended to approve funding of US $340,000 for Ponsri, US $241,000 for Danshui and US $60,000 for Styrotech.

Project N° 18: **Malaysia: Elimination of CFCs in commercial refrigeration products at United (US $415,000). Cost effectiveness: US $5.8/kg.**

Project N° 17: **Malaysia: Elimination of CFCs in commercial refrigeration products at Lian Pang. (US $242,000). Cost effectiveness: US $24.2/kg.**

1. United and Lian Pang are manufacturing commercial refrigerator equipment. In addition to these, United manufactures ice boxes.

2. Under these projects, United will eliminate 71 tons of CFCs (67 tons of CFC-11, 4 tons of CFC-12) and Lian Pang will eliminate 12.5 tons of CFCs (10 tons of CFC-11, 2.5 tons of CFC-12) by using water/HCFC-141b (foam) and HFC-134a (refrigerant) technologies.

3. Capital costs consist of high pressure foaming machines and charging and vacuum system.

4. Operational costs relating to foams are borne by the use of additional MDI and higher price of HCFC-141b compared to CFC-11. Operational costs relating to refrigeration system are borne by the higher cost of compressors, dryer capillaries (incremental cost US $3.0/unit) and higher price of HFC-134a. Two years' duration are used for the basis of incremental operational cost calculations.

5. The high cost-effectiveness of United is due to the elimination of a relatively large volume of CFC-11, at low costs.

6. Regarding period of operational cost calculation, the policy papers on the domestic refrigeration sector "Impact on the Fund of Various Operational Costs Duration," is being submitted for the consideration of the Executive Committee. It may be recalled that at the 12th Meeting of the Executive Committee, Egypt submitted the project: "Conversion of CFC-free technology in the Commercial Refrigeration Sector," but incremental operational costs were not requested.

7. It is therefore recommended to approve funding of US $280,000 for United and US $155,000 for Lian Pang. Funding for the incremental operational costs (US $135,000 and US $87,000) should be deferred until the Executive Committee's decision on the commercial refrigeration sector, or until such a time when incremental operational costs are incurred.

Project N° 9: India: Strategy and action programme for the elimination of CFCs in the manufacture of foams (US $270,000).

1. This project consists of an industry survey, preparation of ODS phaseout strategy of foam sector and three training and information workshop to identify and prepare investment projects.

2. Regarding the activities:

(a) The Executive Committee has already approved: 5 foam sector projects (total costs US $2,344,564) and 10 projects covering several sectors (total costs US $ 2,351,437) including Institutional Strengthening, Country Programme preparation, Project preparation and Survey of ODS use in the small scale sectors, etc.

(b) Similar activities for China were approved at the 10th Meeting of the Executive Committee: Strategy and Action Programme for the Elimination of CFCs in the Manufacture of Foams (US $200,000).

3. Based on the above, the amount recommended for this project is US $200,000 out of the US $270,000 requested.

4. The Secretariat further recommends that:

(a) A strategy should provide a finite time-frame for the phase-out in the sector;

(b) It should identify major foam producers, their link with local CFC (and alternative blowing agent) producers and polyol producers;

(c) It should provide the ODS phase out action plan for small-scale CFC users;

(d) Training and information workshops should be followed by project identification activities; and

(e) UNDP should provide a special report about the progress of this project.

Project N° 5: Cuba: Demonstration of alternatives to CFCs and pilot phase of a CFC recovery/recycling programme in the domestic and commercial refrigeration sector (US $230,000).

1. The purpose of the project is to expose refrigeration service technicians to CFC-free technologies through:

(a) A national workshop to provide information on alternative technologies (e.g., hydrocarbon, ammonia, HFC-134a and HFC-152a), good maintenance practices, and introduction of recovery/recycling programmes (US $40,000);

(b) Three demonstration activities including replacement of CFC refrigeration equipment with CFC-free equipment (HFC-134a cold storage room, HFC-134a air conditioning unit and a commercial refrigeration system using ammonia technology) to be used for demonstration purposes (US $78,000); and

(c) A CFC recovery and recycling programme which comprises procurement of recovery/recharge machines, two training workshops and three international missions (US $112,000).

2. These activities were included in the country programme.

3. In 1991, 311 tonnes of CFC (94 per cent of the total ODS consumption) were used for servicing refrigeration equipment. Currently, the production of domestic refrigerators is paralysed due to financial constraints and lack of supplies.

4. A phase out strategy in the sector has not been developed. The proposed activities focus on providing information for possible future replacements of existing CFC equipment, with minimum impact on the reduction in CFC consumption. A training programme for refrigerator service technicians, which would lead to a significant reduction in venting CFC to the atmosphere, has not been included.

5. The recovery and recycling programme has been targeted for domestic refrigerators where the amount of CFC to be recovered is negligible.

6. The Fund Secretariat recommends approval of funding level of US $30,000 to UNDP to assist the Government of Cuba to develop a phase out strategy in the refrigeration sector.

Project N° 10: India: Demonstration and evaluation of alternative technology for Halon Fire Protection Systems and technical assistance for sectoral strategy for ODS phase-out (US $405,000).

1. The proposal seeks to procure for testing and demonstration purposes the following alternative fire fighting systems:

(a) Fast response sprinkler;
(b) Water mist/fog;
(c) Inert gas;
(d) Dry chemical powder;
(e) Carbon dioxide; and
(f) Fine powder aerosols.

2. The proposal calls for technical assistance for the preparation of a sectoral strategy for the phase-out of the use of halons in India.

3. The project will be executed by the Defence Institute of Fire Research (DIFR) which is well equipped with the necessary laboratories to test and evaluate the alternative systems and to demonstrate their efficiencies for potential users.

4. The stated objective of the proposal is to reduce dependency on halons for fire protection and to facilitate the gradual phase-out of halon production in India through:

(a) Identification and evaluation of suitable technologies;

(b) Familiarization with the alternative system and the necessary technical training for their use and maintenance;

(c) Preparation of specification standards and codes; and

(d) Technology transfer.

5. The data generated from implementation of the above activities will be used to prepare a sectoral strategy for the phase-out of halon uses.

6. According to India's Country Programme, the consumption of halon will continue to increase up to 1995.

7. The proposal was reviewed for the Fund Secretariat by a sector expert who informed that fine powder aerosols are currently being investigated in several other countries.

8. It is to be noted that an investment project for the use of dry chemical powder as a halon substitute in extinguishers is being presented to the Thirteenth Meeting of the Executive Committee.

9. The Secretariat recommends as follows:

(a) Funding should not be approved for ABC dry powder and Fine -Powder Particle Aerosol Systems. The first is part of an investment project being considered at this meeting, and the technology of the latter is still under investigation.

(b) Funding in the amount of US $299,000 should be approved for the remaining activities included in the proposal.

Project N° 1: **Argentina: Technical assistance to prepare a National Halons Programme (US$50,000)**

Project N° 6: **Cuba: Demonstration of fire extinguishing methods using alternative agents (US $46,900)**

Project N° 27: **Uruguay: Technical Assistance for the implementation of the National Programme for the Management and Banking of Halon 1211. (US $272,000)**

1. The first project (Argentina) involves providing assistance to the Government to develop a national programme for the reduction and phase-out of halon and identifying projects to be submitted to the Multilateral Fund.

2. The objective of the second project (Cuba) is to develop a demonstration programme of alternative fire extinguishing methods, including N_2, CO_2, water, water mist, etc. The project includes a technical assessment mission to become familiar with alternative fire extinguishing facilities (US $8,000) and procurement and installation of two demonstration systems N_2 and water mist (US $32,900). As a result, the body governing fire protection will be able to determine which fire protection systems should be used in the replacement or conversion of existing halon-based systems. Emphasis will also be put on halon banking systems. The total halon used in Cuba is very small (3.6 ODP tonnes of halon 1211).

3. The third project (Uruguay) is intended to provide technical assistance and training to the halon users sector and to recover halon 1211 from users for critical uses only. For the recovery programme, 1,500 ABC dry powder extinguishers (US $50 each) and 500 CO_2 extinguishers (US $200 each) will be procured over a two-year period, at a total cost of US $175,000. Funds amounting to US $22,000 are also being requested to set-up a secretariat for operation of the halon bank. One additional halon recycling machine will be provided through the Global Halon Project under the UNDP work programme. The total halon used in Uruguay is very small (5.8 ODP tonnes of halon 1211). The project does not provide information concerning how the excess halon will be disposed of nor does it account for the final use of the

halon 1211 cylinders. The cylinders can be re-used with ABC dry powder by changing the valve and repainting the cylinder. The cost incurred could be offset against savings accruing from the use of the ABC powder (cheaper than halon).

4. Halon 1211 recycling equipment is best used to reduce emissions when test or inspection of the fire extinguisher is required to meet safety requirements for pressure vessels. Large scale halon 1211 recycling and banking is not practical because of the high costs involved and the very limited essential uses of halon 1211. Further funding for complex halon 1211 recycling schemes or replacement of existing halon 1211 or halon 1301 fire equipment might not be considered as appropriate.

5. In all developed countries new use of halon 1211 has been curtailed without banking or recycling.

6. The Secretariat recommends as follows:

(a) Final approval of the requested funding amount, US $50,000, for Argentina project;

(b) Not to approve the Cuba project proposal; and

(c) Approval of funding level of US $14,000 for the Uruguay proposal to implement the training programme, once the two recycling machines are installed.

Project N° 3: **China: Elimination of the use of CFC-113 in the electron gun final cleaning processes at the Tianjin Picture Tube Factory (US $184,000). Cost effectiveness: US $27.4/kg.**

Project N° 4: **China: Elimination of the use of TCA at Baoshi Electronics Corporation Shjiazhuang Manufacturing Operations (US $479,000). Cost effectiveness: US $64.7/kg.**

1. Under these projects, through conversion to chlorinated solvent cleaning and aqueous cleaning, Tianjin will eliminate 8.4 tons of CFC-113 being used for the final cleaning step of electron guns for picture tubes. Baoshi will eliminate 74 tons of TCA being used for the cleaning of pin and anode buttons and electron guns for small CRT display and picture tubes.

2. It may be recalled that the Executive Committee at its 12th Meeting decided that:

(a) Cleaning Applications Deployment Centre:
"Approval would be given provided that China agreed not to include the cost of applications testing in future solvent projects." (UNEP/OzL.Pro/Excom/12/37, para 58, footnote 1).

(b) ODS-free Manufacturing Centre:
"Further project proposals requesting cleaning equipment in the solvent sector in China would be considered within the context of the project."
(UNEP/OzL.Pro/ExCom/12/37, para 107).

3. The proposals should not be approved as submitted. UNDP should revise the two proposals in light of the Executive Committee's decisions mentioned above.

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

(13th Meeting, 25-27 July 1994, Montreal)

1994 WORK PROGRAMME AMENDMENT

OF THE

UNITED NATIONS DEVELOPMENT PROGRAMME

27 June 1994

1994 UNDP WORK PROGRAMME AMENDMENT

A. UNDP's approved activities during 1991-1993 and at the 12th Executive Committee Meeting in March 1994 were as follows:

	(in $ millions)		
	1991-93	1994	TOTAL
CPG (country prog. preparation)	1.031	-	1.031
DEM (demonstration projects)	0.410	1.183	1.593
INS (institutional strengthening)	4.044	0.472	4.516
INV (investment projects)	10.613	12.824	23.437
PRP (project preparation)	1.055	0.425	1.480
TAS (technical assistance)	4.549	0.283	4.832
TRA (training)	1.342	-	1.342
	======	======	======
TOTAL	23.044	15.187	38.231

B. The sectoral breakdown of UNDP's approved activities during 1991-1993 and at the 12th Executive Committee Meeting in March 1994 is as follows:

	(in $ millions)			Tonnes
	1991-93	1994	TOTAL	ODS
Aerosols	0.176	0.208	0.384	30
Foams	9.446	8.683	18.129	2,628
Halons	1.612	0.025	1.637	-
Refrigeration/MAC	2.315	3.250	5.565	318
Solvents	2.255	1.856	4.111	203
Several	7.240	1.165	8.405	-
	======	======	======	=====
TOTAL	23.044	15.187	38.231	3,179

C. For 1994, the first and second columns denote 12th ExCom (March 1994) project approvals and expected ODS tonnes phased out while the third and fourth columns specify UNDP's requested 1994 work programme amendment presented to the 13th ExCom (July 1994) with the corresponding anticipated ODS tonnes to be phased out (in $ millions and ODS tonnes):

	12 EXCOM	(Mar94)	13 EXCOM	(Jul94)
	$	ODS	$	ODS
Aerosols	0.208	30	-	-
Foams	8.683	1,409	14.623	1,931
Halons	0.025	-	0.774	-
Refrigeration/MAC	3.250	292	5.092	112
Solvents	1.856	24	0.663	132
Several	1.165	-	0.130	-
	=====	======	======	=====
TOTAL	15.187	1,755	21.282	2,175

D. UNDP's 1994 work programme approved at the 12th ExCom Meeting in March 1994 thus amounted to $15.187 million that will phaseout 1,755 tonnes of ODS. UNDP's 1994 work programme amendment submitted to the 13th ExCom Meeting amounts to $21.282 million and would phaseout 2,175 tonnes of ODS.

E. Thus UNDP's overall 1994 work programme, following approval of the work programme amendment at the 13th ExCom Meeting, should total $36.469 million and would phaseout 3,930 tonnes of ODS.

F. The following project proposals under $500,000 have been submitted for Executive Committee approval at its 13th Meeting as part of UNDP's 1994 Work Programme Amendment:

		US $
1.	ARGENTINA: Technical assistance to prepare a national halons programme	50,000
2.	CHINA: Danshui - Elimination of CFC-12 in the manufacture of EPE foam sheet at Danshui Huaya Plastics Industries Corp. Ltd.	241,000
3.	CHINA: Elimination of the use of CFC-113 in the electron gun final cleaning process at the Tianjin Picture Tube Factory	184,000
4.	CHINA: Elimination of the use of TCA in the Baoshi Electronic Corporation Shijiazhuang Manufacturing Operations	479,000
5.	CUBA: Demonstration of alternatives to CFCs and pilot phase of a CFC recovery/recycling programme in the domestic and commercial refrigeration sector	230,000
6.	CUBA: Demonstration of fire-extinguishing methods using alternative agents	46,900
7.	INDIA: Bakelite Hylam Limited phaseout of CFCs in the manufacture of phenolic foam and foam products	367,000
8.	INDIA: U-Foam Private Ltd. phaseout of CFC use in the manufacture of polyurethane foams	408,500
9.	INDIA: Strategy and action programme for the elimination of CFCs in the manufacture of foams	270,000

		US $
10.	INDIA: Demonstration and evaluation of alternative technology for halon fire protection systems and technical assistance for sectoral strategy for ODS phaseout	405,000
11.	MALAYSIA: Wong Brothers Electrical and Refrigeration Sdn. Bhd. - Elimination of CFC-11 in the manufacture of rigid polyurethane foam panels for cold storage	299,000
12.	MALAYSIA: Pangkat Refrigeration Industries Sdn. Bhd. - Elimination of CFC-11 in the manufacture of commercial refrigerators	210,000
13.	MALAYSIA: Allied Foam Insulation - Elimination of CFC-11 in the manufacture of polyurethane foams for pipe insulation	276,000
14.	MALAYSIA: Eversoft Foam Industries Sdn. Bhd. - Elimination of CFC-11 in the manufacture of cold cure molded flexible polyurethane foams	185,000
15.	MALAYSIA: Nian Aik Foam Sdn. Bhd. - Elimination of CFC-11 in the manufacture of cold cure molded flexible polyurethane foams	245,000
16.	MALAYSIA: Phoenix Base - Elimination of CFC-11 in the manufacture of flexible polyurethane foam	165,000
17.	MALAYSIA: Lian Pang - Elimination of CFCs in the manufacture of commercial refrigeration products	242,000
18.	MALAYSIA: United - Elimination of CFCs in commercial refrigeration products	415,000
19.	PANAMA: Elimination of CFC-11 in the manufacture of flexible and rigid polyurethane foams in Plastifom S.A., Profomsa and Thermofoam S.A.	155,000
20.	PERU: Project preparation assistance	100,000
21.	PHILIPPINES: Foamcraft Inc. phaseout of CFCs in the manufacture of flexible PUF (slabstock)	185,000

		US $
22.	PHILIPPINES: Metal Forming Corporation phaseout of the use of CFCs in the manufacture of polyurethane insulated building elements	305,000
23.	PHILIPPINES: Elimination of the residual use of CFCs in the manufacture of extruded polystyrene foam sheets (additional company: Styrotech Corp.)	60,000
24.	THAILAND: Ponsri - Elimination of the use of CFCs in the manufacture of extruded polystyrene foam sheet	340,000
25.	URUGUAY: Conversion to CFC-free technology in the manufacture of flexible polyurethane foam	200,000
26.	URUGUAY: Project preparation assistance	30,000
27.	URUGUAY: Technical assistance for the implementation of the national programme for the management and banking of halon-1211	272,000
	TOTAL	$6,365,400

The documentation for all the above project proposals is attached.

The institutional strengthening project proposal for Pakistan has been submitted by the Government directly to the Fund Secretariat for UNDP implementation and has therefore not been included in the above project listing.

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

The following project proposals over $500,000 have been submitted by Governments for Executive Committee approval at its 13th Meeting with UNDP as implementing agency:

		US $
1.	CHINA: Yanfeng conversion to non-CFC technology in the manufacture of flexible and integral skin polyurethane foam	670,000

		US $
2.	CHINA: Elimination of CFC-11 in the manufacture of rigid polyurethane foam products at Tianjin Polyurethane Plastics Plant	690,000
3.	COLOMBIA: Elimination of CFC in the manufacture of domestic refrigerators in Colombia	7,351,770
4.	COLOMBIA: Elimination of the use of ODS in the polystyrene foam sector	1,072,000
5.	MALAYSIA: Oyl Appliances - Elimination of CFC-11 and CFC-12 in the manufacture of refrigerators	658,000
6.	PHILIPPINES: Unimagna - Phaseout of the use of CFCs in the manufacture of commercial refrigerators and ice boxes	1,085,000
7.	SLOVENIA: Elimination of ODS at Plama Co.	1,502,000
8.	THAILAND: Sanden - Elimination of the use of CFCs in the manufacture of commercial refrigerators	618,200
9.	THAILAND: Lucky Group - Elimination of the use of CFCs in the manufacture of flexible polyurethane foam (slabstock)	605,000
10.	URUGUAY: Conversion to CFC-free technology in the manufacture of rigid polyurethane foam (spray)	665,000
	TOTAL	$14,916,970

The documentation for the above project proposals is attached.

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

(13ECWP1.F)

END

PROJECT COVER SHEET

COUNTRY:	**ARGENTINA**
PROJECT TITLE:	Technical Assistance to prepare a National Halons Programme.
SECTOR COVERED:	Halons Sector
ODS USE IN SECTOR:	335 tonnes ODP per year (1992 figure)
PROJECT DURATION:	6 months
TOTAL COST:	$US 50,000
IMPLEMENTING AGENCY:	UNDP
COORDINATING NATIONAL BODY:	Secretaria de Recursos Naturales y Ambiente Humano - Instituto Nacional de Technologia Industrial (INTI)

PROJECT DESCRIPTION:

1. Background.
The Country Programme which will be submitted by the Government at the next Executive Committee Meeting contains a reduction and phaseout schedule for the halons consumption and a general outline to achieve this objective. In addition, during the Regional Halons Workshop held in Caracas from 27 to 29 April 1994, the Government of Argentina has requested UNDP's assistance to develop the National Programme for the Reduction and Phaseout of the consumption of Halons, and to identify and prepare projects to be submitted to the Multilateral Fund.

2. Assistance Requested.
To elaborate this programme that should contain detailed information on the halons sector and on the steps to be undertaken, the following activities have been identified for which UNDP's assistance would be required:

1) Setting up the "Organismo de Administración e Información de Halones" as well as the "Grupo Consultivo del Ozono (GRUCO) -- Sector de Halones" with the participation in all sectors concerned such as industry, final users, defense, telecommunication, energy generation, aviation, Governmental Institutes and Organizations, Standards Institute, etc. The immediate activities will include:

    a) Identify and define essential uses of halons
    b) Based on the above-mentioned uses, recommend a schedule to:
        - reduce halons consumption for non-essential users
        - phaseout of actual halons-based installations

UNDP will provide technical information and guidelines to prepare an adequate legislation on essential uses, on recycling and banking of halons, and on phaseout schedules.

2) To establish a National Recycling Programme for Halons 1211 and 1301, in step with the above-mentioned phaseout programmes, avoiding eventual scarcity of those gases, and on the other hand, minimizing incremental costs resulting from conversion to alternative technologies.

   To analyze various options for the organization of the halons bank (i.e. could be managed by private sector, Government or a mix of both).

   To initiate a demonstration programme in INTI that will train potential users in recycling operations and re-use of halons.

3) To identify and prepare projects to be submitted to the Executive Committee of the Multilateral Fund.

4) To establish a databank to compile existing information on alternative technologies such as N_2, CO_2, powder, water, water mist and chemical drop-in substitutes. The databank should include cost-estimates related to each respective technology, which might be useful information for potential end-users.

5) National Workshop for all parties involved in the programme: Government, Industry and End-Users.

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

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

3. Inputs.

Inputs will include National Consultants (US$ 14,000), International Consultants (US$ 20,000), Organization of the National Workshop (US$ 11,000), and some miscellaneous expenses including Spanish-English translation of documents (US$ 5,000).

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:	One year
PROJECT ECONOMIC LIFE:	10 years
TOTAL PROJECT COST:	USD 482,000
	USD 580,000 Incr. Capital Cost USD 98,000 Incr. Recurrent Benefit
PROPOSED MLF GRANT:	USD 241,000 (reflecting the Chinese share of ownership)
COST EFFECTIVENESS:	USD 0.40/kg/y (unit abatement cost)
COORDINATING NATIONAL BODY:	National Environmental Protection Agency (NEPA)
IMPLEMENTING AGENCY:	UNDP
APPRAISAL DATE:	September 16/1993; June 3/1994

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 using CFC-12 as a blowing agent.

Under this project, Danshui will phaseout 160 tons of ODS annually by converting from CFCs to butane. Safe production is not possible in the current location in view of the residential character of the neighborhood. As the supply of CFCs is currently very erratic, the company has decided to commence immediately with the project on pre-financing provided by the foreign partner and grant from the MLF.

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 (Ministry of Light Industy) is responsible for the phaseout coordination in all foam categories. Ministerial responsibility is divided into "Refrigerating foams" and "Non-refrigerating" foams.

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

- o Ministry of Chemical Industry (MCI),
- o Ministry of Internal Trade (MIT),
- o China Aerospace Industry Corporation (CAIC),
- o Ministry of Machinery Industry (MMI),

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 between 45 and 50. 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
1994	540t resin	205t CFC-12 (forecast)

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 initially identified butane as the replacement of choice. Butane technology is available through equipment manufacturers; however, in this case Danshui will engage in the services of specialists (technology/process and machinery) from its Singapore partner to implement and oversee the whole conversion operation. The Singapore partner has been involved in butane conversion before and possess the technical background for the implementation of such a conversion.

To create acceptable safety conditions, it is necessary to relocate the existing extruder to another location. This proved to be more cost effective than to introduce non-flammable alternatives such as HCFC-22 or the even more expensive HFC-134a. In addition, butane technology constitutes a permanent conversion whereas the use of HCFC-22 would be only an interim solution.

Other safety related modifications will also be implemented to mitigate fire and exposure hazards of butane.

Finally, extensive production and safety training is foreseen to ensure effective transfer of technology related to the new process and a smooth and safe operation.

5. TECHNOLOGY

5.1 OVERVIEW

There are several options to, partially or completely, replace CFCs in the production of thermoplastic foam sheet, such as:

- o Nitrogen,
- o Carbon dioxide,
- o Hydrocarbons (butanes, pentanes, LPG),
- o "Berstorff" technology (nitrogen and 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.

5.2 SELECTION

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. A significant draw back of butane is its flammability, requiring stringent safety precautions.

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

5.2 REQUIRED MODIFICATIONS

The use of hydrocarbons will require substantial changes in the production process and storage facilities. Required equipment modifications and additions may include:

- **Storage**
  - Separate, explosion proof, location of the butane tank.
  - Separate aging (degreasing) area
- **Feeding systems**
  - More 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.
  - Water sprinkler or other automated fire-fighting systems.

To achieve this in the residential setting of the Danshui plant is impractical and nearly impossible without the creation of unacceptable risk for the neighborhood. The production will therefore relocate to a less crowded industrial area.

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 process expert will also include formulation trials under the new process.

6. PROJECT COSTS

6.1 CAPITAL COSTS

Description	Cost (US$)
2 units of 7.5 kg butane tanks (including civil works, piping, installation, etc...)	80,000
Extruder modification	80,000
Fire safety & alarm system	75,000
Moving of equipment	65,000
Building modification	
. Sprinkler system	80,000
. Fire walls	80,000
. Reflection panels	30,000
. Ventilation & exhaust system	20,000
Training	20,000
Contingency and rounding	50,000
TOTAL INCREMENTAL CAPITAL COSTS......USD	**580,000**

6.2 OPERATING COSTS/BENEFITS

There is a net operating benefit of USD 98,000 (at net present value as requested by the MLF). These costs are calculated and explained in detail in Annex-A.

6.3 UNIT ABATEMENT COSTS

a) ODS Reduction Capital Costs....................USD 580,000
b) Annual Incremental Benefits (average)..........USD 31,000
c) Capital Recovery Factor (10y lifetime; 10% interest)...16275
d) ODS reduction/y (base: 1994)...................kg 160,000

Unit Abatement Costs [{(a(c) + b})/d]..........USD/kg/y 0.40

7. FINANCING PLAN

The enterprise requests 50% of the total costs, representing the Singapore share of ownership. This amounts to

USD 241,000

8. PROJECT IMPACT

This project will eliminate the use of at least 160 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.

9. PROJECT IMPLEMENTATION

9.1 MANAGEMENT

UNDP, NEPA and NCLI will oversee the implementation of the project. The project will be implemented by the company.

9.2 PROCUREMENT

Maya Group will procure the project. UNDP and the Chinese Government (NEPA, NCLI) will review this procurement.

9.3 SCHEDULE

TASK	TIME FOR COMPLETION (MONTHS)											
	1	2	3	4	5	6	7	8	9	10	11	12
1. Preparation												
MLF Approval	x											
Building Construction		x	x	x	x							
Relocation						x						
2. Installation												
Machine Modifications							x					
3. Start-up, Training												
Machine Start-up								x				
Safety Training								x				
4. UNDP Commissioning Audit									x			

10. REQUIRED REGULATORY ACTION

The project requires approval of city authorities, represented through the local fire department. Butane at current location will not be approved. Operation at the anticipated new construction site will be approved.

11. ANNEXES

Annex-A: Net Incremental Recurrent Costs
Annex-B: Technical Assessment

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ANNEX-A

DANSHUI OPERATING COSTS

1. ASSUMPTIONS

- Price from July 1993 (Danshui project submission date) Raw material price provided by the company and cross-checked with information from the **Zhejiang** and **Shanghai** No. 18 projects.
- CFC-12 price RMB 12,750 (USD 1,500-1,550)/ton
- Butane price RMB 6,000 (USD 1,100)/ton
- CFC-12 usage = Butane usage
- Required Additive price USD 30/kg
- Preventative maintenance: 5% of project costs

1). MATERIALS COST

BEFORE:	160t CFC-11 @ 1,500................	USD 248,000
AFTER:	160t Butane @ 0.8/kg...............	USD 128,000
	ADDITIVE	USD 24,000
	INCREMENTAL MATERIALS SAVINGS......	USD 96,000

2) OTHER RECURRENT INCREMENTAL COSTS

o	Extra maintenance	USD 40,000
o	Extra Insurance	USD 15,000
o	Recurrent Safety Training	USD 10,000
	NET INCREMENTAL RECURRENT BENEFIT/YR....	USD 31,000
	NET PRESENT VALUE	**USD 98,000**

TECHNICAL REVIEW

PREPARED BY: Bert Veenendaal
UNDP Foam Sector Expert

DATE: June 27, 1994

1. COUNTRY OF ORIGIN:	CHINA
2. PROJECT TITLE:	Elimination of CFC-12 in the manufacture of XPE foam sheets at DANSHUI HUAYA PLASTICS INDUSTRIES CO. LTD.
3. (SUB) SECTOR:	Foamed Plastics
4. CP RELATIONSHIP:	Not mentioned as a company. XPE/PS industry addressed.
5. TECHNOLOGY:	The company intends to replace CFC-12 by butane. This technology is supported provided that safety can be sufficiently maintained. Safety cannot be maintained after technology conversion at the present site. The company therefore will have to relocate the production. The cost of conversion is based on relocation. Only the eligible incremental costs are included.
6. ENVIRONMENTAL IMPACT:	Butane is highly flammable. The project takes this into account. Butane is also photochemically active. There is currently no regulatory restriction in this area in China.
7. PROJECT COSTS:	The project cost is very reasonable. Unit abatement cost is low compared with other projects (0.5-1.0 usual).
8. IMPLEMENTATION:	Adequate
9. RECOMMENDATION:	The project is recommended for approval

PROJECT COVER SHEET

COUNTRY OR REGION:	China
SECTOR COVERED:	Primary Sector: Solvents
ODS CONSUMPTION IN AFFECTED SECTORS	3306 tonnes of ODP in 1991
PROJECT TITLE:	Elimination of the use of CFC-113 in the electron gun final cleaning processes at the Tianjin Picture Tube Factory.
PROJECT DURATION:	Two years from funding availability
PROJECT IMPACT:	Phase out 8.4 T/yr CFC-113 use in China
PROJECT DURATION:	2 years
PROJECT USEFUL LIFE:	10 years

TOTAL PROJECT COSTS:

Total capital investment cost:	USD 233,800
NPV of incremental operating cost:	USD (49,921)
Requested funding:	**US $ 184,000**

IMPLEMENTING AGENCY: UNDP

NATIONAL COORDINATING AGENCY: NEPA THROUGH MEI

PROJECT SUMMARY

The China Country Programme lists four demonstration cleaning lines as part of the country strategy for phasing out ODS in the Solvents sector. Additional lines in similar or related segments are being phased out using similar technology to the demonstration lines. The Tianjin Picture Tube Factory uses CFC-113 in the final cleaning step of electron gun manufacture. Cleanliness and compatibility with the delicate sections of the electron gun are critical for the desired performance of the finished picture tube, thus this application is different from the degreasing of metal parts after stamping or forming operations seen in some other projects in the CRT sector. This project will identify, qualify and install a non-ODS cleaning process that meets these criteria, thereby phasing out the use of CFC-113 at this factory.

PROJECT OF THE GOVERNMENT OF CHINA
ELIMINATION OF THE USE OF CFC-113 IN THE ELECTRON GUN FINAL CLEANING PROCESS AT THE TIANJIN PICTURE TUBE FACTORY

1. PROJECT OBJECTIVE

The objective of this project to eliminate the use of CFC-113 in the final electron gun cleaning process at the Tianjin Picture Tube Factory.

2. SECTOR BACKGROUND

The China Country Programme states that total 1991 ODS consumption in China was 48,239 tonnes with an ODP (ozone-depleting potential) value of 60,352 tonnes. 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 resulting severe damage to the global ozone layer.

ODS consumption in the solvents sector in 1991 amounted to 4,947 tonnes with a combined ODP value of 3306 tonnes. This combination reflects the weighted average of a 0.8 ODP value for CFC-113 and a 0.1ODP value for methyl chloroform. There are 3,200 middle and small-sized enterprises using ODS-based cleaning processes in China at present. With unconstrained consumption, the Country Programme estimates that ODS consumption in this sector by year 2010 would reach 53,571 tonnes growing at over 14% per annum over the period 1991-2010. It is thus critical that ODS consumption in this sector be reduced as soon as possible. This is technologically feasible since alternative processes exist. The main issue is to determine, and then deploy, the cleaning processes, or alternative technologies, most feasible for the many different factory applications throughout China.

3. ENTERPRISE BACKGROUND

The Tianjin Picture Tube Factory, founded in 1974, is located in a busy port city near Beijing. It is operated under the management and oversight of the Ministry of Electonics Industry. The Tianjin Picture Tube Factory manufactures a variety of picture tubes using technology originally obtained from NEC, but the major customers are the telecommunications and computer market segments. The split between captive and independent uses is estimated at 75/25 %. At present the factory employs a total of 1800 employees, with a turnover of 80 MM RMB in 1993 and an estimated 100 MM RMB in 1994 on a capital investment of 60 MM RMB. B/W picture tubes are exported to S.E. Asia. The Factory started using CFC-113 in their cleaning operations in 1980. At present, 4 employees per shift are engaged in the cleaning process.

4. PROJECT DESCRIPTION

4.1 PROJECT GOAL

Identify, test, select and install an alternative cleaning process to the CFC-113 currently used for the final cleaning operation at the Tianjin Picture Tube Factory. The substrates contacted by the cleaning agent are stainless steel, iron/nickel alloy, ceramic and glass. Two related projects, recently approved at the 12th Meeting of the Executive Committee, will not be used to either purchase equipment, or verify cleaning process parameters, due to the fact that this project work plans requires those steps accomplished before the other projcts are capable of delivering them.

4.2 PROCESS SOILS TO BE REMOVED

Dirt, fingerprints, process and handling soils from the production, assembly and inspection of electron guns for picture tubes.

4.3 PRESENT PROCESS

The Tianjin Picture Tube Factory uses over 8 metric tonnes of CFC-113 in a Kaiyo Denki Co., Ltd. three tank (50 cm x 30 cm x 30 cm) batch ultrasonic vapor degreaser to accomplish the final cleaning of 4,000 electron guns/day (design capacity of the degreaser is 5,000 pieces/day). This final step occurs just before the parts are inserted into the tube and a vaccum is pulled. Even the slightest contamination can cause outgassing at the vaccumm tube formation step, when these parts are inserted. This is unlike the Dalian cleaning process, where the parts to be cleaned are metal parts, cleaned in the front end of their process. The Tianjin process is based on technology obtained from NCE in the early 1980's. The parts are cleaned in baskets (24 cmx 14 x 5 cm), each basket is 1/2 full, which is equivalent to 30-40 pieces/load. The baskets are moved manually through the cleaning cycle, which consists of a 40 second dwell time in each tank. The CFC-113 is replaced weekly, with daily additions made to keep the solvent in the machine at correct level. The machine has neither a still for reclamation nor a water separator.

4.4 CLEANLINESS TESTING

There are three steps in the cleanliness evaluation:

a. Visual examination with the unaided eye.

b. Visual examination using a microscope.

c. Sample product build. (When the sample build is done, a critical need is to test for any residue remaining on the parts which may "outgas" when the vacuum is pulled on the tube. Any such outgassing can lead to contamination inside the picture tube, which can seriously shorten the service life of the tube. Higher boiling solvents can be a serious concern as souces of this outgassing-caused quality problem. See technology discussion below.)

4.5 ALTERNATIVE PROCESSES

Acceptable technologies for this type of multi-material cleaning process would generally be characterized as using mild cleaning agents at moderate temperatures. This requirement led to the selection of CFC-113 initially. Acceptable technologies would be chlorocarbons, rust-inhibited semi-aqueous emulsions, other organic solvents or HCFCs. Testing for compatibility with all the materials of construction followed by the actual building of picture tubes using parts cleaned with the proposed alternative process will be required for success.

The Tianjin Picture Tube Factory has already tried the following processes and found them unsatisfactory:

PROCESS	RESULT
Deionized water with ultrasonics	Rusting of iron alloy parts.
Acetone	Rejected by NEPA . Flammable.
Alcohol	First batch of parts satisfactory, quality went down with succeding batches. Also flammable.

Other processes are:

PROCESS	ANTICIPATED RESULT
Methylene Chloride (MC)	Stisfactory provided compatible with all parts of the electron gun, since more aggressive than CFC-113 or HCFC-225. May not remove fingerprints.
Trichloroethylene (TCE)	Satisfactory if higher operating temperature and more aggressive solvent can be tolerated by the parts. May not remove fingerprints.
Perchloroethylene (PCE)	Satisfactory if higher operating temperature (than TCE) but milder (than TCE) solvent can be tolerated by the parts and meet the cleaning requirements. May not remove fingerprints.
Organic/Water Emulsions	Acceptable cleaning, however rust inhibitor probably needed for success. Possible outgassing under vaccumm.
Deionized Water/Detergent	Acceptable cleaning, however rust inhibitor probably needed for success. Possible outgassing under vaccum
HCFC-225	Satisfactory, very similar properties to CFC-113. High probability of success. Very expensive.

5. TECHNOLOGY

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

- chlorinated solvents

- semi-aqueous (organic/water emulsions)
- aqueous
- HCFC solvents
- alcohol or other organic solvents

- hydrocarbon solvents
- process changes

The Tianjin Picture Tube Factory is considering the various alternatives. However, the process implemented must not leave any residues on the parts. The CFC-113 was selected since it is best for both the lens and the complete assembly. In particular it is critical that the cathode coating and the "getter" are not adversely affected. If the electron gun is not clean, then internal arcing, resulting in cathode damage, will occur. Once satisfactory cleaning and compatibility with the cathode coating and the "getter" has been demonstrated, the following cleaning agent attributes will be considered in making the alternative process final choice:

- environmentally friendly
- low in toxicity
- cost effective.
- requires the least changes in the production process.

6. PROJECT COSTS

The following summarizes the anticipated investment cost and related activities for the replacement of the present cleaner.

6.1 TOTAL CAPITAL COSTS

DESCRIPTION	SUB-TOTAL	TOTAL
. Cleaning system with ultrasonics and automated basket handling to minimize worker exposure to alternative solvent vapors. (batch cleaner with ultrasonics and automation for the various cleaning agent options are available at essentially equivalent cost)	$125,000	
· Freight and Installation	10,000	
		$135,000
Facility Modification		
· Electrical & Mechanical work	20,000	
· Process modification, trial runs	15,000	

d product losses		
entilation improvement	10,000	
ismantle existing facilities	2,800	
alvage existing cleaner	(800)	
		47,000
perating Costs (continued)	Subtotal	Total
Technology transfer & Training ncludes production, safety, tart-up &maintenance training		30,000
Acceptance checking of machine		8,000
· Contingency & rounding		13,800
Total		$ 233,800

6.2 INCREMENTAL OPERATING COSTS

The following table summarizes the incremental operating cost:

ITEM	PRESENT SYSTEM	PROPOSED (MC) SYSTEM
1) Material Cost CFC or MC	$25,200 (8400 kilos x $3.00)	$6,552 (10080 kilos x $ 0.65)
2) Labour cost	$27,168	$27,168
3) Energy cost	$2,096 (.06/hp x 8 hrs/shift x 2 shifts/day x 312 days/yr. x 7 hp)	$2,996 (.06 x 8 x 2 x 312 x 10)
4) Maintenance	$1000	$3000
Total:	$55464	$39,716

Cost savings:	$15,748
NPV of 4 year Cost Savings	$49,921

6.3 UNIT ABATEMENT COST

- ODS reduction capital cost.................USD 231,800
- Annual incremental cost......................USD (2140)

- Project useful life..10 years
- ODS reduction...8,400 kg

Unit Abatement Cost [(a/c + b) /d] USD/kg/yr.........0.91 (ODS)
9.1 (ODP)

7. FINANCING PLAN

The company requests reimbursement of the complete project costs, which are estimated to be:
USD 233,800 + (49,921) = USD say 184,000

8. PROJECT IMPLEMENTATION

8.1 MANAGEMENT

UNDP will oversee the completion of this project.

8.2 SCHEDULE

The project will be considered complete when testing has identified a suitable alternative process, that process has been put in place and picture tubes equivalent to those presently produced have been manufactured and accepted by the Tianjin Picture Tube Factory's two major customers. It will be carried out according to the schedule below

Time for Completion

	1994			1995				1996				
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Project Preparation	X											
MLF Approval			X									
Testing of Alternatives		X	X									
Build picture tubes with parts cleaned in alternative processes				X	X							
Finalize New Process Choice					X							

Order Equipment						X	X					
Equipment Inspection prior to shipping												

Time for Completion(contd)

	1994				1995				1996			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Site Preparation							X	X				
Shipping, Installation						X	X					
Trial Runs									X			
Training							X	X	X			
Show parts are meeting customer needs Phaseout actually begins here (1H/1996)											X	X

9. PROJECT IMPACT

This project will eliminate the use of at least 8.4 T of CFC-113 during the first year of implementation.

10. ENVIRONMENTAL ASSESSMENT

Under this project, the Tianjin Picture Tube Factory will convert to a non-ODS cleaning peocess which is technologically accepted world-wide. Solvent cleaning will require on-site reclamation and recycling to minimize the amount of materials required. However, an aqueous process will require, the waste water effluent stream to be filtered and treated prior to discharge to drain in compliance with the standards of NEPA. Since this is a metal cleaning process, removing process soils (as opposed to removal of acidic flux residue), it is unlikely that this project will have a demonstrated adverse environmental impact.

TO: FRANK PINTO
UNDP/ENR
CHIEF, MPU

FROM: CLINTON NORRIS
UNDP CONSULTANT

DATE: 9 JUNE 1994

SUBJECT: PROJECT TECHNICAL REVIEW - TIANJIN PICTURE TUBE FACTORY

I have reviewed the China Project, "**Elimination of the use of CFC 113 in the Electron Gun Final Cleaning Process at the Tianjin Picture Tube Factory**", from the solvent sector, based on discussions with the author and with the factory, as well as review of the document.

1	Country of Origin	China
2	Project Title	Elimination of the use of CFC 113 in the Electron Gun Final Cleaning Process at the Tianjin Picture Tube Factory
3	Sector	Solvents
4	Relationship to C.P.	The project addresses how this factory ODS phase out fits in with the C.P. and the rest of the Sector.

5 Technology

Technical Soundness

This project substitutes different, but effective ODS alternative technology for the solvent cleaning line in use. It is an application of cleaning technology to fill a unique precision cleaning need in the sector, and could almost be considered a demonstration project of its own right in the solvents sector. It includes the process definition, qualification, and installation of cleaning technology that will meet these unique needs.

The selection of non-aqueous technology in this case appears to be more sound than aqueous technology, since the cleaning step here is the final step just before the electron gun parts are inserted in the gun and a vacuum is pulled on the assembly. Under vacuum, outgassing can occur if there is the slightest volatile residue left on the parts (due to slow drying), and this can result in grave shortening of the life of the gun due to arcing. The factory has already run tests using aqueous based technology, and found rust to be a problem with some parts. The use of an anti rust compound could leave a quality reducing volatile residue on the parts just prior to the vacuum being pulled on the assembly. Alcohol has low probability of success due to its low loading capacity in this critical, precision cleaning operation. The low loading capacity leads to very rapid loss of cleaning effectiveness, as found in the test runs by the factory. Discussions with the factory also reveal that there is an inorganic coating on the surfaces of the parts, applied with organic solvents. Thus the desirable solvent volatility properties must be balanced with their compatibility properties associated with the coating adhesives. The use of ultrasonics and batch multi-sump low emission units will be required for the alternatives being considered, and as mentioned in the project document, these units are all comparably priced. The use of HCFC 225 would have a very high probability of success, but it is a very costly one at more than $30 per kilo, and uses a transitional compound.

Safety

The use of solvents must provide for low exposure levels, both acutely and chronically, due to their toxicity. Thus, in order to control exposure incidents, handling such as loading, unloading, solution makeup, and solvent transfer procedures (including spent materials) should be spelled out and people trained before they are permitted to become operators in the cleaning area. Periodic retraining is also recommended. Chronic exposure needs to be controlled via equipment design for appropriate exhaust and low emissions, and procedures need to be adopted which limit access or require respiratory protection if sampling shows it to be necessary. We are informed that the equipment is isolated, and therefore allows for control of incidental exposure. The limited number of operators should allow for thorough training to control incidents and chronic exposure. The operating costs include a training component to account for personnel turnover and periodic training updates.

6 Environmental Impact

Since the most likely process will employ a chlorinated solvent such as methylene chloride or trichlorethylene or perchloroethylene, these compounds must have exposure controls as mentioned above, and spill control is extremely important to avoid ground water contamination. Spent solvent controls are also needed, to ensure proper disposal, in accordance with Country environmental standards.

7 Project Costs

The cost components identified in the project cover the equipment required, ventilation improvements for exposure control, the training component, and operational cost components needed to run safely and under adequate environmental control. Evaluation of the process options is not anticipated to be very costly since the enterprise will build the test guns at its own expense, as it has been doing, and the other test costs of defining the process are primarily visual inspection by the enterprise. The value of the machine to be replaced is essentially scrap value. It is recommended that the machine be evaluated to determine if it can be modified for use in some other project in China, as a cold cleaning hydrocarbon machine.

8 Implementation Timeframe

The proposed implementation timeframe is feasible.

9 Recommendation

The project is sound, needed, and has a reasonably good level of unit abatement cost - about $2.50/Kg. **Approval as proposed is recommended**, with the proviso that the safety, environmental, and potential equipment repatriation issues will be addressed.

PROJECT COVER SHEET

COUNTRY:	China
SECTOR COVERED:	Primary Sector: Solvents
ODS CONSUMPTION IN AFFECTED SECTORS	3306 tonnes of ODP in 1991
PROJECT TITLE:	Elimination of the use of TCA in the Baoshi Electronics Corporation Shjiazhuang Manufacturing Operations
PROJECT DURATION:	Two years from funding availability
PROJECT IMPACT:	Phase out 74 T/yr TCA use in China
Project Duration:	2 years
Project useful life:	10 years

TOTAL PROJECT COSTS:

Total capital investment cost:	USD 454,000
NPV of incremental operating cost:	USD 25,000

Requested funding: **US $ 479,000**

IMPLEMENTING AGENCY: UNDP

NATIONAL COORDINATING AGENCY NEPA THROUGH MEI

PROJECT SUMMARY

The Baoshi Components Factory uses TCA in the cleaning steps of their manufacturing operations in Shijiazhuang,-

a) in their pin and button manufacturing prior to their critical controlled oxidation process. Cleanliness at this point is critical for the performance of the finished picture tube.

b) in their electron gun manufacturing to remove rust preventative, processing oils, and machine lubricating oils from electron gun parts prior to burnishing.

This project will identify, qualify and install non-ODS cleaning processes in all these manufacturing operations, thereby phasing out the use of TCA in Baoshi, Shijiazhuang.

Prepared by: William Kenyon and the Ministry of Electronics Industry, PRC
Reviewed by: Clinton Norris

PROJECT OF THE GOVERNMENT OF CHINA
ELIMINATION OF THE USE OF TCA IN THE BAOSHI ELECTRONIC CORPORATION
SHIJIAZHUANG MANUFACTURING OPERATIONS

1. PROJECT OBJECTIVE

The objective of this project is to eliminate the use of TCA at Baoshi's operations in Shijiazhuang, namely

a) in the pin and anode button cleaning process prior to the critical controlled oxidation step in Baoshi's components manufacturing, and

b) in the electron gun parts cleaning prior to the burnishing process in Baoshi's electron gun parts manufacturing operation.

2. SECTOR BACKGROUND

The China Country Programme states that total 1991 ODS consumption in China was 48,239 tonnes with an ODP (ozone-depleting potential) value of 60,352 tonnes. 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 resulting severe damage to the global ozone layer.

ODS consumption in the solvents sector in 1991 amounted to 4,947 tonnes with a combined ODP value of 3306 tonnes. This combination reflects the weighted average of a 0.8 ODP value for CFC-113 and a 0.1 ODP value for methyl chloroform. There are 3,200 middle and small-sized enterprises using ODS-based cleaning processes in China at present. With unconstrained consumption, the Country Programme estimates that ODS consumption in this sector by year 2010 would reach 53,571 tonnes growing at over 14% per annum over the period 1991-2010. It is thus critical that ODS consumption in this sector be reduced as soon as possible. This is technologically feasible since alternative processes exist. The main issue is to determine, and then implement, the cleaning processes, or alternative technologies, most feasible for the many different factory applications throughout China.

3. ENTERPRISE BACKGROUND

The Baoshi Electronic Corporation (Group) operates a number of plants specializing in the manufacture of high quality components to meet the picture tube and CRT display requirements of the broadcast (TV), computer and process control industries. The Baoshi Electronic Corporation has made the phase out of ODS a corporate goal. The first phase of their work focuses on two sites located in Shijiazhuang, a busy industrial city south of Beijing. Operated under the management and oversight of the Ministry of Electronics Industry, these manufacturing operations will serve as a center of excellence for the Baoshi Corporation besides using their proximity to accelerate the phase out by learning from each other. This teaming approach, common in developed countries phase-out planning and replication, will be used by MEI in this project.

The Baoshi Electronic Corporation (Group) Components Plant started up in 1990, and specializes in the manufacture of a wide variety of electron guns for small, high quality monochrome CRT display and B/W picture tubes. The technology was obtained from Japan, but the major customers are 7-8 domestic television manufacturers . The production is split equally between captive and independent uses, with about 20% exported. At present the operation employs a total of 460 employees, with a turnover of 24 MM RMB on a capital investment of 30 MM RMB. Baoshi Electronics gun manufacturing started using TCA in their cleaning operations in 1990. At present, 2 operators per shift for 2 shifts are engaged in the cleaning process, for a total of 8-10 persons, once the management and maintenance people are included.

4. PROJECT DESCRIPTION

4.1 PROJECT GOAL

Identify, test, select and install ODS Free cleaning processes for the:

a) Pin and anode button pre-oxidation cleaning operation at the Baoshi components manufacturing plant where the substrates contracted by the cleaning agent are non-magnetic stainless steel alloys and iron/nickel alloys.

b) Electron gun metal parts cleaning operation at the Baoshi electronic gun manufacturing plant, where the substrates contacted by the cleaning agent are non-magnetic stainless steel alloys and iron/nickel alloys.

Two related projects, recently approved at the 12th Meeting of the Executive Committee, will not be used to either purchase equipment, or verify cleaning process paarameters,due to the fact that this project work plan requires those steps to be accomplished before the other projects are capable of delivering them.

4.2 PROCESS SOILS

The process soils are:

a) Mineral based stamping oil from the production of pins and anode buttons for picture tubes, and

b) Rust preventative on incoming metal stock, mineral based stamping oil from the production of electron gun parts, and lubricating oil from the machines used to make the parts

4.3 PRESENT PROCESS

The processes presently in use are described separately for convenience. There are 3 different cleaning lines being phased out. These are inserted in different processes from the process used in Dalian picture tube part cleaning.

Exiting Line 1 & 2, the next step is to process the part surface at high temperatures in a controlled oxidation step.

Exiting line 3, the next step is wet burnishing to remove surface imperfections before stamping.

The pin and anode button process has six basic steps: forming, degreasing, tumbling, rinsing, blasting and oxidation. TCA in two two-tank batch ultrasonic vapor degreasers is used to accomplish the first of two cleaning steps prior to the controlled oxidation of the pins and anode buttons. (The second step in the process is an aqueous detergent wash followed by deionized

water rinses and then drying. This part of the process would not be changed.)

Cleaner #1 was built by the Boda Company (Shenzhen, PRC). It is one year old, has ultrasonics in both .sumps and is equipped with a automatic programmable hoist with a hexagonal cross-section basket. The basket can be rotated by the mechanism to expose all the surface of the parts to the solvent. The basket is loaded to 1/3 to 2/3 of capacity, equivalent to approximately 10 kg./load. Two baskets (20kg.) are cleaned per hour in this machine. This machine does not have a recycling still. It is located further away from the ventilation ducts.

Cleaner #2 was built by the Baron-Blakeslee, Inc. Company (USA). It is a three year old low emission (LE) model, so it would be suitable for use with other solvents after modification. It has ultrasonics and is equipped with a manually operated hoist. The capacity of this machine does not have a recycling still and ventilation suitable for TCA.

The electron gun parts, which vary in size and complexity, are formed and then cleaned with TCA in a two sump ultrasonic vapor degreaser prior to aqueous burnishing step. After the aqueous burnishing and polishing step, the parts are rinsed in DI water and then dried in a hot air oven before assembly into electron guns.

Cleaner #3 was built by the Crest Ultrasonics Company (USA) and has been in service for four years. It has ultrasonics in the first sump but not in the second. Two sizes of baskets are used to hold the parts during cleaning, The basket sizes are 25 cm x 25 cm x 25 cm (small) and 43 cm x 30 cm x 30 cm (large). Each basket is loaded to 1/3 to 2/3 of capacity, then moved manually by the operator from one sump to the next during the cleaning process. Basket loads range from 10 kg up to 15-20 kg. Typically, two- five baskets are cleaned per hour in this manner, thus over 100 million parts are cleaned each year (equivalent to about 3 million electron guns). While this machine does not have a recycling still, it is fitted with a ventilation hood . A small open tank of TCA without cooling coils is next to the cleaner, This tank, which serves as a soak tank, will also be eliminated.

4.4 CLEANLINESS SPECIFICATION TESTING

Pins and anode buttons must be both oil-free after the two step cleaning process prior to the controlled oxidation, while the electron guns parts must be oil-free prior to the wet burnishing process. The usual production test is a visual "water break" test after the cleaning process has been completed. There are four steps in the overall cleanliness evaluation for alternate process qualification:

a. Visual examination with the unaided eye.
b. Visual examination using a microscope.

c. SEM analysis
d. Sample product build.

4.5 ALTERNATIVE PROCESSES

Acceptable technologies for these types of cleaning processes for stainless steel alloys and ferrous alloys would generally include chlorocarbons, aqueous detergent, semi-aqueous emulsions, other organic solvents or HCFCs. Testing for compatibility with the materials of construction followed by the actual building of electron guns and picture tubes using parts cleaned with the proposed alternative processes will be required for success. (The pin & anode button team had already tried using TCA alone or an aqueous detergent solution alone. Neither single process met their pre-oxidation cleanliness standards, thus in this case a combination cleaning system may be warranted).

Other processes that should be evaluated to replace the TCA in Baoshi's two step cleaning process would be:

PROCESS	ANTICIPATED RESULT
Methylene Chloride (MC)	Satisfactory provided compatible with the parts and meets process requirements
Trichloroethylene (TCE)	Satisfactory if higher operating temperature and more aggressive solvent can be tolerated by the parts.
Deionized water/detergent	Acceptable cleaning; parts can go wet into burnishing step. However, did not meet pin & anode button cleanliness standards when used alone.
Organic/Water Emulsions	Acceptable cleaning; parts can go wet into burnishing step. However, may not give oil-free surface, will require testing.
Alcohol or Other Organic Solvents	Alcohol Soil loading capability low, would probably require mixed solvent system. Flammable, requires fire suppression system
HFC-225	Possibly satisfactory, very similar properties to CFC-113, very costly

Hydrocarbon	Would leave oil on parts unless a very low boiling, volatile and therefore flammable hydrocarbon were used

5. TECHNOLOGY

In the solvent sector, there are several options for the replacement of CFC-113 solvent in metal cleaning processes:
- chlorinated solvents
- HCFC solvents
- alcohol or other organic solvents
- aqueous
- semi-aqueous
- hydrocarbon solvents
- process changes

The Baoshi Components Factory will consider the various alternatives. However, the process implemented must not leave any residues on the parts, Each part must be oil-free and spot-free prior to entering the critical oxidation step in the BTU furnaces. Alternative processes that meet these criteria will then be judged on the following, prior to a final process selection:
- environmentally friendly
- low in toxicity
- cost effective.
- requires the least changes in the production process.

At this point, the most likely processes are

a) for components cleaning-	Cleaner 1 replaced with solvent cleaning (most probably Methylene Chloride or Trichloroethylene)
	Cleaner 2 replaced with solvent cleaning (most probably Methylene Chloride or Trichloroethylene)
b) for electron gun cleaning-	Cleaner #3 replaced with aqueous/semi-aqueous cleaning

The above are the basis for the project cost estimates

6. PROJECT COSTS

The following summarizes the anticipated investment cost and related activities for modification of Cleaners #1 & #2 for use with trichchloroethylene or methylene chloride, and replacement of Cleaner #3 with an aqueous detergent system.

6.1 TOTAL CAPITAL COSTS

DESCRIPTION	SUB-TOTAL	TOTAL
.Convert Cleaner 1 for alternative solvent use with cooling, heating and freeboard modifications	$40,000	
.Convert Cleaner 2 for alternative solvent use with cooling, heating and freeboard modifications	$40,000	
.Add automated basket handling to BBI system to minimize worker exposure to alternative solvent vapors	$25,000	
.Install cleaning system with ultra sonics, oil separator and automated basket handling to replace Cleaner #3. (batch cleaners with ultrasonics & automation for the various cleaning agent options which can minimize worker exposure to alternative cleaning agent vapors , are available at essentially equivalent cost)	$125,000	
.Freight and Installation	$30,000	

		$260,000
Facility Modification		
· Electrical & Mechanical work, site prep	40,000	
· Process modification	30,000	
· Ventilation improvements-3 locations	40,000	
. Dismantle existing facilities to replace Cleaner #3	2,000	
. Scrap value-Cleaner #3	(1,000)	

		91,000

.Technology transfer & Training (2 sites, 3 cleaning operations, includes production, safety maintenance & start-up training	60,000	
· Acceptance checking of machine, including env. samples	16,000	
.Contingency and Rounding	27,000	---------
Total	$454,000	

6.2 INCREMENTAL OPERATING COSTS

The following table summarizes the incremental operating cost:

ITEM	PRESENT SYSTEM	PROPOSED SYSTEM
1) Material Cost TCA or TCE	$105,820 (74000 kilos x $1.43)	$106,128 (80,400 kilos x $ 1.32+)
2) Labor cost	$67,920	$67,920
3) Energy cost	$8,384 (.06/hp x 6 hrs/shift x 4 shifts/day x312 days/yr. x 7 hp x 2 cleaners) + (0.06/hp x 8 hrs/shift x 2 shifts/day x 312 days/yr. x 7 hp x1 cleaner)	$11,984 (.06 x 6 x 4 x 312 x 10 x 2) + (.06 x 8 x 2 x 312 x 10 x 1)
4) Maintenance	$2,000	$6,000
Total:	$184,124	$192,032
Cost Increase:		$7,908
NPV of 4 year Cost		$25,068 say 25,000

6.3 UNIT ABATEMENT COST: REPLACEMENT OF THE PRESENT CLEANER

- ODS reduction capital cost.................USD 454,000
- Annual incremental cost....................USD 7,908
- Project useful life............................ 10 years
- ODS reduction.................................. 74,000 kg

Unit Abatement Cost [(a/c + b) /d] USD/kg/yr....1.33 ODS Basis
$13.30 ODP Basis

7. FINANCING PLAN

The Baoshi Electronic Corporation (Group) requests reimbursement of the complete project costs, which are estimated to be:
USD 454,000 + 25,000 = USD 479,000

8. PROJECT IMPLEMENTATION

8.1 MANAGEMENT

UNDP will oversee the completion of this project.

8.2 SCHEDULE

The project will be considered complete when testing has identified a suitable alternative process, that process has been put in place and picture tubes using Baoshi's pin and anode buttons cleaned by the new process have been manufactured and found to be equivalent to those presently produced by the Baoshi Components Factory's four major customers.

It will be carried out according to the schedule below

Time for Completion

	1994				1995				1996			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Project Preparation				X								
MLF Approval						X						
Testing of Alternatives					X	X						
Build picture tubes with parts cleaned in alternative processes										X	X	
Finalize New Process Choice								X				
Order Equipment								X	X			

Equipment Inspection prior to shipping						
Site Preparation				X		X
Shipping, Installation	X		X			
Trial Runs					X	
Training	X		X		X	
Show parts are meeting customer needs				X	X	

9. PROJECT IMPACT

This project will eliminate the use of at least 74 T of TCA during the first year of implementation.

10. ENVIRONMENTAL ASSESSMENT

Under this project, the Baoshi Electronic Corporation (Group) will convert to a non-ozone depleting cleaning processes which are technologically accepted world-wide. Where solvent cleaning is selected, on-site reclamation and recycling to minimize the amount required will be implemented. Where an aqueous process is qualified, the waste water effluent stream will be filtered and treated prior to discharge to drain in compliance with the stringent standards of the DOE. Since this is a metal cleaning process, removing process soils (as opposed to removal of acidic flux residue), it is unlikely that this project will have a demonstrated adverse environmental impact.

TECHNICAL REVIEW

I have reviewed the China Project, "Elimination of the use of TCA in the Baoshi Electronic Corporation Shijiazhuang Manufacturing Operations", from the solvent sector, based on discussions with the author and with the company, as well as review of the document.

1	Country of Origin	China
2	Project Title	Elimination of the use of TCA in the Baoshi Electronic Corporation Shijiazhuang Manufacturing Operations
3	Sector	Solvents
4	Relationship to C.P.	The project addresses how this factory ODS phase out fits in with the C.P. and the rest of the Sector.

5 Technology

Technical Soundness

This project substitutes effective ODS alternative technology choices for the solvent cleaning lines in use. It includes the process definition, qualification, and installation of cleaning technology that will meet the unique needs as described in the document.

The use of existing equipment in two of the applications will somewhat restrict the technology choices, but they will be effective and can be used safely if appropriate procedures are followed.

Discussions with the company revealed that the gun part manufacturing line has downstream aqueous cleaning and has been judged to provide parts of good quality, which means that oxidation and occasional water marks pose only minimal problems. It also means that the use of an upstream aqueous cleaning process should be very satisfactory.

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Safety

The probable use of solvents must provide for low exposure levels, both acutely and chronically, due to their toxicity. Thus, in order to control exposure incidents, handling such as loading, unloading, solution makeup, and solvent transfer procedures (including spent materials) should be spelled out and people trained before they are permitted to become operators in the cleaning area. Periodic retraining is also recommended. Chronic exposure needs to be controlled via equipment design for appropriate exhaust and low emissions, and procedures need to be adopted which limit access or require respiratory protection if sampling shows it to be necessary. The limited number of operators should allow for thorough training to control incidents and chronic exposure.

6 Environmental Impact

For the electron gun parts manufacturing line, an aqueous(or semi-aqueous) process would have a minimal environmental impact. Discussions with the company revealed that the plant's existing waste treatment can readily handle the anticipated 20 -40 gallons per shift of detergent solution waste stream, from the wash sump.

For the other two lines, the use of a volatile solvent such as methylene chloride or trichlorethylene or perchloroethylene should have exposure controls as mentioned above, and spill control is extremely important to avoid ground water contamination. Spent solvent controls are also needed, to ensure proper disposal, in accordance with Country environmental standards.

7 Project Costs

The cost components identified in the project cover the equipment required, ventilation improvements for exposure control, the training component, and operational cost components needed to run safely and under adequate environmental control. Test costs of defining the process are primarily visual inspection by the enterprise, but the building of the parts and probable scrap and re-cleaning for recovery would be added costs. There is an allowance in the project for this.. The use of the relatively new machines by modification for the replacement solvents is a cost effective solution.The value of the machine to be replaced for the cleaning of electron gun parts is essentially scrap value. It is recommended, however, that the machine be evaluated to determine if it can be modified for use as a cold cleaning hydrocarbon machine.

8 Implementation Timeframe

The proposed implementation timeframe is feasible.

9 Recommendation

The project is sound, needed, and has a level of unit abatement cost - about $0.72/Kg/yr (ODS) that is very good, and at $7.20/kg/yr (ODP) is acceptable for TCA. Approval as proposed is recommended, with the proviso that the safety, environmental, and potential equipment repatriation issues will be addressed..

CLINTON NORRIS

9 JUNE 1994

PROJECT COVER SHEET

COUNTRY:	**CUBA**
PROJECT TITLE:	**Demonstration of Alternatives to CFCs and Pilot Phase of a CFC Recovery/Recycling Programme in the Domestic and Commercial Refrigeration Sector.**
SECTOR COVERED:	Refrigeration Sector / Airconditioning
ODS USE IN SECTOR:	311 tons per year (as per figures for 1991).
PROJECT IMPACT:	Reduction in CFC consumption by 10.2 tons/year.
PROJECT DURATION:	1 years.
ECONOMIC LIFE:	5 years.
TOTAL COST:	$US 230,000
PROPOSED MLF GRANT:	$US 230,000
COST-BENEFIT RATIO OF PHASEOUT:	5.9 US$/kg
COORDINATING NATIONAL BODY:	**Comision Nacional de Recursos Naturales de Ambiente (COMARNA).**
IMPLEMENTING AGENCY:	**UNDP**

PROJECT SUMMARY:

The project is to the expose and familiarize the Cuban Refrigeration/Air Conditioning Sector with various methodologies and technologies available to reduce the use and to phase out CFCs through:

- **workshop in good maintenance practices and overview and illustration of alternative technologies available**
- 3 hands-on demonstration activities in the refrigeration and airconditioning sectors
- Phase 1 of a recovery/recycling programme

The workshop and demonstration activities would include practical demonstration of equipment using alternatives to CFCs. A system for monitoring the quantities of CFC recycled (with periodic evaluation) is planned to ensure the success of the recovery/recycling programme.

PROJECT OF THE GOVERNMENT OF CUBA

DEMONSTRATION OF ALTERNATIVES TO CFCS AND PILOT PHASE OF A CFC RECOVERY/RECYCLING PROGRAMME IN THE DOMESTIC AND COMMERCIAL REFRIGERATION SECTOR.

1. PROJECT OBJECTIVES.

The two objectives of the project are:

1. To provide technical assistance for the domestic and commercial refrigeration services sector, by means of one national workshop and three demonstration activities on the use of alternatives to CFCs.

2. To initiate a National Programme of installation of equipment for CFC recovery, recycling for the refrigeration services sector.

2. SECTOR BACKGROUND

Cuba's Country Programme for the reduction of Ozone Depleting Substances (ODS) was approved in July 1993. It stipulates that 93.4 % of ODS is in the refrigeration and airconditioning sector (i.e. 311 tons of CFCs per year). The country programme included a list of projects in the refrigeration sector which were reviewed during a mission by UNDP to Cuba in February 1994 and which forms part of the present project.

Evolution in prices in the international market directly affects consumption in the country. In accordance with the provisions of the Copenhagen Amendment, CFC production will cease by the end of 1995 in the developed countries, which will affect its availability. In view of the fact that Cuba has to import all of its CFCs, and taking into account that the refrigeration service sector is the major consumer, the need has arisen to

- familiarize engineers and technicians in the sector with the new technologies replacing CFC-equipment.

- rationalize and economize the consumption of CFCs through a comprehensive recovery/recycling plan.

It should also be noted that the national workshop will utilize (among other materials) some of the existing training documentation and materials developed in the region previously, such as the ones prepared in a previous workshop in Venezuela in 1992 (including a training videotape). Furthermore, following UNEP documents will be made available at the workshop:

- Manual for Trainers, based on Regional Training Courses.
- Manual and Guidelines on Good Practices for Small and Medium-Size Systems.
- Technical Directory on Recovery and Recycling Machines

In view of the fact that UNEP and UNIDO are also actively involved in this sector, they will be asked to participate in one of the workshops.

3. PROJECT JUSTIFICATION.

One of the highest priorities in the phaseout of the use of CFC's in the refrigeration sector is to improve maintenance practices of technicians, repairing and servicing existing CFC-installations to avoid unnecessary losses and venting of CFC's. This project will disseminate this type of information (see activity 1).

The recovery/recycling project constitutes a first phase of a National Programme which aims at phasing out CFC for the commercial refrigeration sectors and will result in a phaseout of 10.2 tons of CFCs per year. To ensure its success, the Government will introduce a comprehensive monitoring system to check on a periodic basis how much CFC's are being recycled by each of the recovery equipments provided through this project. (See activity 5).

New refrigeration equipment to be purchased in the future will be using refrigerants other than CFCs. It is therefore important to disseminate information on alternative technologies associated with these new refrigerants. For the reasons stated above, the proposed demonstration and training activities for engineers and technicians in the sector and installation of CFC recovery-recycling equipment is considered a high priority for the country. During a recent visit by UNDP staff in Cuba, the need of this kind of demonstration activities was found to be most urgent to expose technicians in the sector with this kind of equipment for the very first time. (See activities 2,3,4).

4. PROJECT ACTIVITIES AND PROJECT COSTS.

Activity 1: National Demonstration Workshop on Good Maintenenance Practices, Recovery/Recycling Programmes and on Refrigeration Equipment using alternatives to CFC for the Domestic and Commercial Refrigeration Sectors.

To demonstrate alternative technologies to a large number of engineers/technicians working in this sector. A National Demonstration Workshop of three days will be held covering alternative technologies using propane, isobutane, mix of propane/isobutane, ammoniac, HFC-134a and HFC-152a, good maintenance practices, introduction of recovery/recycling programmes, etc.

	US$
4 International Consultants/Lecturers (see note) Agency Participation (UNEP, UNDP, UNIDO) (travel/DSA only)	20,000 9,000
Logistical Arrangements for Workshop	6,000
Duplication of Technical Literature	1,000
Contingencies	4,000
Total	40,000

Note: One consultant will also assist the counterpart in project preparation activities wherever needed.

Activity 2: Demonstration Activity for Refrigeration in the Tourist Sector.

Replacement of CFC-based cold storage rooms at two hotels of medium capacity using HFC-134a technology. Hotel "Kholy" with 136 rooms has 7 cold rooms, one of which will be replaced, eliminating the need of about 15 kg of CFC's per year for servicing. The other hotel "Hacienda Las Lagunas" will replace its only cold storage room which will also eliminate about 15 kg of CFC's per year for servicing. A one-day training workshop will be held at the hotels to demonstrate the new technology to technicians working in this sector.

	US$
Purchase of HFC-134a Installations for Cold Storage Rooms to be used in the two hotels for demonstration purposes (incl. transport and installation)	18,000
Hands-on training workshop for maintenance technicians	5,000
Contingencies	1,000
Total	24,000

Activity 3: Demonstration Activity for Airconditioning in the Public Health Sector.

Replacement of a CFC-based Airconditioning system in a pediatric hospital using HFC-134a technology. A one day training workshop will be held at this hospital to demonstrate the new technology to technicians working in this sector. Consumption of about 100 kg per year of CFC's for servicing will be eliminated.

	US$
Purchase of one HFC-134a Airconditioning System to be used in the hospital for demonstration purposes (incl transport and installation)	22,000
Hands-on training workshop for maintenance technicians	5,000
Contingencies	1,000
Total	28,000

Activity 4: Demonstration Activity for Refrigeration in the Commercial Sector.

Replacement of a CFC-based Refrigeration System in a Supermarket using NH_3 technology. A one day training workshop will be held at this supermarket to demonstrate the new technology to technicians working in this sector. Consumption of about 70 kg per year of CFC's for servicing will be eliminated.

	US$
Purchase of one Ammoniac Commercial Refrigeration System to be used in a supermarket for demonstration purposes (incl transport and installation)	20,000
Hands-on training workshop for maintenance technicians	5,000
Contingencies	1,000
Total	26,000

Activity 5: Recovering/Recycling Project

Creation of a National Recovery-Recycling Network, which will select, train and monitor a first batch of workshops where the recovery and/or recycling equipment will be utilized. Two 3-day workshops will be held to train the technicians. About 10 tons per year of CFC's will be eliminated through recovery/recycling. This amount was estimated as follows.

Each mobile recovery unit will service about 16 refrigerators per day with an average charge of 0.2 kg. Technicians might work in two shifts to obtain this number. It is estimated that out of the 16 units, about 13 will have CFCs which can be recycled. It should be noted that the non-usable CFCs (3 out of the 13 above-mentioned daily units).

It is also estimated that for each refrigeration unit that does contain re-usable CFC's, an average of 50% of the original charge will remain at the time of recovery. The 30 recovery units will therefore recover :

30 X 13 X 0.2 X 0.5 = 39 kg per day

In a year of about 256 working days one comes to 10 tons of CFC's per year.

	US$
International Consultant (3 missions) (see note)	18,000
30 mobile recovery systems	45,000
6 Recycling Units with quality control of CFC	24,000
5 Large storage cylinders 30 Small storage cylinders	2,500 2,500
Logistics for two 3-day workshops	10,000
Contingencies	10,000
Total	112,000

Note: Consultant will also assist counterpart in project preparation activities.

4. EXPECTED PROJECT RESULTS.

- Demonstration of alternative technologies and training of technicians in the refrigeration and airconditioning sector will be accomplished.
- After a 2-year period, beginning with the installation of the demonstration and recycling/recovery equipment, a reduction of 10.2 tons/year of CFC is expected.

5. TIMETABLE

- The national workshop will take place three months after the start of the project.
- The demonstration activities in the three subsectors (tourism, health and Commercial Refr.) will be implemented as soon as the equipment has arrived and has been installed successfully.
- Installation of CFC recovery/recycling equipment is planned for September 1994, after the operators have been selected and trained, and the contractual terms for the operation of the equipment have been defined.

6. COORDINATING NATIONAL BODY.

COMARNA will monitor the overall progress and implementation of all activities. Various activities will be implemented through the various ministries and institutes directly involved.

7. PROJECT COSTS

All capital costs were spelled out in paragraph 5 and their total amount equals US$ 230,000. No significant recurrent cost or savings are anticipated. For the Recycling activity (phase 1) possible savings due to recycled CFCs will be less or equal to the increased costs to introduce the recycling network for the very first time in Cuba (i.e. training needs of technicians, increased labor, installation of the monitoring system, etc).

a) Incremental Capital Cost	230,000 US$
b) Project Economic Life Time	5 years
c) Incremental Recurrent Cost	nil
d) CFC Consumption	10.2 tons/yr
e) Capital Recovery Factor (5 years)	0.2638
Unit abatement cost (a * e + c) / d	6.0 US$/kg

PROJECT COVER SHEET

COUNTRY:	**CUBA**
PROJECT TITLE:	Demonstration of Fire Extinguishing Methods using Alternative Agents
SECTOR COVERED:	Halons Sector
ODS USE IN SECTOR:	3.6 tons per year (as per figures for 1991).
PROJECT IMPACT:	N/A (Demonstration Project)
PROJECT DURATION:	1 year.
TOTAL COST:	$US 46,900
PROPOSED MLF GRANT:	$US 46,900
COORDINATING NATIONAL BODY:	COMARNA
GOVERNMENT EXECUTING AGENCY:	National Fire Protection Department, Ministry of the Interior
IMPLEMENTING AGENCY:	UNDP

PROJECT SUMMARY:

Although the use of halogenated substances in fire extinguishing in Cuba is small and properly monitored by the institution governing that activity (Ministry of the Interior), the country has nevertheless expressed the wish to phase out and restrict their uses, in view of the fact that installations based on halons will always contain a potential risk of emissions into the atmosphere. For this reason, it is necessary to gradually introduce alternative fire extinguishing agents which could replace the halons-based systems, and which would be acceptable from an environmental point of view. In this context, the Ministry of the Interior, as the governing body for fire protection in the Republic of Cuba, together with other Cuban government institutions, and with the cooperation of UNDP, has proposed to develop a demonstration programme of alternative fire extinguishing methods. Alternative fire extinguishing methods that will be demonstrated during this project include N_2, CO_2, water, water mist, etc. Therefore, appropriate systems that decrease the negative effects to the ozone layer and at the same time allow demonstration and training of technicians and responsible personnel in the use of those substances is required.

PROJECT OF THE GOVERNMENT OF CUBA

DEMONSTRATION OF FIRE EXTINGUISHING METHODS USING ALTERNATIVE AGENTS

A. Development problems to be addressed through the proposed project

Although the major responsibility for the reduction and future elimination of the use of halons as extinguishing agents, as well as the installation of extinguishing systems using alternative substances that produce a similar effect during the extinguishing of a fire belongs to the National Fire Protection Department of the Ministry of the Interior, those measures also have a direct effect on other state-administered organizations, private institutions, and the people as a whole.

The Ministry of the Interior has designed a strategy of "conducting technical and economic feasibility studies for the development of modifications to existing fire extinguishing equipment and facilities using halons, through the use of alternative extinguishing agents." The project will be developed within this Ministry of the Interior, with the principal beneficiary being its subsidiary agency, the National Fire Protection Department.

B. Project justification

The specific problem to be addressed through the execution of the project is the substitution for and eventual elimination of halons as extinguishing agents, through the use of alternative substances.

At the conclusion of this project, it is expected that the body governing fire protection activity in the country will master the specifics of each type of alternative fire protection system, in such a way that it will be skilled and trained in its respective uses, with a view to achieving the replacement or conversion of systems employing halogenated agents throughout the country. Emphasis will also be put on halon banking systems.

This project will represent the first step towards full replacement of halons based systems throughout the country. The intended beneficiaries will be state-administered organizations and private institutions that use fire extinguishing systems, and more particularly, technical specialists and personnel involved with fire protection, who would gain the necessary expertise in the use of those systems.

C. Immediate objectives and activities

1. Familiarization with the experience gained in other countries in alternative fire extinguishing facilities.

   1.1. A technical assessment mission to become familiar with similar facilities as well as gaining experience with them.

   1.2. Designation of the technology to be selected for startup of the demonstration and training facility in fire protection.

2. Planning and installation a facility where demonstration equipment will be installed to illustrate the use of alternative fire fighting methods. At least two alternative methods will be demonstrated through this demonstration equipment : N_2 and water mist.

   2.1. Acquisition of demonstration equipment.

   2.2. Subcontract for installation of demonstration equipment

3. Demonstration and training in fire extinguishing methods in the facility and develop habits and practical skills necessary for the use of those systems.

   3.1. Demonstration workshops for technicians and specialists

   3.2. Development of training methods for personnel involved with the operation of those systems

D. Inputs

External inputs planned for the execution of the project amount to US$ 46,900 to be committed during 1994:

Items	1994	Total
Public dissemination	4,000.00	4.000.00
Technical Assessment Mission	8,000.00	8,000.00
Equipment and accessories	30,000.00	30,000.00
Subcontract for Installation	2,900.00	2,900.00
Contingency	2,000.00	2,000.00
Project total:	46,900.00	46,900.00

E. Review and submission of reports

Review and submission of reports on the results of tests will be provided as requested by the financing agency, in this case UNDP. The technical-economic evaluation may be conducted by all of the parties involved in the project, in order to reach definite conclusions on the objectives established.

PROJECT COVER SHEET

COUNTRY:	INDIA
PROJECT TITLE:	BAKELITE HYLAM LIMITED PHASEOUT OF CFCs IN THE MANUFACTURE OF PHENOLIC FOAM AND FOAM PRODUCTS
SECTOR COVERED:	Foamed Plastics
ODS USED IN SECTOR:	1577 T CFC (= ODP) 1991
PROJECT IMPACT:	Phaseout 58 T CFC-11 AND CFC-113
PROJECT DURATION:	One year
PROJECT ECONOMIC LIFE:	10 years
TOTAL PROJECT COST:	Incremental Capital Cost USD 367,000
PROPOSED MLF:	USD 367,000
COST EFFECTIVENESS:	USD 1.03/kg/yr
COORDINATING NATIONAL BODY:	Ministry of Environment and Forestry (MOEF)
IMPLEMENTING AGENCY:	UNDP
APPRAISAL DATE:	December 1993/May 25, 1994

PROJECT SUMMARY

Bakelite Hylam Limited (BHL), set up in 1948 and a pioneer in the field of thermosets, started manufacture of decorative laminates and industrial laminates in 1951. BHL set up resin making facilities in 1961 and besides meeting the captive requirements for laminates, has since been manufacturing phenolic resins and unsaturated polyesters. BHL has a fully equipped, modern Research & Development laboratory approved by the DST. As an inhouse R&D effort, Bakelite Hylam has developed phenolic foam based on speciality phenol-formaldehyde resins. BHL has been marketing this product since 1988 in the form of continuous slabs, blocks and contoured pipe sections. The main blowing agents used are CFC 11 and CFC 113. Approximately 30T of blowing agent was used in 1991-92 and the projected usage for 1993-94 is 58T. BHL has planned to consume 72T CFC in the year 1994-95. Most of the products manufactured find application in thermal insulation, false ceiling and process pipe insulation. BHL also exports phenolic foam blocks to South East Asia and some Middle-East countries and has a substantial plan to export large volumes to these areas.

Phaseout of CFCs (ODS) is required as a country policy as well as to meet the growing export market for CFC free products. HCFC 141 b and n-Pentane has been found to be a suitable substitute for phenolic foam formulations. However, the discontinuous block making machine and the continuous foam boarders are not suitable for such a drop-in-substitute. An active programme is already in hand to evaluate the long term effects of such substitutes in phenolic foam, which is showing a promising trend.

To achieve the phaseout of CFCs, replacement of blending, metering and mixing systems along with proper explosion and fire protection devices would necessarily have to be introduced. It is also expected that the incremental costs for such substitute would be relevant because of the non-availability as well as the current international market prices, specially 141 b. It is expected that in due course of time, HCFC would also be replaced with the proper HFCS

.....2/-

substitute. Hence a one-time modification to the plant and machinery suitable for the manufacture of phenolic foam is a very relevant proposition. However, while considering the use of such substitutes (141b, n-pentane, etc.) one has to be aware that the thermal conductivity would not be the same as that of CFCs and till such time that an exact substitute is found, a higher thickness may be necessary for the same insulation value, which the manufacturer may have to absorb as an interim measure.

Therefore, a proposal is being put forward for consideration of a changeover which would be an interim solution and for an eventual long term solution.

Prepared by: Bakelite Hylam
Mr. Roy

Reviewed by: Bert Veenendaal
UNDP Foam Sector Expert

PROJECT OF THE GOVERNMENT OF INDIA

BAKELITE HYLAM - ELIMINATION OF CFC 11 AND CFC 113 IN THE MANUFACTURE OF RIGID PHENOLIC FOAM AND FOAM PRODUCTS USED FOR THERMAL INSULATION.

1. PROJECT OBJECTIVES

i) to phase out the use of CFCs in the production of rigid phenolic foam for the insulation of buildings, cold storages, false ceiling and plant and equipment

ii) to participate in the National Objective which satisfies the Montreal Protocol in the preservation of the environment

iii) through technology and plant upgradation to meet such requirement

2. SECTOR BACKGROUND

Indian foam industry consumed 1557 T CFCs in 1991 (Ref. India country programme). CFC 11 was dominant substance followed by CFC 12 as shown in table I.

Table I

ODS Consumption in Foams (1991 : metric tons)

Category		CFC 11	CFC 12	CFC 113
Polyurethane Foams (PUF)				
Flexible PUF		160		
Rigid PUF		975		
Refrigerator Insulation	500			
General Insulation	250			
Thermoware	225			
Integral Skin, RIM and Misc.		62		
Phenolic Foams		15		15
Thermoplastic Foams		70	280	
Total		1282	280	15

The sector experiences impressive growth based on :

- o The current low polyurethane use per capita;
- o The current and expected growth in GNP;
- o The substitution of the use of mine al fibres by rigid PUF in the insulation of refrigerations;
- o Substitution of fire prone insulating material with phenolic foam

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

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

Complete phaseout for foams other than rigid PUF is targetted for the year 2000, rigid PUF are expected to be CFC-free from the year 2006. Phenolic foam substitution can be implemented by 1995 if desired.

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

3. ENTERPRISE BACKGROUND

Bakelite Hylam Limited (BHL), which was established almost half a century ago, has a very strong market presence backed up by a strong R&D and technical support cell. Apart from being pioneers in the field of thermosets, BHL has done pioneering work in developing and marketing phenolic foams with low thermal conductivity and exceptional fire resistant properties. At present, most of the insulation foam manufactured by BHL is based on CFCs. As BHL has set on a trend in adopting forward technology, several alternative blowing agents have been looked at and it is established by the company that n-Pentane and 141 b could be used as substitute for CFC 11 and CFC 113 in the manufacture of phenolic foams. However, it has not so far been possible to attain the same thermal resistance performance with such substitutes. The company envisages to cross production of 1000 T of phenolic foam by 1995. BHL has plans to double its production capacity of phenolic foam in future.

4. PROJECT DESCRIPTION

Under the project, Bakelite Hylam Limited will phase out the use of CFCs in the production of rigid phenolic foam and foam products. At present, for the phaseout programme 141 b and n-Pentane would only be considered. It is envisaged that HCFC/Pentane to HPC change over would not need much modification of the hardware.

This project would require the replacement of the wet end of the laminator which is not suitable for the change over. Zaco (PTI) bv, one of the world leaders in the manufacture of continuous laminators, have designed and supplied the plant and machinery. On the basis of detailed discussion with them, the following conclusion has been arrived at for the necessary change over to n-Pentane/HCFC 141 b keeping the safety factors fully in mind.

5. TECHNOLOGY

5.1 OVERVIEW

The appropriate technology for a drop-in-substitute though not known, our in-house developmental work during the last three years has shown a distinct feasibility of HCFC (141 b) and n-Pentane being used for such a purpose. The long term effects of thermal conductivity drift and higher conductivity value still is a matter of concern. It may be necessary that a special purpose surfactant would have to be developed to counteract such problems. Initially, therefore, it may be necessary to absorb some of the cost involved in offering higher thicknesses so as to achieve the same thermal resistance.

5.2 SELECTION

BHL has selected the use of n-Pentane and 141 b as the blowing agent to participate in this programme which would include use of higher molecular weight higher viscosity resol system.

5.3 REQUIRED MODIFICATION

Because of the higher viscosity and pre-blending requiring inflammable blowing agents, it would be necessary to replace the entire wet end of the plant and machinery and also to incorporate adequate safety measures against fire and explosion hazard. This would include replacement and incorporaton of the following plant and machinery as discussed in detail with Zaco (PTI) bv, The Netherlands, the original suppliers of our foam plant. A quotation (Annexure II) has also been obtined from them along with a P & I diagram for such a change over.

The change over that needs to be carried out in the BHL foam boarder would be :

a. Metering Skid
b. Mixing head with hydromotor 12 KW
c. Hydraulic unit 15 KW
d. Set of Hoses and piping
e. Pentane detection panel + 6 sensors for the oven
f. Metering panel with close loop system
g. Operator panel
h. Pentane bulk tank and ex-bulk equipment
i. Engineering service
j. Local scope of work
k. Cabling, erection

l. Extractor system laydown

m. Piping

n. Supervision, travel of foreign technicians, packing, transportation, etc.

USD 367,000

6. PROJECT COST SUMMARY

6.1 SUMMARY OF PROJECT COSTS

The total project incremental cost of $373,400 is calculated as the capital cost. The capital costs include all the modifications as per paragraph 5.3 and Annex II, and comes to USD 367,000. No incremental recurrent cost is claimed. The analysis and estimation of incremental recurrent costs is presented in Annex I.

6.2 UNIT ABATEMENT COSTS

a)	Incremental Capital Cost	USD 367,000
b)	Capital Recovery Factor (10 yrs)	0.16275
c)	Incremental Recurrent Cost	----
d)	CFC (ODS) Reduction/Y	58,000 kg

Unit Abatement Cost = (a(b)+ c)/d = 1.03 USD/kg/yr

7. FINANCING PLAN

The company requests the financing of the project incremental capital cost of USD 367,000.

8. PROJECT IMPLEMENTATION

8.1 MANAGEMENT

It is proposed that the company will enforce the changes and UNDP-OPS will oversee this project. This project is significant for future projects in India under the Montreal Fund as it will function as a "beacon" project. An intensive observation and supervision by an agency with experience in similar projects shall be called for.

8.2 PROCUREMENT

It is proposed that UNDP's office for project services (OPS) will arrange the project procurements. OPS would cooperate with local UNDP office and MOEF, and receive technical assistance from UNDP-UNS.

8.3 SCHEDULE

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

9. REQUIRED REGULATORY ACTION

The project requires no regulatory action.

10. PROJECT IMPACT

This project will eliminate the use of at least 58 tons of CFC 11 in the first year of implementation. Market growth indicates that this may increase by 10% annually in subsequent years. BHL's past performance dictated by 'concept' selling considerations of phenolic foam, cannot be a factor to determine future volumes and BHL is all set for accelerated volume growth, the concept having been established. The project employs commercially and environmentally acceptable technology.

ANNEX I

INCREMENTAL RECURRENT COST

ASSUMPTIONS:

• CFC-11/113 mixture price:	USD 2,500/t
• Pentane price:	USD 1,500/t
• 1 part CFC replaced by 0.7 part pentane	
• Density increase to maintain insulation properties:	5-10 %
• Annual production:	1,000 t
• Materials cost based on CFCs	USD 1.58/kg

BEFORE:	58 t CFCs @ $ 2,500	USD 145,000
AFTER:	40 t Pentane @ $ 1,500	USD 60,000
	Density Increase: 5-10% at cost @ $ 1,580	USD 79,000 - 158,000

Incremental Recurrent Cost/Benefits USD 6,000 (benefit) - 73,000 (Cost)

Because of the uncertainty of the final density, the incremental cost analysis is ambiguous and no incrmental cost is therefore claimed.

ANNEXURE II

Price breakdown of modifications Bakelite laminator (22-11-1993)

PRICES

Description of equipment/works	Part A cost for modif. of plant to PENTANE	Part B add.modif. for update machine as Sellink	Part C optional extra's
Supply Zaco (PTI)			
Paperstand for 3 rolls (top paper)			[illegible]
Paperstand for 3 rolls (bottom-paper)			39.750,=
Fife unit top-paper		15.315,=	
Fife unit bottom-paper		14.400,=	
Laydowntable (baseframe 9 mtr)		29.625,=	
Heating sections (hot water + vacuum)		-	34.500,= *
Sideguidance laydown (Sellink syst)		3.750,=	
Movable traverse bridge + flushtray		20.250,=	
Traverse beam with heavy Hepco rail		18.750,=	
Nipunit with vacuum plate(as Sellink)		90.000,=	
Vacuumfan for nip unit		4.500,=	
Flexible cabletray for laydown system		4.500,=	
Factory assembly of laydown equipment		18.000,=	
Metering skid,50 kg (acc flowscheme)	112.500,=		
Mixinghead with hydromotor 12 Kw	15.000,=		
Hydraulic unit 15 Kw	30.000,=		
Set of hoses + piping (skid -> head)	7.500,=		
Pentane detection panel + 6 sensors	57.000,=		
Metering panel with closed loop syst.	95.500,=		
[illegible]	[illegible]		
Traverspanel with servomotor drive		68.000,=	
Operator panel with Sony nip read-out	4.900,=		
Temp.controllers for heating sections			7.500,= *
Switchboxes for paperstands			750,=
Pentane bulktank + Eex bulk equipment	90.000,=		
6 mtr.insulated conveyor with hatch		26.000,=	
Factorytest of traverse system		5.250,=	
Engineering			
Part A	12.000,=		
Part B		20.000,=	
Part C			7.500,= *
Total value of imp. goods (ex facory)	429.[illegible]00,=	338.340,=	129.750,=
LOCAL works and supplies(by Bakelite)			
Dismanteling of existing meteringunit	4.000,=		
Dismanteling of existing laydowntable		6.000,=	
Dismanteling of existing paperstands	2.000,=		2.000,=
Dismanteling of existing curing conv.		2.000,=	
Erection part A (4 weeks local men)	10.000,=		
Erection part B (2 weeks local men)		5.000,=	
Erection part C (1 week local men)			2.500,=
Cabling part A (incl. materials)	30.000,=		
Cabling part B (incl. materials)		8.000,=	
Cabling part C (incl. materials)			3.000,=

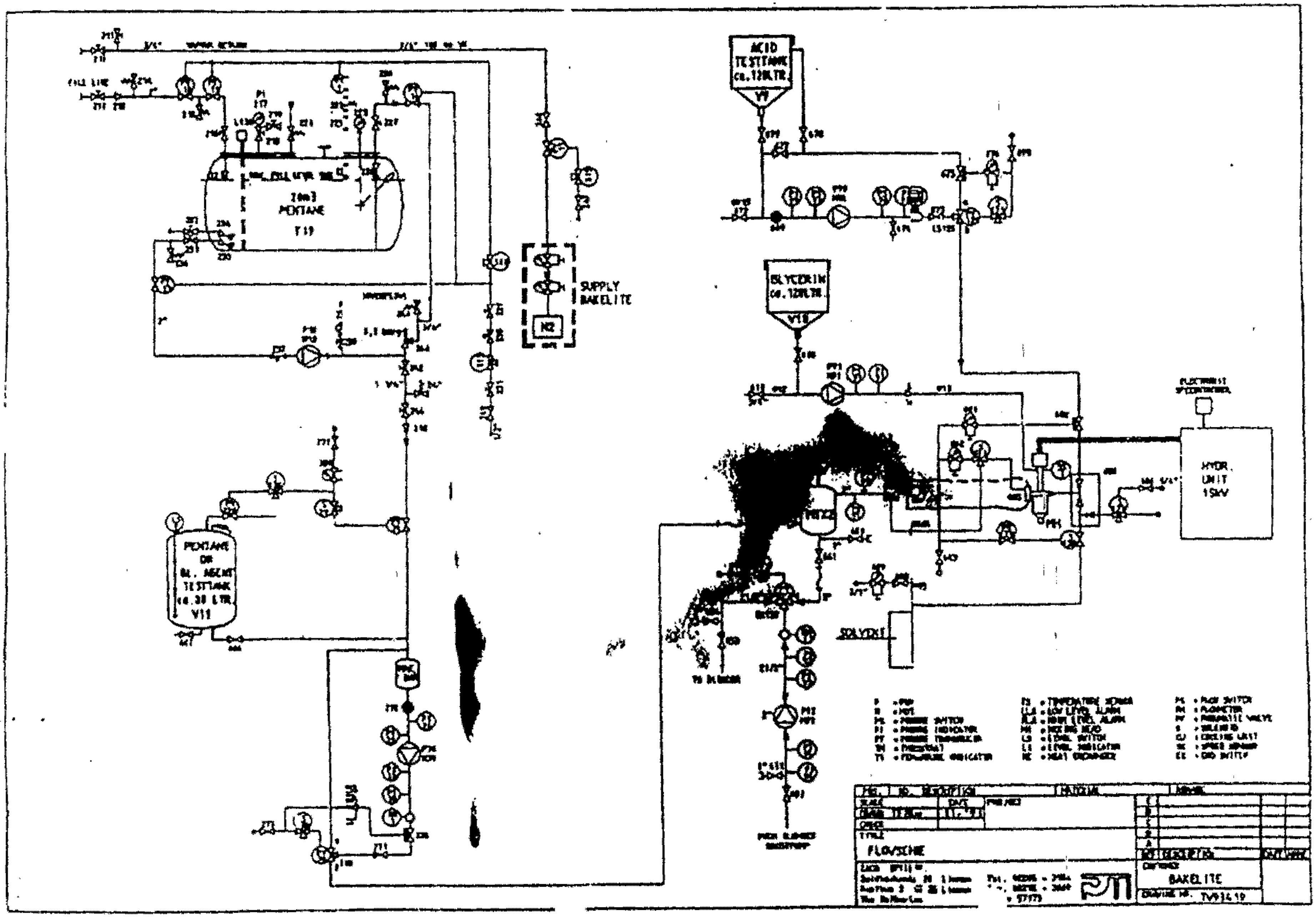
ANNEXURE II

Local works and supplies(by Bakelite) (continued)			
Extraction system metering/laydown	30.000.=		
Rerouting piping (blenders -> skid)	15.000,=		
Pentane piping (bulktank -> skid)	10.000,=		
Pentane tankembedding, filling-point, protection-pipes and fence with doors	22.000,=		
hot air flow trough curing section		7.500,=	
Hotwaterunit for heatingsections			4.000,=
N2 battery with 2-step press.reducer	8.000,=		
Modification of laydown enclosure	7.000,=		
Supervision (ZACO)			
Mechanical eng. 4 weeks part A	25.000,=		
Electrical eng. 4 weeks part A	25.000,=		
4 return tickets	12.000,=		
Mechanical eng. 2 weeks part B		12.500,=	
Electrical eng. 2 weeks part A		12.500,=	
2 return tickets		6.000	
Mechanical eng. 1 week part C			6.250,=
Electrical eng. 1 week part C			6.250,=
2 return tickets			6.000,=
Local cost ZACO supervisors (hotel and expenses,paid by Bakelite)			
Part A (2 men)	6.000,=		
Part B (2 men)		3.000,=	
Part C (2 men)			1.500,=
Packing of electrical panels (crates)	4.000,=	800,=	
Transport equipment (House/house)			
Part A (1 container 20 ft)	10.000,=		
Part B (1 container 40 ft)		15.000,=	
Part C (1 container 40 ft)			15.000,=
Total cost DFL	649.900,=	416.640,=	176.250,=
	Part A+B+C = Dfl [illegible]		

Dfl 649900 = 367,175 USD

@ 1 USD = 1.77 Dfl

ANNEXURE II


ACID TESTTANK ca. 120LTR.
V9
GLYCERIN ca. 120LTR.
V10
20m3 PENTANE
T19
PENTANE OR BL. AGENT TESTTANK ca. 30 LTR
V11
SUPPLY BAKELITE
N2
HYDR. UNIT 15kV
SOLVENT
FLOWSCHE
BAKELITE

TECHNICAL REVIEW

PREPARED BY: Bert Veenendaal
UNDP Foam Sector Expert

DATE: June 11, 1994

1.	COUNTRY OF ORIGIN:	INDIA
2.	PROJECT TITLE:	Bakelyte Hylam Limited Phaseout of CFCs in the manufacture of phenolic foam and products
3.	(SUB)SECTOR:	Foamed Plastics
4.	CP RELATIONSHIP:	Included in the Country Programme
5.	TECHNOLOGY:	The choice n-pentane as replacement technology is supported. HCFC-141b seems not necessary as pentane could be implemented directly and is more cost effective. The company seems to realize this as the operating cost are based on pentane
6.	ENVIRONMENTAL IMPACT:	Pentane is highly flammable and should be handled accordingly. The project addresses this. Pentane also is photochemically active and its status under Indian regulations should be checked
7.	PROJECT COSTS:	There are no UAC (unit abatement cost) standards available for Phenolic Foams. Compared with other insulation foams the cost seems normal (about 1.50-2.50 US$/kg/y seems standard)
8.	IMPLEMENTATION:	Adequate
9.	RECOMMENDATIONS:	The project is recommended

PROJECT COVER SHEET

COUNTRY:	India
PROJECT TITLE:	U-FOAM PRIVATE LTD phaseout of CFC use in the manufacture of polyurethane foams
SECTOR COVERED:	Foamed plastics
ODS USE IN SECTOR:	1,577 tonnes CFCs (=ODP) in 1991
PROJECT IMPACT:	Phaseout 35 tonnes/year of CFC-11 (base 1993)
PROJECT DURATION:	One year
PROJECT ECONOMIC LIFE:	10 years
TOTAL PROJECT COST:	USD 395,000 Incremental Capital Cost USD 13,500 Incremental Recurrent Cost
PROPOSED MLF GRANT:	USD 408,500
COST EFFECTIVENESS:	US$ 1.95/kg/y
COORDINATING NATIONAL BODY:	Ministry of Environment and Forests (MOEF)
IMPLEMENTING AGENCY:	UNDP
APPRAISAL DATE	May 24, 1994

PROJECT SUMMARY

Under this project U-FOAM will phaseout the use of CFCs in its production of flexible and rigid PUF through a combination of methylene chloride, water blown technologies and HCFCs. The project will require upgrading of existing ventilation systems, replacement of a low pressure foaming unit by and acquisition of some ancillary equipment. Higher production costs for rigid PUF are partly offset by savings through the use of methylene chloride in the slabstock process. The use of HCFCs constitutes an interim solution and the company intends to replace these by HFCs as soon as such technology is economically viable. The upgraded equipment is already suited for such a use.

PROJECT PREPARATION AND TECHNICAL ASSESSMENT

The project was preapred by Mr. Bert Veenendaal with the assistance of national foam sector consultants. The project has been reviewed and approved with modifications by Dr. Mike Jeffs together with an explanation how these comments are addressed.

PROJECT OF THE GOVERNMENT OF INDIA

U-FOAM PRIVATE LTD ELIMINATION OF CFC-12 IN THE MANUFACTURE OF POLYURETHANE FOAMS.

1. PROJECT OBJECTIVE

The objective of this project is to (i) phaseout the use of CFCs in the production of rigid and flexible PU foams; (ii) to assure safe workplace conditions in the use of methylene chloride as a CFC-replacement technology.

2. SECTOR BACKGROUND

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

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

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

The sector experiences impressive growth, based on:

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

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

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

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

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

3. ENTERPRISE BACKGROUND

U-FOAM was founded in 1960 as one of the first Indian enterprises involved in the production of polyurethanes. The enterprise manufactures:

Application	Equipment
Flexible Slabstock PUF	UBT 65 Hennecke HP Machine
Flexible Molded PUF	HK 270 Hennecke HP Machine
Rigid PUF Panels	Low Pressure Units
Rigid and Flexible PUF Bunstock	Semi-Automatic Batch Mixer
Rigid PIR and PUR Spray Foams	H-11 Gusmer LP Machine
	H-250 Hennecke LP Machine

The company currently employs 140 in locations at Hyderabad. Main markets are furniture, bedding, automotive and miscellaneous insulation applications.

4. PROJECT DESCRIPTION

U-FOAM utilized in 1993 about 35 tons CFCs in the manufacture of flexible PUF (slabstock, molded and bunstock), rigid PUF (panels, spray) and PIRF (spray). The company has on its own already phased out a considerable larger amount through replacement by methylene chloride, but is facing some process and industrial hygienic burdens that keep at this moment it from further replacement.

Under this project U-FOAM will phaseout the remaining use in its various processes as follows:

- o Slabstock: methylene chloride; softening additives;
- o Molded: water based high resilience foam systems;
- o Block molded: methylene chloride; HCFC-22;
- o Panels: HCFC-22;
- o Spray foam: HCFC-22.

To achieve this in a safe way without undue impairment of processing and product quality it is necessary to

- o Improve the ventilation systems;
- o Add a metering unit;
- o Replace the low pressure panel unit;
- o Add a blending unit;
- o Add a chiller and a mold heater.

In addition, process and safety training on the use of methylene chloride will be needed. This is to be provided by an external process specialist.

The use of methylene chloride will ultimately provide some cost savings, that will offset a part of the higher production costs for high resilience and HCFC-22 foams.

The company is aware that the use of HCFCs constitute an interim solution and is prepared to follow-up with permanent replacement when feasible. The equipment will be capable to that purpose at no or minimal additional investment.

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.

Routes to replace CFCs in the production of rigid PUF (R-PUF) and polyisocyanurate foams (PIRF) include:

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

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

The first solution--also called the "liquid" solution--employs technology 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 has recently been commercially introduced on several occasions, but its flammable character requires safety conditions and limits its use.

5.2 SELECTION

The enterprize intends to phaseout CFCs in the slabstock production by completing any feasible replacement by methylene chloride and the use of an 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.

In the rigid foam production reduced CFC followed by residual phaseout through the use of an HCFC is preferred. HCFC-22 is the blowing agent of choice, but HCFC-141b may also be considered in initial trials to provide comparative data.

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 an additional metering stream for the use of a softening agent.

Because of higher viscosities and low boiling point of the HCFC-22, high pressure manufacturing equipment is required. In addition, existing high pressure equipment has to be checked on proper pump ratio's and modified in case of fixed ratio's or insufficient range. Auxiliary blending equipment will be needed as future polyol systems may be delivered without pre-blended blowing agents.

The complexity of the product range of U-FOAM will require careful adjustment of formulations. This will be done with the help of an external process specialist, who will also provide the necessary safety training & perform an industrial hygienic survey.

6. PROJECT COSTS

6.1 SUMMARY OF PROJECT COSTS

The total project incremental cost of USD 595,000 was calculated as the incremental capital costs plus the net incremental recurrent costs for four years discounted at 10%.

6.2 CAPITAL COSTS

The following capital costs are expected related to this project:

o	Upgrading of ventilation and encapsulation systems	USD 40,000
o	Additive metering system	USD 5,000
o	Chiller for existing HP equipment	USD 10,000
o	Mold oven	USD 40,000
o	Premixer	USD 75,000
o	HP foaming unit for panels	USD 150,000
o	Modification of a fixed gear HP unit	USD 10,000
o	Monitoring unit for ambient air quality	USD 5,000
o	Trials, training, IH survey	USD 25,000
o	Contingency and rounding	USD 35,000
	TOTAL INCREMENTAL CAPITAL COSTS	**USD 395,000**

Annex-A provides more detailed information.

6.2 OPERATING COSTS

The company expects recurrent incremental costs based on higher prices for polyol and HCFC-22 as well as from formulation changes. These costs are expected to amount to USD 316,000 over the four years following implementation (1995 thru 1998). Net present value of these costs at 10% discount amounts to:

USD 13,500

Annex-B provides more detailed information.

6.4 UNIT ABATEMENT COSTS

a)	Incremental Capital Costs......................USD	395,000
b)	Capital Recovery Factor...........................	.16275
c)	Incremental Recurrent Costs (1993).............USD	4,000
d)	CFC Consumption (1993)..........................kg	35,000
	UNIT ABATEMENT COSTS [(a(b) + c)/d]..........USD/kg/y	**1.95**

7. FINANCING PLAN

The company requests reimbursement of <u>US$ 328,500</u> representing all eligible incremental costs.

8 PROJECT IMPLEMENTATION

8.1 SCHEDULE

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

8.2 MANAGEMENT

IDBI (Industrial Development Bank of India) will oversee the administrative and operational aspects of this project. UNDP's foam sector experts will provide technical advice and technical monitoring of the project.

8.3 PROCUREMENT

Local procurement will be supervised by IBDI following UNDP rules.

9. REQUIRED REGULATORY ACTION

The project requires no regulatory action.

10. PROJECT IMPACT

This project will eliminate the use of at least 35 tonnes of CFC-11 in the first year of implementation.

11. ANNEXES

Annex-A: Detailed Capital costs
Annex-B: Calculation of recurrent incremental costs
Annex-C: Technical Review

IND/UFOAM004
94-06-08

ANNEX-A

INCREMENTAL CAPITAL COSTS
U-FOAM PROJECT

The following explanations can be offered to the budget as proposed in the project document:

VENTILATION UPGRADE

Experience values from other projects (Indonesia, China, Egypt) are used to establish the value of USD 40,000. It includes the encapsulation of a slabstock unit and a bunstock unit as well as improved ventilation in two production area's. The figure is relatively low compared with other projects because of plant layout and existing systems that need only upgrading and not replacement.

NEW EQUIPMENT

Price inquiries are made by phone at several manufacturers. prices received are also compared with other projects (Sunpra, India; MISR Foam, Egypt and Mobica, Egypt).

TRAINING, TRIALS, IH-SURVEY

The following trials are needed:

o Slabstock	- external consultant:	
	7 days @ 500.........3,500	
	DSA,TA............1,000	
	Travel............5,000.......	USD 8,500
	- Chemicals for Trials.....20,000	
	foam value......(10,000)......	USD 10,000
o Bunstock	- Chemicals for trials......2,500	
	foam value.......(1,500)......	USD 1,000
o Panels	- Chemicals for trials..... 5,000.......	USD 5,000
	(no rest value)	
o IH-survey	- One day @ 500.........................	USD 500
TOTAL..		USD 25,000

(Survey to be done by external consultant)

ANNEX-B

INCREMENTAL RECURRENT COSTS
U-FOAM PROJECT

The following incremental recurrent costs would occur if U-FOAM had converted in 1993:

SLABSTOCK/FLEXIBLE BUNSTOCK

Old	10,000kg CFC-11 @ 3.50...USD	(35,000)		
New	10,000kg MC @ 1.00...USD	10,000..........USD	(25,000)	

PANELS/SPRAY/RIGID BUNSTOCK

Old	77,000kg System @ 3.56....USD	(274,000)	
New	77,000kg System @ 3.94....USD	303,000..........USD	29,000

TOTAL INCREMENTAL RECURRENT COSTS..............USD 4,000

Assuming a 10% discount rate and four years of operation, this amounts to a net present value of:

USD 13,500
==========

TECHNICAL REVIEW

U-FOAM

SCOPE

The project is concerned with the replacement of CFC 11 in the manufacture of a range of flexible and rigid polyurethane foams.

RECOMMENDATION

The project is supported subject to clarification / rectification of the items below.

RELEVANCY AND ADEQUACY OF INFORMATION

Generally adequate. No equipment quotations are included. Price enquiries by phone and comparisons with other projects are not sufficient.

TECHNICAL SOUNDNESS

The choices of replacement technologies are generally sound. The use of methylene chloride and water blowing are the norms for slabstock and moulded foams respectively. For the rigid foams, the use of HCFC 22 for panels should be suitable since the steel facings will provide adequate projection against the high rate of thermal conductivity ageing for this blowing agent. For spray foams the foam thickness can be adjusted for the reduced aged insulation value.

The use of HCFC 22 for block moulded flexible foams is not supported - on the basis that HCFCs should not be used in a non insulating or non integral skin foams for safety applications. The project should be examined in this light. (Reviewer's understanding is that bunstock in this context is flexible - Annex B is confusing in this respect.)

LESSON FROM EXPERIENCE

None

ENVIRONMENTAL ISSUES

Use of HCFCs should be limited to insulation foams or integral skin foams as noted above. HCFC 22 is recognised as an interim solution and its replacement by a zero ODP blowing agent should be implemented as soon as practicable.

SAFETY ISSUES

The safety issues associated with the use of methylene chloride appear to be adequately addressed. The implementing agency should satisfy itself that the modifications and training are fully implemented.

COST EFFECTIVENESS

Unit Abatement Cost is reasonable.

OTHER

None

GMFJ/kd/15/9/93

Comments are addressed as follows:

1. Implementation will be subject to international bidding, following UNDP rates. This satisfies the reviewer.

2. HCFC-22 is not intended for flexible foam. Rather MC will be used in this case.

3. Reviewer's understanding of the block foam process is incorrect. It produces flexible as well as rigid foams from different dispensers.

PROJECT COVER SHEET

COUNTRY:	India
PROJECT TITLE:	Strategy and Action Programme for the Elimination of CFCs in the Manufacture of Foams
SECTOR COVERED:	Foamed plastics
ODS USE IN SECTOR:	1,577 tonnes CFCs (= ODP) in 1991
PROJECT IMPACT:	Preparation of a detailed action and monitoring plan to eliminate the use of CFCs in foams (all categories). The action plan is a condition for an orderly, cost-effective ODS phaseout
PROPOSED BUDGET:	US$ 270,000
EXECUTING AGENCY:	Ministry of Environment and Forests (MOEF)
IMPLEMENTING AGENCY:	UNDP

PROJECT SUMMARY

MOEF is the coordinating national body for the implementation of the ODS phaseout programme in India. To effectively and efficiently implement such a task, it will be necessary to develop detailed, sector specific strategies that will address information, motivation identification, technology selection, etc.

This project is to formulate such a strategy as well as develop and implement a related action plan for the foam sector, the third largest ODS consuming sector in India with 15% of the total consumption.

The strategy will build on preliminary work that was done as part of the CP preparation. The work plan will include an industry survey, workshops for awareness creation and technology transfer, and needs/requirements analysis for chemicals and equipment for ODS phaseout projects to guide the local supply industry in suitable capacity build-up.

PROJECT OF THE GOVERNMENT OF INDIA

STRATEGY AND ACTION PROGRAMME FOR THE ELIMINATION OF CFCS IN THE MANUFACTURE OF FOAMS

1. PROJECT OBJECTIVE

The objectives of this project are: (1) to collect information needed to prepare for a complete phaseout of the use of CFCs in foamed plastics in Indian industry; (2) to prepare an ODS phaseout strategy; and (3) to prepare and implement a detailed action plan for the specified ODS phaseout.

2. SECTOR BACKGROUND

The Indian foam industry consumed, in 1991, 1,577 tonnes of CFCs. CFC-11 was the dominant substance, followed by CFC-12. More detailed information is provided in Annex-1.

The sector experiences impressive growth, based on:

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

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

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

The sector has around 230 active enterprises. About 20% of these companies are large or medium sized and have relatively sophisticated manufacturing equipment. The remaining 80% operate small scale units and are technically and chemically unsophisticated. An overriding challenge will be to identify these companies and to develop an ODS transition management planning based on acceptable and affordable technology.

3. PROJECT DESCRIPTION

During the preparation of the Indian Country Programme (CP), a sectoral group for the foam sector, consisting of representatives of Government and Industry, prepared a draft report addressing strategic considerations concerning ODS phaseout in the Indian foam industry (Annex-A). This report served as a key resource for the preparation of the CP.

Although this report lacks the depth to serve as a sector strategy and detailed action plan, it provides a useful preparatory stepping stone.

Under this project the Government of India intends, in close cooperation with the industry, to complete the formulation of such a strategy and action plan and to take all actions needed to initiate its implementation.

To prepare such a strategy it is necessary to:

- o Identify all individual ODS users
- o Analyze and categorize the users based on process, size and products
- o Select technologies that ate suited technically and economically
- o Achieve commitment from users, trade associations and Government Agencies

Key elements of the strategy will be:

- o Awareness dissemination
- o Building of skills, knowledge and capacity
- o Description of the specific task of the executors of the strategy and expression of their commitment
- o A detailed phaseout plan addressing management, timeframe and anticipated cost
- o A concept on how to deal with foam enterprises in the small scale (including tiny) and informal sector
- o Implementation monitoring

There are several related activities necessary for the preparation and the initiation of the implementation of this strategy:

- o An industry survey to provide the necessary data on use, production program, current equipment etc. Such a survey should be closely coordinated with the one that was already approved for the entire small (including tiny) and informal sector (IND/SEV/11/TAS/11; UNDP implementing agency) to avoid overlapping activities
- o Evaluation of technologies and strategies specifically suited for small scale ODS users in the foam industry. A proposal for such an evaluation program is currently in preparation at UNDP after investment proposals in other countries showed that applying the same technologies on the small users is economically and technically not feasible

- Early phaseout/demonstration projects. Some companies are in need of an accelerated program to cope with existing customer demands (export, automotive industry) or to prepare for future demands (polyol suppliers and blenders). The need to prepare a strategy should not interfere with the immediate formulation and implementation of such projects and the Indian Government specifically states its intention to promote and support such projects. At the same time such projects demonstrate to the industry the viability of ODS phaseout under the MLF programme. Experience from other countries (Malaysia, Egypt) have shown the need as well as the success of such an approach.
- Training/information sessions. Enterprises have to be informed on technologies, how to prepare investment projects etc. Experience in other countries, specifically Indonesia[1], have shown the merit of such an approach in an early phase.

Not all these elements will be financed from this project. Early phaseout/demonstration projects will be prepared and financed through the standard process for the financing of investment projects under the Multilateral Fund (MLF) of the Montreal Protocol.
The development of technologies for the small scale industry will be proposed through a general project.
Monitoring is part of the institutional strengthening process. This project will provide the funds for the remaining activities and provide for the necessary coordination of the individual actions.

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[1] A workshop in Indonesia followed by plant visits generated more than USD 5,000,000 in projects and provided useful information and industrial commitment for the entire projects. Similar experience comes from China where the World Bank is currently implementing a series of three workshops followed by project formulation, the goal of five projects per workshops is exceeded by more than 100% Government commitment to expedite the projects from such workshops in a fast oace is crucial and the Indian Governments is expressing through the submission of this project such a commitment.

4. PROJECT COSTS

The following is a summary of the expected costs related to the activities mentioned in the project description.

ACTIVITY	BUDGET
o Industry survey	US$ 45,000
o Preparation and implementation of three (3) workshops	205,000
o Preparation of a strategy/action plan	20,000
TOTAL	US$ 270,000

Supporting documentation is provided in Annex-2.

5. FINANCING PLAN

Recipient requests a grant for the full amount as budgeted.

6. IMPLEMENTATION

MOEF, with assistance from UNDP, will oversee the implementation of this project. Communication and concurrence with other implementing agencies is important and will be integrated in the process of implementation. It is expected that the project can lead to a proposed application-specific action plan within nine months after approval.

It should be pointed out that this project should not delay the submittal of selected early ODS phaseout projects in the foam sector. Many facilities have already provided sufficient information to warrant such submittal.

7. PROJECT IMPACT

This project will have no **direct** impact on the use of CFCs. It will, however, allow the formulation of an application and technology specific phaseout strategy and action plan for the Indian Foam Sector, and so will indirectly contribute to the phaseout annually of around 1,600 tonnes of CFCs (base 1991). It also may have a significant cost mitigation effect, as it allows identification of the most relevant and applicable technologies and consequent economic phaseout costs for individual facilities, including the option of consolidation in an effort to avoid unnecessary excess capacity. Finally, it will allow the Government as well as implementing agencies to adequately monitor the actual ODS phaseout progress in this sector.

8. ANNEXES

Annex-1: Detailed outline of proposed activities and related costs

Annex-2: Report on the "FOAMS" Group for the Country Programme on National Strategy of Phasing out Ozone Depleting Substances

..\FOAMSTRA.003
26 June 1994

ANNEX-1

INDIA FOAM UMBRELLA PROJECT

DETAILED OUTLINE OF ACTIVITIES

INDUSTRY SURVEY

PURPOSE:

- To identify individual ODS users in the Indian foam sector;
- To obtain critical information on equipment, chemicals and applications.

PROCEDURE:

- Establishment of a task force;
- Interviews with the supply industry;
- Coordination with the organizers of the small scale industry survey (to avoid double work);
- Distribution of questionnaires;
- Conduction of verification visits;
- Preparation of report.

BUDGET:

o National Experts (fees, travel, expenses)	....	$ 20,000
o International Experts (fees, travel, expenses)	....	10,000
o Task Force organizational expenses, meeting costs, etc.	....	10,000
o Administrative costs (mailings, reports, etc.)	....	5,000
TOTAL COST OF SURVEY	....	**US$ 45,000**

TECHNICAL/INSTRUCTIONAL SESSIONS

PURPOSE:

- o To create awareness within the foam industry on ozone layer depletion, the Montreal Protocol and the MLF;
- o To inform companies and entities on project eligibility, application procedures for funds, project cycle and other information related to the preparation of ODP phaseout investment projects;
- o To inform potential recipients on available ODS phaseout technologies in the foams sector.

PROCEDURE:

- o Identification of three suitable locations;
- o Identification of workshop participants (from survey information);
- o Identification of lecturers/presenters;
- o Preparation of agenda, handouts etc.
- o Conduct the workshops.

BUDGET:

o	National Experts (fees, travel, expenses)	... $ 25,000
o	International Experts (fees, travel, expenses)	... 40,000
o	Workshop participants expenses (fees, travel, expenses)	... 125,000
o	Organizational arrangements, location and facilities rental	... 10,000
o	Mailings, telephone and fax charges, miscellaneous	... 5,000
	TOTAL COST OF WORKSHOPS	... **$205,000**

ANNEX 2

REPORT OF THE FOAMS GROUP FOR THE INDIA COUNTRY PROGRAMME ON THE NATIONAL STRATEGY OF PHASING OUT OZONE DEPLETING SUBSTANCES (17-18 June 1993, New Delhi)

Second Draft (16 July 1993)

The Ozone Group on 'Foams', as constituted by the Ozone Cell of the Ministry of Environment & Forests Govt. of India (Ref.4(1)/1/92-C.1 of 3rd June, 1993) met at Delhi on 16th, 17th & 18th of June and have pleasure in submitting the Draft Report of the Group for the Country Programme.

The following members were present:

1. Mr. M. Sarangapani (Convenor), Chairman, Polyrethane Council of India
2. Mr. R. Sethuraman, Managing Director and Mr. B.K. Sethuraman, Technical Manager, U B Petroproducts Ltd., Madras
3. Mr. K. Satyanarayana Rao, Manali Petrochemicals Ltd., Madras
4. Mr. Mukesh Bhuta, Expanded Incorporation, Bombay
5. Representative of Shivathene Linopack Ltd., Parwanoo (HP)
6. Mr. A.C. Padamsee represented by Mr.K.Unnikrishnan, CMD, Eagle Flask (P) Ltd., Bombay.
7. Mr. S. Gulati, Punjab Scooters, Nabha (Punjab)
8. Managing Director - represented by Mr.C.S. Chirumulay, Sunpra Energy & Recovery Pvt. Ltd., Mulshi, Distt. Pune
9. Mr. V.K. Jain, Managing Director, Gujarat Fluorochemicals, New Delhi
10. Mr. Rajdeep Anand and Mr. Rabinder Kaul, Nominees of SRF Limited, New Delhi
11. Mr. Y. Khambata, Godrej GEC, Bombay
12. Mr. L.C. Gupta, Voltas Ltd., Bombay
13. Mr. M.N. Hawal and Mr. Sandeep Bhatia, Navin Flourine Industries, Bombay
14. Mr. Prosanto Pal and Mr. Girish Sethi, TERI
15. Dr. Indrani Chandrasekharan, MoEF
16. Mr.Bert Veenendaal, UNDP Consultant

However, there were some absentees and alternate members of some of the companies were present. The Groups deliberations were fruitful and extensive information was generated. The Groups Report was presented by Mr. Sarangapani, the Convenor on the 18th afternoon and was ably assisted by the Consultant, Mr. Veenendaal.

I wish to express my grateful thanks to Mr. Charles B. Catenach, Consultant of World Bank and Mr. Clinton J. Norris, UNDP Consultant for their participation. I am also indebted to the Ministry's representative Dr.(Ms.) Indrani Chandrasekharan and the TERI personnel for their participation.

The Agenda before the Group Meeting was:

1. Opening Remarks by Convenor

2. Review of portions related to Foams in
   - National Task Force Report
   - Sub-Committee Report

3. ODS Consumption in 'Foams' Sector in 1991 and split of this consumption in sub-sectors:
   - Flexible moulded
   - Rigid PU (Refrigeration insulation, General insulation, Thermoware, Integral skin)
   - Phenolic foam
   - Polyolefinic foam
   - Polystyrene foam
   - Miscellaneous

4. Projections as per (3) above upto 2010

5. Role of Polyol manufacturers

6. Data on major endusers

7. Identification of alternative blowing agent sub-sectorwise

8. Formulation of country strategy for ODS phaseout

9. ODS phaseout schedule for 'Foams" sector

10. Policy issues governing imports, duty/tax exemptions and any incentives required for changeover to alternative blowing agents

11. Other regulatory measures required

12. Broad identification of projects for ODS phaseout requiring funding from Multilateral Fund

13. ODS phaseout financial and incremental costs

14. Preparation of 'Sectoral Group Draft Report'

15. Presentation of 'Draft Report on 18th June, 1993 after lunch at 1400 hours to Inter-Ministerial Committee

The group met again on 17th July 1993 during the 1st CP Workshop from 16-18 July 1993 at New Delhi to review the sectoral group report in the presence of the UNDP Consultant, Mr. Bert Veenandaal. The following members were present:

1. Mr. M.Sarangpani, Convenor
2. Mr. C.Vaghani, Milton Plastics Ltd.,
3. Mr.K Satyanarayana Rao, Manali Petrochemicals Ltd.
4. Mr. Muthukrishnan, U B Petroproducts Ltd.
5. Mr. Sandeep Bhatia, Navin Flourine Industries
6. Mr.S S Ghatage and Mr.C S Chirmulay, Sunpra Energy and Recovery Pvt. Ltd.
7. Brig S U Day, Eagle Flask Industries Ltd.
8. Mr. Girish Sethi, Tata Energy Research Institute

SECTORAL GROUP ON "FOAMS"
- SECOND DRAFT REPORT -
JULY 16, 1993

1. INTRODUCTION

This draft report of the sectoral group on "Foams" for the preparation of the Indian Country Program for the Phaseout of Ozone depleting Substances under the Montreal Protocol follows the outline of the "China Country Program" (China CP, Pg 2)

Following this format will therefore facilitate the subsequent merger of the individual sector reports.

The original sectoral structure, classified foams used for insulation of domestic refrigerators in the sector "Refrigeration and Air conditioning". Statistics and ODS phaseout technologies do not quite follow this classification, and it was decided to deal with these foams in the "Foams" sectoral group. Data and issues related to these foams were also integrated with the "RAC" group.

ODS SITUATION IN FOAMS

The ODS consuming Foamed Plastics industry in India consists of:

- Polyuerethane Foams (PUF)
- Extruded Polyolefinic Foams (EPE/EPP)
- Extruded Polystyrene Foams (EPS)
- Phenolic Foams

There are other foamed plastics that use no ODS, such as:

- Polyvinyl Choride Foams.
- Expanded Polystyrene Foams

The majority of the ODSs used in the foam industry are CFCs. There is also a small and relatively poor documented use of MCF in mould release agents and adhesives. Consumption data on these substances are included in other statistics (solvents).

Table 1 shows the Foam Sector's consumption data on CFCs in 1991. Main applications for the different plastics are shown in Table 2

Table 1: ODS Consumption in Foams (1991; MT)

Category	CFC-11	CFC-12	CFC-113
Polyurethane Foams (PUF)			
Flexible PUF			
Slabstock			
Moulded	35*	-	-
	160	-	-
Rigid PUF			
Refrigeration			
Insulation	500	-	-
General Insulation	250	-	-
Thermoware	225	-	-
Integral skin and RIM	20	-	-
	15	-	15
Phenolic foams			
	70	280	-
Extruded Polyolefinic			
Foams	--	**	-
Extruded Polystyrene	7	-	-
Foams			
Miscellaneous			
TOTAL	1282	280	15

* It is reported that CFC-11 is largely replaced by methylene chloride in this category. However, pockets of CFC use remain.

** It is reported that the EPS industry has replaced the use of CFCs by hydrocarbons. This matter will be verified.

Table 2: Applications for Foamed Plastics

Category	Application
Flexible PUF	
Slabstock	Mattresses, Furniture, Padding
Moulded	Automotive, Furniture
Rigid PUF	
Refrigerator Insulation	Domestic Refrigeration and Freezers
General Insulation	Cold storage, Boilers, Building
Thermoware	Thermo-Bottles, Casseroles
Integral Skin and RIM	Furniture, Automotives
Phenolic Foam	Building, Miscellaneous, Industry
Thermoplastic Foams	
Polyolefinic Foam	Packaging
Polystyrene Foam	Fast Food, Packaging
Miscellaneous	Building, Shoe Industry

2.2 FORECASTING OF UNCONSTRAINED ODS DEMAND TO YEAR 2010

The plastic industry in India did not grow at the rate at which it grew in the rest of SE Asia. India's per capita use of, for instance, polyurethanes is one of the lowest in the world: less than 50g/y, compared to 100 g/y in Indonesia and 120 g/y in China. The relative low current use as well the expected growth in GNP--nearly twice the rate of the established economies in Western Europe and the USA--is the base for a forecast of above average growth rates for the foamed plastics sector. It is expected that in this sector the domestic refrigeration will even outperform other categories.

Annual growth rates for Domestic Refrigeration are forecasted to be 15% from 1993 thru 2010 and then to follow GNP growth. For other CFC-11 foams, growth rates of 12% are expected from 1993 thru 1996, 9.5% from 1997 thru 2005 and 8% from 2006 thru 2010.[1]

[1] The growth rate projections originate from sub-committees of the "Task Force on National Strategy for Phasing Out of Ozone Depleting Substances" (November 1991). Independent projections from polyol manufacturers are similar. The growth rate projection for refrigeration foams originates from the sectoral group on RAC.

Annexure 1 shows the different forecasts in ODS consumption for the sector growth rates taken.

2.3 INDUSTRIAL STRUCTURE

There are about 225 ODS consuming enterprises in India that manufacture foamed plastics. Nearly 15% of these companies are large or medium sized and have comparatively sophisticated manufacturing equipment. The remaining ones operate small scale units and are technically and chemically unsophisticated. Table 3 provides information on numbers and size of enterprises per category.

Strategic chemicals for the industry in view f CFC phaseout are CFCs/HCFCs, Polyols and Isocyanates.

There are currently four (4) manufacturers of CFC-11 and -12 in India and these companies have adequate capacities for current and future unconstrained demand. From the HCFCs that are considered in the foam industry as interim replacement, i.e. HCFC-22, HCFC-123, HCFC-141b and HCFC-142b, only HCFC-22 is currently domestically produced. The CFC supply industry will need guidance as to what substances will be needed and what volume predictions can be made in conjunction with regulatory assurances of permitted use for at least 20 years before local production of other substances can be considered.

Imports of CFCs/HCFCs are low and only through system blends.

Polyols are supplied by four (4) domestic manufacturers, from which three (3) have ties with foreign companies. There is significant import of polyols as well as of system blends. There is currently no indigenous production of isocyanates, based on the relatively small market. This may well change in the near future. Imports of isocyanates are subject to significant import duties. This is a barrier for the use the use of water/isocyanate as an economically viable CFC substitute.

All other raw materials, additives, catalysts, etc. are also imported and subject to substantial duties.

Table 3: Industrial Structure of the Foam Industry

Category	Number of MED/Large	Companies Total
Flexible PUF Slabstock Moulded	 10 8	 65 32
Rigid PUF Refrigerator Insulation General Insulation Thermoware	3 10 5	8 64 43
IS and RIM PUF	3	5
Phenolic Foams	1	1
Thermoplastic Foam Extruded Polyolefine Foams Extruded Polystyrene Foams	 2 1	 5 1 [2]
Miscellaneous	4	5-- [3]
TOTAL	47	230

2.4 INSTITUTIONAL FRAMEWORK

The Polyurethane Council of India and Trade Associations representing polystyrene and polyolefine foams are functioning as apex bodies looking after the interests of their respective members. The Council is intimately involved in the preparation of the Country Program, and future involvement in the program implementation is foreseen.

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[2] This information is to obtained from Polystyrene Trade Association (TERI).

[3]. Needs input from Polyol manufacturers (UB).

2.5 INDUSTRIAL AND INSTITUTIONAL RESPONSE

Several categories of the industry have already responded to the need of substitution of ODSs on a rather individual basis:

- The flexible slabstock industry has CFCs already substantially replaced, mainly be methylene chloride. This has, however, created in many cases health hazards through high exposure levels to this substance, and corrective action is necessary.

- Major automative seat moulders have taken positive steps towards a change to CFC-free systems

- Polyol manufacturers and system suppliers have already experimented with the preparation of low CFC and non-CFC systems.

- Several rigid foam manufacturers have tried low CFC and HCFC-141 b systems.

- Most EPS and several EPE/EPP manufacturers have changed from CFC-12 to hydrocarbons (butane or LPG).

The government has supported those actions by the granting of an "ECOMARK". Products which are CFC free can be granted this label. This program is implemented by BIS.

3. ODS PHASEOUT IMPLEMENTATION

3.1 ODS SUSBTITUTES

A flood of CFC replacement technologies have been proposed recently for the manufacture of foamed plastics. The Indian foam industry will base selection from these technologies on the following standards of acceptance:

- acceptable performance
- proven technology
- commercially available
- acceptable processing
- sufficient safety
- environmentally acceptable
- economically viable

Given these criteria, preference will be given to technologies that are based on indigenous production to be employed in these technologies.

Not all replacement technologies meet these criteria, especially the environmental acceptability. These technologies, however may provide, sometimes an important interim function, and allow the industry to search for better solutions, while in the mean time, progressing with CFC phase-out, in particular the case with technologies that employ HCFCs.

The more sophisticated companies are well aware of the whole array of available substitutes, and it is expected that these companies will select their own preferences. Small companies will need substantial support in the selection process. This can be done through demonstration projects, workshops, study tours and special documentation--[4]

Table 4 shows the technologies per category that the industry believes to be currently the best available alternative. The current supply situation in India is specifically taken into consideration, and has led to preferences that are sometimes different from internationally usual preferences. It should also be pointed out that in individual contexts, different technologies, other than described may be justified.

Table 4: Preferred Phaseout Technologies for the Foam Industry

Category	Preferred Technology	Acceptable Alternatives
Flexible PUF Slabstock Moulded	Methylene chloride CFC-free HR Systems	Alternative Mfg Techn. Methylene Chloride
Rigid PUF Refrigerator	Low CFC/HFCC-22	HCFC-22/142b, Cyclopentane, HCFC-134a, HCFC-141b
Gnl Insulation Thermoware	Low CFC/HCFC-22 CO2	HCFC-123, HCFC-141b HCFC-22, HCFC-123
IS and RIM PUF	HCFCs, atmospheric gases	Methylene Chloride
Phenolic Foams	Pentane	Other Hydrocarbons (like isobutane)
Thermoplastic Foams EPE/EPP Foams EPS Foams	Hydrocarbons Hydrocarbons	HCFC-22 HCFC-22, CO_2

[4] The UNEP Technical Options Committee prepares every two years an updated assessment of replacement technologies in foams. UNDP has in addition prepared several documents that provide an overview of replacement technologies particularly from a standpoint of application in developing countries.

3.2 INDUSTRY ACTION

The Ozone group on "Foams" has developed a phased action plan that will lead to complete phase-out of the Ozone Depleting Substances. The action plan, prioritized and targeted for implementation dates is shown in Table - 5

Table 5: Proposed Industry Action on CFC Phase Out

1.	**INITIAL PROJECTS**	**1994-97**
1.1	'Beacon' projects for plants representing all foam categories	
1.2	Early phaseout program for selected, especially export oriented facilities	
1.3	Introduction of BEST MANAGEMENT PRACTICES to secure minimized material (CFCs) losses	
1.4	Residual CFC phase-out in the flexible PUF slabstock industry	
1.5	Elimination of the use of CFC's in the manufacturing of Phenolic Foams	
2.	**INVESTMENT PROJECTS** (First Batch)	**1995-98**
2.1 2.2	Phase-out of CFC's in flexible PUF moulded plants Phase-out of the use of CFC's in the manufacturing of EPE/EPS foams	
3.	**INVESTMENT PROJECTS** **(Second Batch)**	**1997-2000**
3.1 3.2	Phase-out of the use of CFC's in the manufacturing of rigid P.U. Foams (Low 'K' - factor dependency) Reduction of the use of CFC's in the manufacturing of rigid P.U. Foams (High 'K' - factor dependency)	

4.	INVESTMENT PROJECTS (Third Batch)	2000-2002
4.1	Elimination of the use of CFC's in the manufacturing of integral skin and R.I.M. foams	
4.2	Elimination of the use of CFC's in the manufacturing of Microcellular and Miscellaneous Foams	
5.	RIGID FOAMS Final CFC's Phase-out Implementation (includes refrigerator foams)	1999-2004
6.	RESIDUAL Phase-out Program	2004-2006

Successful implementation of the strategy will require actions from raw materials suppliers and Trade Associations. These actions should guarantee suitable availability of replacement chemicals at acceptable prices, evaluation capacities and training facilities for the ODS consuming Foam Industry and Institutional support for the phase-out programs, promotional programs etc. Table 6 describes the required industry and institutional actions.

A small group of foam industry representatives to attend the SPI (Society of Plastic Industry, USA) in Vancouver from October 10-13, 1993 will be necessary to keep pace with the changeover in the technology in the foam sector.

Table 6: ODS Phaseout in the Foam Industry:
Supporting Actions by Supplier Industry and Trade Associations

1.	**SUPPLIER INDUSTRY**
1.1	CFC/HCFC manufacturers - availability of HCFC-22 at reasonable price - availability of HCFC-141b
1.2	Polyol Manufacturers - Participation in awareness programmes and project identification - Polyol and systems for the different new developments - evaluation capacity for new technologies - training facilities and demonstration facilities
1.3	Other Suppliers as needed
2.	Trade Associations and National Small Scale Industries Corporation (NSIC)
2.1	Polyurethane Council - Support for Awareness Program - Support for Multifacet Projects - Implementation of a Labelling Policy
2.2	NSIC - To reach out to the small users - Support for awareness programmes

3.3 GOVERNMENT ACTION

Government action will be needed to develop product standards, and for the institution and implementation of awareness programs. Government action should be preferably supportive and not restrictive. However, in the later phase of the program some restriction on the use of CFCs may be needed to enforce compliance with the Montreal Protocol. Table 7 describes Government actions that industry would like to see implemented in support of the industry program.

Table 7: Government Action to Support CFC Reduction in the Foam Industry

1. Implementation of Applicable Standards by BIS in consu tation with the Industry.

2. Implementation of Awareness Programs through audio visual programs and seminars for the smaller consumers.

3. Incentive Programs like tax relief for new chemicals (HFCs, HCFCs, isocyanates and additives) and for CFC-free end products (import duty, excise taxes, etc.)

4. Tax credits for investment in new CFC-free and related equipment.

5. Tax exemption from import duty on capital equipment.

6. Tax Exemption for Multilateral Fund (MLF) Grants.

7. Encouragement of the indigenous production of chemical compounds needed in CFC-free systems such as isocyanates, HCFCs, HFCs and additives at reasonable cost levels.

8. Discourage setting up any new production facilities which involves use of CFC's after 1997.

9. Promotion of conservation through reclaiming, recovery and reuse.

10. Discourage use of CFCs for non-essential uses after 1997.

3.4 ODS PHASE-OUT SCHEDULE AND COSTS

Table 5 shows the time schedule for the individual actions to achieve full phase-out of the use of ODS in the foam industry. Based on this schedule , the forecasts of unconstrained growth, the phaseout schedule graphs illustrating the compliance with Montreal Protocol stipulations are prepared (graph 1)

Table 8 shows the costs involved (1993 cost base) in the CFC phase-out in the manufacturers of foams. These costs include higher prices for raw materials, equipment modifications and replacements, training awareness programs and other institutional support needed to support the goal. There are several joint ventures with foreign companies in the plastic industry. It is estimated that the exclusion of the cost related to the interest of these companies will reduce the estimated $62 million to about $55 million.

Table 8: CFC PHASEOUT COSTS-FOAMS
(Base: 1993; US$ 000's)

CATEGORY	INCREMENTAL COST		
	INVESTMENT	OPERATION	TOTAL
Flexible PUF			
Slabstock	1,300		1,300
Moulded	5,000	5,000	10,000
Rigid PUF			
Refrigerators	18,000	10,000	28,000
Gnl Insulation	3,080	5,000	8,080
Thermoware	4,760	4,500	6,260
ISF, RIM Foams	600	900	1,500
Phenolic Foams	250	-	250
EPS/EPE	1,000	-	1,000
Miscellaneous	500	-	500
Polyol Mfg.	3,500		3,500
TOTAL	34,990	25,400	60,390

4. OPTIONS FOR ACCELERATION

Sector phase-out plan is designed in such a way that an acceleration of the phase-out for developing countries as allowed under the Montreal Protocol from 2010 to 2006 can be met. (graph 2)

Further acceleration is feasible for non-appliance foams. The lack of mature technology for Refrigeration foams that allows complete phase-out inhibits any prediction to a feasible accelerated program for phase-out in this category.

Estimated Unconstrained Demand of CFC11, CFC-12 and CFC-113 (MT)

Year	Refrigeration Insulation (CFC-11)	Other CFC-11 Foams	Sub-Total (CFC-11)	CFC-12	CFC-113		Total	
					ODS	ODP	ODP	ODS
1991	500	782	1282	280	15	16	1577	1578
1992	575	821	1396	330	18	19	1749	1745
1993	661	920	1581	390	21	22	1911	1993
1994	760	1030	1790	460	24	26	2275	2277
1995	874	1153	2027	543	29	31	2600	2602
1996	1006	1292	2298	641	34	38	2972	2974
1997	1157	1415	2572	705	39	42	3315	3318
1998	1330	1549	2879	775	46	50	3701	3704
1999	1529	1696	3225	853	54	58	4133	4137
2000	1759	1857	3616	938	64	69	4618	4623
2001	2022	2034	4056	1032	75	81	5164	5169
2002	2326	2227	4553	1135	88	90	5777	5783
2003	2675	2439	5114	1248	104	111	6466	6473
2004	3076	2670	5746	1373	115	123	7235	7243
2005	3537	2924	6461	1510	127	136	8099	8108
2006	4068	3158	7226	1631	140	150	8998	9008
2007	4678	3411	8087	1762	151	162	10003	10013
2008	5380	3683	9063	1903	163	175	11130	11142
2009	6187	3978	10165	2055	177	189	12397	12410
2010	7116	4296	11412	2219	191	204	13822	13836

Growth rates taken:

Refrigeration Insulation = 15%

Other foams: CFC-11: 1991-1992 = 5%, 1992-1996 = 12%, 1996-2005 = 9.5%, 2005-2010 = 8%

Other foams: CFC-12: 1991-1996 = 18%, 1996-2005 = 10%, 2005-2010 = 8%

Other foams: CFC-113: 1991-2003 = 17.5%, 2003-2005 = 10.5%, 2005-2010 = 8%

PROJECT COVER SHEET

COUNTRY	:	INDIA
PROJECT TITLE	:	DEMONSTRATION & EVALUATION OF ALTERNATIVE TECHNOLOGY FOR HALON FIRE PROTECTION SYSTEM AND TECHNICAL ASSISTANCE FOR SECTORAL STRATEGY FOR ODS PHASE OUT.
SECTOR COVERED	:	HALON SECTOR (FIRE FIGHTING)
ODS CONSUMPTION OF ODP FACTOR	:	3,650 MT. ODP. (FOR HALON 1211 AND 1301)-1991
PROJECT DURATION	:	THREE YEARS-OCTOBER '94 TO SEPT. '97
PROJECT IMPACT	:	NO DIRECT IMPACT BUT RELEVANT FOR PHASE OUT THREE HUNDRED ODS TONS PER YEAR INITIALLY AND SMOOTH & GRADUAL HALON PRODUCTION PHASE OUT BY EARLIEST.
TOTAL PROJECT COST	:	4 51,000 USD
FUND BORN BY INDIA	:	46,000 USD
TOTAL MULTILATERAL FUND REQUIRED	:	4 05,000 USD
IMPLEMENTING AGENCY	:	UNDP
NATIONAL EXECUTING AGENCY	:	DEFENCE INSTITUTE OF FIRE RESEARCH
NATIONAL IMPLEMENTING AGENCY	:	MINISTRY OF ENVIRONMENT AND FOREST, OZONE CELL.

1. PROJECT SUMMARY

To achieve goals set out in India's halon phase out plan described in the country programme, the following activities are required in order to adopt and absorb alternative technologies for fire protection identified by Halon Technical Option Committee of UNEP and adopted in many countries for halon replacement. It is essential to get prototype of each alternatives to evaluate and demonstrate their performance against typical application in India. It is also important to get technical assistance from International experts to utilize the alternates in best possible ways under various application situations. Preparation of sectoral strategy to phase out ODS (Halon sector) will be the part of this project. This activity is planned to be under taken at Defence Institute of Fire Research, Delhi. The following systems will be required for the project.

(i) Fast response sprinkler system.

(ii) Water mist/fog system both low pressure and high pressure.

(iii) Inert gas such as Inergin system or Nitrogen, Argon system.

(iv) Dry chemical powder system.

(v) In cabinet and sub floor CO_2 system.

(vi) Fine Powder particle-Aerosol type systems (Combustion generated Aerosols)

(vii) Technical Assistance and preparation of sectoral strategy for ODS Phase out.

To install these systems, existing facilities will be modified as necessary together with the introduction of measures to ensure system optimisation quality control.

2. SECTOR BACKGROUND

Due to rapid Industrialisation, the need for new fire protection systems are increasing. India is late starter in halon use and till recently was totally dependent on importation, even now halon 1301 is being imported.

To become self sufficient for its critical uses, there was a programme for Halon 1301 production indigenously, however, till recently no Halon-1301 production has succeeded in India. Consequence to Montreal Protocol decisions of Nov. 1992 to stop production of Halons in developed countries, India will not be able to import halons to cover its needs. It is therefore considered that to meet the challenge, alternatives to halon are introduced expeditiously. It is envisaged that dependence on halon will be reduced expeditiously and market forces will bring down excessive halon production and consumption. It will also allow India to produce or import the new alternative systems. From a limited survey carried out, it is observed that some of the large user having over 100 metric tons Halon 1301 are looking for approved & established alternatives.

India's Halon consumption during 1991 is 750 MT ODS, which is 550 MT of halon 1211 and 200 MT of 1301. It is seen that Halon 1301 is totally used in fixed fire protection while halon 1211 is also used in some application as fixed installation which may account about 100 MT. The total ODP for two halons will be 3,650 MT taking ODP value as 3 and 10 respectively. India produces about 50 MT halon 1211 per year (M/s Navin Fluorine Industries). India does not produce Halon 1301 in absence of suitable substitute and alternative in India and depleting foreign supplies, fire/explosion risks are expected to rise. There are no regulation and regulatory authority in the country for Halon use. Ministry of Home, office of the Fire Adviser extends advises to Civil Ministries, departments and public sector. Fire Adviser, Ministry of Defence, plays advisory role in Defence Sector. In general, each department, industry, private or government has its own codes of practices for fire prevention and fire fighting, guided by above authorities, General Insurance coy, Tarrif Advisroy Committee and Bureau of Indian Standard. There are Fire Research Laboratories and Fire Equipment, Material Test and Evaluation Centres but not so advanced as in developed countries. In India Ozone Cell under Ministry of Environment and Forest is responsible for ozone depleting substances phase out. India's country programme has since been approved and this project is included to be undertaken in order to meet the goals set out for ODS phase out. Therefore this project is consistent with India's Country Programme.

3. PROJECT DESCRIPTION

The project aims at establishing necessary technical conditions for technology transfer and their adoption/absorption. The various alternatives to Halon fire protection system are to be imported. These alternatives have recently been developed in advanced countries and are being recommended for various application in place of Halon fire protection systems. India does not produce any of these alternative systems at present for which financial assistance is asked. It is also pointed out that these alternative systems are application specific and in developed countries they are also country specific. United Nation's Environment programme, Halon Technical option committee has also recommended these alternative systems as specific application oriented.The main aim is to evaluate six numbers of alternatives to halon local applicaiton and total flooding fixed fire extinguishing system. These alternative systems are required for testing in typical fire situation under Indian conditions. The various alternatives are also required for effective performance & demonstration to users in different Halon using sub sectors. This will help in early dissemination of information, developing confidence and fasten the process of halon phase out without compromising fire safety. This project will cover the following alternative systems and technical assistance:–

(i) Fast response sprinkler system

(ii) Water mist/fog system, high and low pressure.

(iii) Inert gas such as inergen system or nitrogen argon system (Argonite).

(iv) Dry chemical powder system.

(v) In cabinet and sub floor CO_2 system

(vi) Fine powder particle-Aerosol type system. (Combustion generated aerosols)

(vii) Technical assistance and preparation of sectoral strategy for ODS phase out.

Above systems when installed will be tested, evaluated and demonstrated to defence and civil sector users and fire equipment manufactures, consultants, regulatory authorities and standardisation bodies. Some of the typical areas planned where simulated system will be demonstrated are control rooms of power plants, chemical/petro-chemical/oil industries, computer room (EDP centre), generator rooms, flammable liquid storage/pumping station. engine and machinary rooms, Telephone exchange, Aircraft flight line etc.

The project will be carried out at Defence Institute of Fire Research. This Institute is the main research and test/evaluation laboratory for fire extinguishing system and has emassed considerable experience in this field over the years. Defence Institute of Fire Research, though is a Defence laboratory is the main Fire Technology development, evaluation, testing and training Institute in India. In India, the requirement of Fire equipments systems and extinguishant are met through private sector Industries. There is no Govt. Factory either in defence or civil sector manufacturing fire protection items. It was therefore felt in the past that a national centre/ facility be made available for evaluation of fire protection equipment and system to meet the needs of country. Today Defence Institute of Fire Research to a great extent acts as consultant to many civil, and private sector companies. Institute is main laboratory for development of codes and standards on Fire equipment for Bureau of Indian standard and meets its needs for testing & certificatioin. During 1992-93 alone, more than 100 consultancy work were done by the Institute for oil, power, petrochemical, and private fire equipment companies. Other associates of the Institute are Loss Prevention Association of India, Steel and Fertiliser, Thermal & Nuclear Power Plants. The institute is one of the main training institute imparting training to defence personel and civil fire service personel on specialised fire fighting systems. In view of the wide association with users and Industry, the Institute is fully geared for dissemination of the knowledge on alternative technologies and hasten the process of ODS phase out in Halon sector. The above mentioned alternate/systems will be imported and installed in fire test laboratories constructed for this purpose in the Institute for demonstration to all sectors of industry in India.

Tests will be carried out on each of these system under simulating conditions for various type of fire risk/fire situation to collect necessary data and to understand and use necessary standards/installation rules. If required modificaitons will be made to suit Indian conditions.

Defence Institute of Fire Research will form a project team of the scientists comprising of engineers, chemists, fire protection engineers and professional fire personel. The team will be headed by Director of the Institute and work will be progressed through a project executor.

The broad objectives of this project are:

(i) To ultimately reduce dependance on Halons for fire protection and facilitate gradual phase out of Halon production in India. Approximately 300 MT ODS saving is expected from this project annually.

(ii) To identify suitable technologies and evaluate them under Indian Conditions.

(iii) To provide facilities for education, training in the use, installation and maintenance of these systems.

(iv) To generate data for preparation of specification standard & codes for switch over to alternative Halon system for existing and new facility.

(v) To provide necessary background for transfer of Technology, between Indian companies /Consumers with foreign manufacturers.

(vi) Preparation of background strategy paper for halon sector ODS phase out and a tentative time frame for Halon users for project preparation.

SHORT TERM OBJECTIVE

The short term objective of the project is to install, test and demonstrate the above mentioned non-Halon fire protection systems in relation to protective facility and thereby demonstrating the methods for reducing the dependence on Halons.

LONG TERM OBJECTIVE

Replacement of Halon systems by way of identified technology transfers in the future together with stepwise implementation of the Halon sector ODS phase out strategy.

4. PROJECT IMPLEMENTATION PLAN

The project has the following eight components which will all be carried out for each of the above mentioned fire protection systems

(i) Collection of technical information

(ii) Import, installation & quality control of alternative systems.

(iii) Test/demonstration systems and identification of field uses.

(iv) Technical analysis & studies of the results.

(v) Reporting, guidelines for field use and data generation for new codes & specifications.

(vi) Preparation of sectoral strategy for phase out of Halons and technical assistance.

The immediate objectives, outputs and activities for each of these components are described in the following section.

(i) Collection of technical information

The immediate objective of this component is to get an overview of the number and types of Halon fire protection systems in India. The component further includes collection of information on available non-halon alternative fire protection systems in other countries.

The out up of this component will be generation of data for change over/conversion of Halon system to new Halon alternative systems.

(ii) Import, Installation & quality control of alternative systems

The objective of this component is to select and import devices for the six types of non-Halon fire protection demonstration systems. The selection of devices from abroad will be carried out under due consideration to the possibilities of buying domestically manufactured parts.

The import components are—

- Fast response sprinkler head, valves, pumps and other necessary items recommended by technology giving company.
- Water mist/fog-nozzels 2/3 types 10-15 nos. cylinder (low & High pressure) valves, automatic activation valves & such other component suggested by technology giving company.
- Inert gas-Inergen/Argonite cylinders, valves nozzels and other necessary parts of system suggested by the supplying company.
- Dry chemical powder system.–ABC Powder, cylinder nozzles, valves, & other important parts suggested by the technology supplying company.
- Combustion Generated Aersol system complete with chemical charges.
- Purchase of domestically manufactured parts/components for installation of these systems such as piping, pumps, detectors, waters source, test facility, simulation

facility for various types of fires. CO_2-N_2 gas filling facility, control panels & such other equipments as required for installation and demonstration.

The output of the project component is to import, purchase of domestic parts so that six non-halon fire protection demonstration systems can be installed and tested for quality control.

(iii) Test/demonstration systems and identification of field uses

The immediate objective of this component is to set up test and monitoring plans for testing the installed demonstration systems. The component further includes the testing of each of the six non-Halon demonstration systems, in order to evaluate the system's functions, liability, performance etc. The testing also includes compilation processing of the test data.

The output of this component is a report containing the test results of each of the six demonstration systems. Component is also to identify the fields of use (application) of the six different non-Halon fire protection systems as substitutes of the existing Halon fire protection systems. The identification will be based on the collected information and the evaluation of test results. The activity also includes number of demonstrations to develop confidence of the users and fire equipment manufacturers in India.

(iv) Technical analysis and studies of the results

The objectives of this component is to analyse the collected data from the tests of the six demonstration systems, in order to evaluate if the systems are able to meet the requirements and if they are applicable under Indian conditions.

The output of the project component is a report containing summary of the function and performance of the demonstration systems and evaluation of the applicability of the systems.

(v) Reporting, guidlines for field use and data generation for new codes & specifications

Objective is to prepare report of the total project. The output of the project component is a report identifying the possible application of the six types of non-halon fire protection systems in relation to the existing and future requirements for fire protection systems and will also generate technical data for preparation of new codes & standards etc by a designated body.

(vi) Preparation of sectoral strategy for phase out of Halons and technical assistance

The objective of this component is to summarize the findings of the project in a report that will be available to various user sector e.g. local fire bureaus, the designers and manufacturers of fire protection devices, service and maintenance people and safety officers in the industry.

The output of the project component is a report that will be distributed to the above mentioned users. This will also specify the implementation strategy for Halon phase out and will include the following:

(i) Report on evaluation of six systems.

(ii) Sectoral strategy for ODS phase out.

(iii) Propose time of implementation

(iv) Workshops.

(v) Identification & preparation of other projects in Halon sector.

5. Project implementation and monitoring

It is proposed to constitute a project implementing committe to expedite various stages of the project. The committee will comprise of members from various Govt. departments, major users, consultants, fire fighting equipment companies, legislative and standardisation bodies, some important being, Oil Industry Safety Department, Oil and Natural Gas Commission, Indian Oil, National Thermal Power Corporation, Steel authority of India, Civil Aviation/National Air port Authority, Bureau of Indian Standard, Loss Prevention Association of India, Merchantile & Marine Engg. Deptt., Confederation of Indian Industries, Fire Adviser Min. of Home, Fire Advisor Ministry of Defence and Fire chiefs of Metropolitan city members from fire fighting equipment manufacturing association of India etc. This committee will be made keeping in view geographical and sectoral distribution inorder to disseminate the information on Halon alternative technologies and also to get benefit of the experience of various sectors in organising the demons trations and finalisation of strategy for Halon phase out.

The work will be progressed in close coordination with National and International implementing agencies. When the project is completed and technical background developed, new standards, codes and specifications will be available to the users for installation of Alternative Halon Fire Protection Systems. It is also expected that the Identified & demonstrated systems will have greater impact on new fire protection systems. However, some users will also take up the conversion project from Halon to Non-Halon systems. Overall market forces are expected to help in reducing the dependence on halons after project report is available to users and manufacturers of fire fighting equipments. Follow-up action will facilitate subsequent implementation of countries programme.

6. PROJECT BUDGET ESTIMATES

Activity	Alternative Systems-Cost (in USD)								
	Fast Response sprinkler system	Water Mist/ Fog system	Inergen Gas system	Dry Powder system	In Cabinet Sub-floor CO2 system	Fine-powder Particle Aerosol Type System	M.L.F Required	Total Fund born by India	Total Activity project cost
1. Collection of Tech. Information	2,000	2,000	2,000	3,000	2,000	2,000	13,000	3,000	16,000
2. Import, Installation & quality control	48,000	56,000	36,000	35,000	36,000	40.000	251,000	10,000	2,61,000
3. Test & Demostration / Identification of field uses	10,000	15,000	7,000	7,000	5,000	5,000	49,000	20,000	69,000
4. Technical Analysis of the results	3,000	3,000	3,000	4,000	3,000	3,000	19,000	8,000	27,000
5. Reporting & guidelines for use	5,000	3,000	5,000	4,000	3,000	3,000	23,000	5,000	28,000
TOTAL	68,000.	79,000.	53,000.	53,000.	49,000.	53,000.	3,55,000	46,000	4,01,000
6. Preparation of Sectoral strategy & Tech. Asstanc.	Total cost for all the six alternative systems & strategy preparation for ODS phase out in Halon sectors =						50,000		

Total Multilateral Fund required = 4,05,000 USD
Total Fund born by India = 46,000 USD
Total cost of the project = 4,51,000 USD

Cost on project born by India is contributed to the following:

1. Manpower and resources. 2. Utilities, land and buildings. 3. Communication in India & abroad 4. Secretariate & stationery 5. Transportation 6. Fuel for fire test 7. Fabrication of simulation facility 8. Instrumentation for test data generations and laboratory facility 9. Cost to travel in India by representatives of various organisations.

DETAILS OF BUDGET ACTIVITY

Collection of Technical Information includes:

- Visits to the sites of Halon users & manufacturers. Travelling expenses, etc.
- Communication expenditure like FAX, Telephone, Telex & Technical Correspondence.
- Purchase of standards, specifications, mannuals, literature on the alternative systems etc.
- Establishment cost i.e. Xerox, Stationery, Typing/Printing etc.

Import, installation and quality control includes

- Import of six alternative system
- Purchase of domestic parts and system installation cost for each system as under:-

(i) Fast response sprinkler system

Static water vessel/tank 20,000 litrs capacity, Water Supply Jockey Pumps, Valves, Sprinkler pipings stands, Hard standing, Control panels. Fire test trays, Fire simulation facility, Power points, Tools for repair and maintenance and local installation cost (labour).

(ii) Water Mist/Fog System

Simulation facility such as generator room, control rooms, EDP facility, communication facility, fuel and fire geometry, technical data collection and processing instrumentation, installation cost (labour) etc.

(iii) Inergen gas system

Gas mixing and filling facilities. Piping & discharge nozzels, flowmeters, sampling of combustion and final gases. Fabrication of test chamber/room of various sizes. Measuring instruments for technical data collection and their analysis.

(iv) Dry Powder Systems

Refilling and pressurisation of powder systems. Pipings, compressors, quality control equipments. Simulation facility for fire tests, hard standings and fabrication of test beds, the trays & fuel for fire test.

(v) In Cabinet-subfloor CO_2 system

CO_2 filling facility, CO_2 system, installation pipings, nozzels and simulation test facility, Closed cabinet and false ceilings. Hard standing, Test Chambers, installation cost (labour cost), Quality control and instrumentation for technical data collection.

(vi) Fine Powder Particle Aerosol

This is a consumable powder system and will require enough numbers of chemical charges. Test & simulation facilities will be required by system supplier. Technical data generation instrumentation.

TABLE

TIME SCHEDULE

Work on all the six sub-systems will be carried out simultaneously as per the following work plan

Sl. No.	Activities	1994 year			1995 (in months)												1996 (in months)												1997 (in months)								
		10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9
1.	Collection of Technical Information	x	x	x	x	x	x																														
2.	Import of Devices /Eqpts					x	x	x	x	x	x	x	x	x	x	x	x																				
3.	Purchase of Domestic Devices									x	x	x	x	x	x	x	x																				
4.	Installation & Quality Control																x	x	x	x	x	x															
5.	Testing of Demonstration system & Identification of field of use																			x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		
6.	Technical Analysis & studies																														x	x	x	x	x		
7.	Prepration of sectoral strategy & reporting																																	x	x	x	x

Abbre., 1=Jan., 2=Feb. etc.

PROJECT COVER SHEET

COUNTRY:	Malaysia
PROJECT TITLE:	**WONG BROTHERS ELECTRICAL AND REFRIGERATON SDN. BHD.** - Elimination of CFC-11 in the Manufacture of Rigid Polyurethane Foam Panels for Cold Storage
SECTOR COVERED:	Foams
ODS USE IN SECTOR:	600 MT in 1991 - foam
PROJECT IMPACT:	Phaseout of 35 MT of CFC-11
PROJECT DURATION:	One year
TOTAL PROJECT COST:	USD 275,000 Incremental Capital Cost US$ 24,000 Incremental Operating Cost
PROPOSED MLF GRANT:	USD 299,000
COST EFFECTIVENESS:	USD 1.69 kg/y (unit abatement cost)
NATIONAL COORDINATING AGENCY:	Department of Environment (DOE)
IMPLEMENTING AGENCY:	UNDP
APPRAISAL DATE:	7 June 1994

PROJECT SUMMARY

Wong Brothers is a 100% Malaysian-owned company. It manufactures rigid panels for cold storage in commercial and industrial refrigeration. It also undertakes spray foam insulation works. CFC-11 is used as a blowing agent in both types of operation. Under the project, the use of CFC will be phased out by switching to an alternative technology of combined reduced-CFC technology and replacement of the residual CFCs by HCFC-141b. The company realizes that this constitutes an interim solution. Investment cost will include a high pressure dispenser, a pre-mixing unit, trials and incremental recurrent cost.

Prepared by: Mr. Tommy Lauridsen, Foam Consultant
Reviewed by: Mr. Bert Veenendaal, UNDP Sector Expert (Foams)

PROJECT OF THE GOVERNMENT OF MALAYSIA

WONG BROTHERS ELECTRICAL AND REFRIGERATION SDN. BHD. - ELIMINATION MINATION OF CFC-11 IN THE MANUFACTURE OF RIGID POLYURETHANE PANELS AND SPRAY FOAM

1. PROJECT OBJECTIVE

The objective of this project is to phase out the use of CFCs in the manufacture of rigid panels for commercial and industrial refrigeration and in spray foam application.

2. SECTOR BACKGROUND

The CFC consumption in the foam sector in Malaysia is estimated to have reached 600 MT 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

Wong Brothers is a 100% Malaysian-owned private enterprise with over 30 years of experience in the manufacture of polyurethane insulation panels for commercial and industrial refrigeration. It currently operates with a C-100 low pressure machine and a fixed ratio Gusmer spray machine. CFC-11 is purchased separately and premixed manually in polyol component. The company employs about 50 staff.

4. PROJECT DESCRIPTION

Wong Brothers utilizes annually about 35 tons of CFC-11 in the manufacture of polyurethane panels. The company has decided to replace CFC, under the project, through a combination of reduced-CFC technology and HCFC-141b, which will require the use of high pressure machine and variable ratio spray machine. A pre-mixing unit will also be installed to handle the different blends required. The use of HCFC-141b technology is expected to result in higher recurrent cost.

5. TECHNOLOGY

5.1 OVERVIEW AND SELECTION

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

- **i) HCFC-141b**
- **ii) HCFC-142b**
- **iii) HCFC-22**
- **iv) HFC-134a**
- **v) Cyclopentane (CP)**

Most technologies are employed in conjunction with increased water content. 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.

Wong Brothers has selected CFC-11 replacement through partial replacement by water in combination with HCFC-141b.

5.2 IMPACT ON PRODUCTION PROCESS

The use of reduced-CFC technology will require the use of high pressure foam dispenser. HCFC-141b is moderately flammable. For the intended purpose the blends should not cause any risk, but a monitoring check will be performed to assure safe working levels. The current hand-mixing method will be replaced by a pre-mixing unit which could be used to blend other HCFCs. This will save up to 20% of ABA.

6. PROJECT COSTS

6.1 TOTAL CAPITAL COSTS

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

DESCRIPTION	TOTAL (US$)
High pressure foaming machine	110,000
Pre-mixing unit	75,000
High presure variable ratio spray machine	40,000
Start-up & trials	10,000
Technology transfer	10,000
Contingency & Rounding	30,000
TOTAL:	US$ **275,000**

6.2 OPERATING COSTS

It is expected that the proposed conversion will result in a higher annual recurrent cost calculated as follows:

Before:	35 MT of CFC-11 @ US$ 2.0	US$ 70,000
After:	21.0 MT of MDI @ US$ 1.85	38,850
	11.2 MT of HCFC-141b @ US$ 4.0	44,800
RECURRENT INCREMENTAL COST	....	US$ 13,650

Net Present Value (2 yrs; 10% discount) .... US$ 23,655
say US$ 24,000

6.3 UNIT ABATEMENT COST

a)	ODS reduction project cost	US$ 275,000
b)	Annual incremental cost	13,650
c)	Project useful life	10 years
d)	ODS reduction/year	35,000kg
e)	Capital recovery factor (10%)	0.16275
	Unit abatement cost [(a(e) + b)/d]	US$/kg/y 1.69

7. FINANCING PLAN

The company requests the financing of the total project cost estimated at:

US$ 299,000

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 and provide technical assistance.

8.3 SCHEDULE

Implementation schedule will start with MLF approval of the project and will end after trials have confirmed that acceptable product can be made under the new production system. A detailed activity schedule is provided below.

TASK	TIME FOR COMPLETION (MONTHS)											
	1	2	3	4	5	6	7	8	9	10	11	12
Preparation												
MLF Approval	x											
Procurement Prep.		x										
Vendor selection			x									
Installation												
Arrival, Customs							x					
Installation								x				
Start-up,												
Machine Start-up									x			
Trials, Training										xxxxxxx		
Certification												x

9. PROJECT IMPACT

This project will eliminate the use of at least 22 MT of CFCs in the first year of implementation. The project employs commercially and environmentally acceptable technology.

Annex: Technical Assessment

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940607/004

TECHNICAL REVIEW

PREPARED BY: Bert Veenendaal
UNDP Foam Sector Expert

DATE: June 13, 1994

1. COUNTRY OF ORIGIN: MALAYSIA

2. PROJECT TITLE: WONG BROTHERS ELECTRICAL AND REFRIGERATION SDN. BHD - Elimination of CFC-11 in the manufacture of Rigid Polyurethane Foam Panels for Cold Storage

3. (SUB)SECTOR Foams

4. CP RELATIONSHIP: Not known

5. TECHNOLOGY: The choice of technology of the company is HCFC-141b. This is in the context of this enterprise the most feasible solution. Although pentane was considered, the consultant that helped in the project preparation felt that the safety would be compromised and advised at this moment 141b. Another reason could have been mentioned: the company cannot use pentane in its spray foam operation. To operate in a relative small operation two different technologies would be unadvisable from a cost- as well as from an organizational standpoint

6.	ENVIRONMENTAL IMPACT:	HCFC-141b is moderately flammable. No specific precautions will be needed in the process under discussion, but a safety post-audit should confirm that workplace concentrations are not exceeding 10% of the LEL. The substance carries also an ODP and is considered a transitional compound. The company should monitor the market on non-ODP solutions that can be processed on the same equipment and apply these as soon as cost will allow this.
7.	PROJECT COSTS:	The unit abatement cost are reasonable for this type of operation (recent projects in Egypt, Malaysia and Thailand range from 1.56 to 2.54).
8.	IMPLEMENTATION:	Adequate
9.	RECOMMENDATION:	The project is recommended for approval

PROJECT COVER SHEET

COUNTRY:	Malaysia
PROJECT TITLE:	**PANGKAT REFRIGERATION INDUSTRIES SDN. BHD.** - Elimination of CFC-11 in the Manufacture of Commercial Refrigerators
SECTORS COVERED:	Foamed plastics Refrigeration
ODS USE IN SECTOR:	600 MT in 1991 - foam 1,500 MT in 1991 - refrigerant
PROJECT IMPACT:	Elimination of 20 MT of CFC-11
PROJECT DURATION:	One year
TOTAL PROJECT COST:	US$ 185,000 Incremental Capital Cost US$ 25,000 Incremental Operating Cost
PROPOSED MLF GRANT:	US$ 210,000
COST EFFECTIVENESS:	US$ 2.26 kg/y (unit abatement cost)
NATIONAL COORDINATING AGENCY:	Department of Environment (DOE), Malaysia
IMPLEMENTING AGENCY:	UNDP
APPRAISAL DATE:	7 June 1994

PROJECT SUMMARY

Pangkat Refrigeration Industries Sdn. Bhd. is a 100% Malaysian-owned commercial refrigerator manufacturer. Its main products are rigid panels for cold storage in commercial and industrial refrigeration. The company currently uses CFC-11 as a blowing agent in the production of rigid foams. Readily available ODS-free cooling systems and refrigerants are used. Under the project, Pangkat will eliminate the use of CFC-11 by switching to an alternative technology of combined reduced-CFC technology and replacement of the residual CFCs by HCFC-141b. The company realizes that this constitutes an interim solution. However, the high pressure equipment to be procured under the project would be able to employ emerging ODS-free technology such as carbon dioxide and HFCs as they mature. The company expects an increase of recurrent incremental cost.

Prepared by: Mr. Tommy Lauridsen, Foam Consultant
Reviewed by: Mr. Bert Veenendaal, UNDP Sector Expert (Foams)

PROJECT OF THE GOVERNMENT OF MALAYSIA

PANGKAT REFRIGERATION INDUSTRIES SDN. BHD. - ELIMINATION OF CFC-11 IN THE MANUFACTURE OF RIGID POLYURETHANE FOAM PANELS FOR COLD STORAGE

1. PROJECT OBJECTIVE

The objective in this project is to phase out the use of 20 MT of CFC-11 in the manufacture of rigid polyurethane panels at Pangkat.

2. SECTOR BACKGROUND

The CFC consumption in the foam sector in Malaysia is estimated to have reached at least 600 MT in 1991. This is about 8% of the total ODS and 7% of the Malaysian ODP generatiion. CFC-11 (polythylene foam sheet) are the dominant substances in this sector, with much smaller usage of MCF, CFC-114 and CFC-115. The refrigerant is the biggest CFC-consuming sector which constitutes 1,500 MT in 1991. CFC-12 is the main substance used primarily in automobile and home appliance industries.

3. ENTERPRISE BACKGROUND

Pangkat is a 100% Malaysian-own company. It produces rigid panels for cold storage use in commercial and industrial refrigeration. The company currently uses CFC-11 as a blowing agent and operates with a C-100 low pressure machine. CFC-11 is purchased separately and is mixed manually into the polyol component.

4. PROJECT DESCRIPTION

Pangkat utilizes annually about 20 tons CFC-11 in the manufacture of rigid polyurethane panels. Under this project the use of this substance will be phased out through a combination of reduced CFC technology and HCFC-141b has been selected to be the interim replacement of choice, to be followed up by a non-ODS technology. The existing low pressure machine will be replaced with a high pressure machine. It is expected that higher recurrent cost will result related to the higher cost of HCFC-141b.

5. TECHNOLGY

5.1 OVERVIEW AND SELECTION

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

i) HCFC-141b
ii) HCFC-142b
iii) HCFC-142b & HCFC-22
iv) HFC-1341
v) Cyclopentane (CP)

Most technologies are employed in conjunction with increased water content. In addition, compounds such as perfluoroalkanes, HCFC-123, fluorinated ethers and 2-chloropropane have been suggested, but are immature in technology, limited in availabilty or toxicologically contested.

5.2 SELECTION

Pangkat has selected CFC-11 replacement through partial replacement by water in combination with HCFC-141b. HCFC-22 and 142b would require extra investment in pre-mixing equipment. Cyclopentane is not feasible based on the plant conditions that cannot be made safe enough for this purpose. The HFC-134a solution is too expensive.

5.3 IMPACT ON THE PRODUCTION PROCESS

The use of reduced CFC technology will require the empoyment 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 will be performed to assure safe working levels. The curent manually mixing method will be terminated through the use of pre-blended systems. This will save up to 20% of ABA.

6. PROJECT COSTS

6.1 TOTAL CAPITAL COSTS

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

DESCRIPTION	COST IN US$
Foaming machine	110,000
Mixing head beam	20,000
Freight & Installation	15,000
Start-up, trials	5,000
Technology transfer, training	15,000
Contingency & Rounding	20,000
TOTAL	**US$ 185,000**

The prices are calculated from available price lists.

6.2 RECURRENT INCREMENTAL COSTS

It is expected that the proposed conversion will result in a higher annual recurrent cost calculated as follows:

Before:	20 MT of CFC-11 @ US$ 2.0	US$ 40,000
After:	7.5 MT of HFCF-141b @ US$4.0	30,000
	13.5 MT MDI @ $1.85	24,975
RECURRENT INCREMENTAL COST		**US$ 14,975**
	say	**US$ 15,000**

Net Present Value (2 yrs; 10% discount) .... US$ 25,000

6.3 UNIT ABATEMENT COST

a) ODS reduction project cost	US$ 185,000
b) Annual incremental cost	15,000
c) Project Usseful Cost	10 years
d) ODS reduction / year	20,000 kg.
e) Capital recovery factor	0.16275

UNIT ABATEMENT COST [(a(e) + b)/d] = US$ 2.26

7. FINANCING PLAN

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

US$ 210,000

8. PROJECT IMPLEMENTATION

8.1 MANAGEMENT

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

8.2 PROCUREMENT

UNDP will oversee the procurement and provide technical assistance.

8.3 SCHEDULE

Implementation schedule will start with MLF approval of the project and will end after trials have confirmed that acceptable product can be made under the new production system. A detailed activity scheduled is provided below.

TASK	TIME FOR COMPLETION					
	Q3	Q4	Q1	Q2	Q3	Q4
1. Preparation						
MLF Approval	x					
Procurement	x					
2. Installation						
Machine Arrival			x			
Machine installation			x			
3. Trial Testing						
Start-up, trials			x			
Training				x		
Commissioning				x		

9. PROJECT IMPACT

This project will eliminate the use of 20 tons of CFCs in the first year of implementation. The project employs commercially and environmentally acceptable technology.

Annex: Technical Assessment

TECHNICAL REVIEW

PREPARED BY: Bert Veenendaal
UNDP Foam Sector Expert

DATE: June 13, 1994

1.	COUNTRY OF ORIGIN:	MALAYSIA
2.	PROJECT TITLE:	PNGKAT REFRIGERATION INDUSTRIES SDN. BHD. - Elimination of CFC-11 in the manufacture of Commercial Refrigerators
3.	(SUB)SECTOR	Foamed Plastics/Refrigeration
4.	CP RELATIONSHIP:	Not known
5.	TECHNOLOGY:	The choice of technology of the company is HCFC-141b. This is in the context of this enterprise the most feasible solution. Although pentane was considered, the consultant that helped in the project preparation felt that the safety would be compromised and advised at this moment 141b. This advise is supported
6.	ENVIRONMENTAL IMPACT:	HCFC-141b is moderately flammable. No specific precautions will be needed in the process under discussion, but a safety post-audit should confirm that workplace concentrations are not exceeding 10% of the LEL. The substance carries also an ODP and is considered a transitional compound. The company should monitor the market on non-ODP solutions that can be processed on the same equipment and apply these as soon as cost will allow this.
7.	PROJECT COSTS:	The unit abatement cost are reasonable for this type of operation (recent projects in Egypt, Malaysia and Thailand range from 1.56 to 2.54). The somewhat higher cost for Pangkat is related to the size of the production

8.	IMPLEMENTATION:	Adequate
9.	RECOMMENDATION:	The project is recommended for approval

PROJECT COVER SHEET

COUNTRY:	Malaysia
PROJECT TITLE:	**ALLIED FOAM INSULATION** - Elimination of CFC-11 in the Manufacture of Polyurethane Foams for Pipe Insulation
SECTORS COVERED:	Foamed plastics
ODS USE IN SECTOR:	600 MT in 1991
PROJECT IMPACT:	Elimination of 25 MT of CFC-11
PROJECT DURATION:	One year
TOTAL PROJECT COST:	US$ 260,000 Incremental Capital Cost US$ 16,000 Incremental Operating Cost
PROPOSED MLF GRANT:	US$ 276,000
COST EFFECTIVENESS:	US$ 2.08 kg/yr (unit abatement cost)
NATIONAL COORDINATING AGENCY:	Department of Environment (DOE)
IMPLEMENTING AGENCY:	UNDP
APPRAISAL DATE:	7 June 1994

PROJECT SUMMARY

Allied Foam Insulation is a 100% Malaysian-owned private company. It manufactures pipe insulation products and uses CFC-11 as a blowing agent. Under the project, the company will phase out the use of 25 MT of CFC-11 through conversion to a combination of reduced auxiliary blowing agent (ABA) technology and HCFC-141b. This constitutes an interim replacement towards full water-blown system or other emerging non-ODS solutions. Investment under the project will include replacement of the existing machines with a high pressure foaming unit, a variable ratio spray machine, trials and incremental operating cost.

Prepared by: Mr. Tommy Lauridsen, Foam Consultant
Reviewed by: Mr. Bert Veenendaal, UNDP Sector Expert (Foams)

PROJECT OF THE GOVERNMENT OF MALAYSIA

ALLIED FOAM INSULATION SDN. BHD. - PHASE OUT OF THE USE OF CFCs IN THE MANUFACTURE OF PIPE INSULATION FOAMS

1. PROJECT OBJECTIVE

The objective of this project is to phase out the use of CFC-11 in the manufacture of rigid polyurethane foam at Allied Foam Insulation Sdn. Bhd.

2. SECTOR BACKGROUND

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

3. ENTERPRISE BACKGROUND

Allied Foam Insulation is a 100% Malaysian owned private company manufacturing sprayed pipe and pre-fabricated half-pipe insulation foam products. The company currently operates one low pressure Cannon foam dispenser and a Gusmer spray foam machine. CFC-11 is currently pre-blended in the polyol (A) component through an open top system.

4. PROJECT DESCRIPTION

Allied Foam Insulation utilizes annually about 25 tons of CFC-11 in the manufacture of pipe insulation foams. Under the project, the company will eliminate the use of CFC through conversion to a combination of reduced-ABA technology and HCFC-141b as an interim replacement of choice, followed by a non-ODS technology which may include full water-blown system or other emerging ODS-free technologies. The system conversion will require installation of a high pressure foaming unit with two mixing heads, a variable ratio small spray machine and a pre-mixing unit to handle other types of HCFCs. Trials and incremental operating cost will also be included.

5. TECHNOLOGY

5.1 OVERVIEW AND SELECTION

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

- CFC-11 > partial water / HCFC-141b
- CFC-11 > partial water / HCFC-22 - 142b / HFC-134a
- CFC-11 > partial water / (cyclo)pentane

For pipe insulation the use of HCFC-141b will for the time being be the solution as the processing technology and product performance is environmentally acceptable and the chemical is locally available.

5.2 PRODUCTION PROCESS

The use of reduced-CFC/water-blown technology will cause higher viscosities and will require the use of high pressure foaming equipment. HCFC-141b are moderately flammable. For the intended purpose the blends should not cause any risk, but a monitoring check will be performed to assure safe working level. The current manual mixing method should be replaced by an automated pressurized one. This will save up to 20% ABA.

6. PROJECT COST

6.1 TOTAL CAPITAL COSTS

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

DESCRIPTION	COST IN US$
1 high pressure foaming unit	110,000
1 pre-mixing station with tank	65,000
1 small spray foam machine	40,000
Test and trials	8,000
Technology transfer	10,000
Contingency & Rounding	27,000
TOTAL	**US$ 260,000**

The prices are calculated from available price lists and direct enquiries at suppliers.

6.2 OPERATING COST

It is expected that the proposed conversion will result in higher recurrent cost based on the following calculations:

Before:	25 MT of CFC-11 @ US$ 2.00................	US$ 50,000
After:	15 MT of MDI @ US$ 1.85....................	US$ 27,750
	8 MT of HCFC-141b @ US$ 4.0...............	US$ 32,000

RECURRENT INCREMENTAL COST........................ US$ 9,750

NET PRESENT VALUE (2 yr, 10% discount) .... US$ 16,000

6.3 UNIT ABATEMENT COST

a)	ODS reduction project costs	US$ 260,000
b)	Annual incremental cost	9,750
c)	Project useful life	10 years
d)	ODS reduction/year	25,000 kg
e)	CAPITAL RECOVERY FACTOR (10%)	0.16275

Unit abatement cost [(a(e) + b)/d] = US$ 2.08 kg/yr

7. FINANCING PLAN

The company requests the financing of the total project costs, estimated at

<u>US$ 276,000</u>

8. PROJECT IMPLEMENTATION

8.1 MANAGEMENT

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

8.2 PROCUREMENT

UNDP will oversee the procurement and provide technical assistance.

8.3 SCHEDULE

Implementation schedule will start with MLF approval of the project and will end after trials have confirmed that acceptable product can be made under the new production system. A detailed activity schedule is provided below:

TASK	TIME FOR COMPLETION (MONTHS)											
	1	2	3	4	5	6	7	8	9	10	11	12
Preparation												
MLF Approval	x											
Procurement Prep.		x										
Vendor selection			x									
Installation												
Arrival, Customs							x					
Installation								x				
Start-up,												
Machine Start-up									x			
Trials, Training										xxxxxxx		
Certification												x

9. PROJECT IMPACT

This project will eliminate the use of at least 25 MT of CFCs in the first year of implementation. The project employs commercially and environmentally acceptable technology.

10. ANNEXES

Annex A: Technical Assessment

TECHNICAL REVIEW

PREPARED BY: Bert Veenendaal
UNDP Foam Sector Expert

DATE: June 13, 1994

1.	COUNTRY OF ORIGIN:	MALAYSIA
2.	PROJECT TITLE:	ALLIED FOAM INSULATION - Elimination of CFC-11 in the manufacture of Polyurethane Foams for Pipe Insulation
3.	(SUB)SECTOR	Foamed Plastics/Refrigeration
4.	CP RELATIONSHIP:	Not known
5.	TECHNOLOGY:	The choice of technology of the company is reduced ABA/HCFC-141b. This is for this type of pipe insulation currently the most feasible solution. Although pentane could be considered for the half-pipes, it cannot be used in the field. For a company in this size it is not advisable to go with two technologies
6.	ENVIRONMENTAL IMPACT:	HCFC-141b is moderately flammable. No specific precautions will be needed in the process under discussion, but a safety post-audit should confirm that workplace concentrations are not exceeding 10% of the LEL. because the company works partly on site under ever changing conditions, it should be considered to have a portable monitor added to the project. The substance carries also an ODP and is considered a transitional compound. The company should monitor the market on non-ODP solutions that can be processed on the same equipment and apply these as soon as cost will allow this.

7. PROJECT COSTS: The unit abatement cost are reasonable for this type of operation (recent projects Brazil, China, Egypt and Uruguay range from 0.92 to 2.39). The somewhat higher cost for Allied is related to the fact that it uses spray foam <u>and</u> block foam

8. IMPLEMENTATION: Adequate

9. RECOMMENDATION: The project is recommended for approval

PROJECT COVER SHEET

COUNTRY:	Malaysia
PROJECT TITLE:	EVERSOFT FOAM INDUSTRIES SDN. BHD. - Elimination of CFC-11 in the manufacture of Cold Cure Molded Flexible Polyurethane Foams
SECTORS COVERED:	Foamed plastics
ODS USE IN SECTOR:	600 MT in 1991 - foam
PROJECT IMPACT:	Elimination of 30 MT of CFC-11
PROJECT DURATION:	One year
TOTAL PROJECT COST:	US$ 185,000 Incremental Capital Cost
PROPOSED MLF GRANT:	US$ 185,000
COST EFFECTIVENESS:	US$ 1.00 /kg/yr
NATIONAL COORDINATING AGENCY:	Department of Environment (DOE),Malaysia
IMPLEMENTING AGENCY:	UNDP
APPRAISAL DATE:	7 June 1994

PROJECT SUMMARY

Eversoft Foam Industries is a 100% Malaysian-owned private company manufacturing moulded mattresses. CFC-11 is currently used as a blowing agent in the production process. The project will eliminate the use of 30 MT of CFC-11 through conversion to a full water-blown technology. The existing foaming unit will be replaced by a high pressure foam dispenser. Higher incremental operating cost is expected at least during the first two years after the system conversion as a result of additional isocyanates needed.

Prepared by: Mr. Tommy Lauridsen, Foam Consultant
Reviewed by: Mr. Bert Veenendaal, UNDP Sector Expert (Foams)

PROJECT OF THE GOVERNMENT OF MALAYSIA

EVERSOFT FOAM INDUSTRIES SDN. BHD. - PHASE OUT OF THE USE OF CFCs IN THE MANUFACTURE OF MOULDED COLD-CURE FLEXIBLE FOAM

1. PROJECT OBJECTIVE

The objective of this project is to phase out the use of CFC-11 in the manufacture of molded cold-cure flexible foam at Eversoft Foam Industries Sdn. Bhd.

2. SECTOR BACKGROUND

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

3. ENTERPRISE BACKGROUND

Eversoft Foam Industries is a 100% Malaysian owned private company manufacturing moulded mattresses. The company currently operates a low pressure Cannon foaming unit. CFC-11 is manually pre-mixed for cold-cure process. The company has partially switched to methylene chloride technology and is currently using 60% MDI and 40% TDI.

4. PROJECT DESCRIPTION

Eversoft Foam Industries utilizes annually about 30 tons of CFC-11 in the manufacture of flexible cold-cure mattresses. Under the project, the company will eliminate the use of CFC-11 through conversion to a full water-blown system to complete its ODS phaseout plan. The existing foaming equipment will be replaced with a high pressure machine. No incremental cost impact is anticipated.

5. TECHNOLOGY

5.1 OVERVIEW AND SELECTION

There are numerous technologies to replace the use of CFCs in flexible foam by non-ODS or low-ODS options. Available replacements are:

- Alternative blowing agents (methylene chloride, HCFC-141b, HCFC-123)
- Softening agents
- Reduced index/additive technology
- extended range polyols

5.2 PRODUCTION PROCESS

The use of an all water-blown system for the wide ranging products of the recipient will require the employment of a high pressure foaming machine, with two mixing heads and a wide-range output.

For cold-cure systems, the most suitable ODS replacement technology is to change to a water blown system. The conversion will involve the use of more MDI and will increase the viscosity considerably.

6. PROJECT COST

6.1 TOTAL CAPITAL COSTS

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

DESCRIPTION	COST IN US$
1 high pressure foaming unit with two mixing heads	130,000
Freight & installation	20,000
Trials & start up	10,000
Technology transfer	10,000
Contingency & Rounding	15,000
TOTAL	**US$ 185,000**

The prices are calculated from available price lists and direct enquiries at suppliers.

6.2 OPERATING COST

The savings to be realized will offset the cost increases, as the following calculation shows:

Before:	30t CFC-11 @ USD 2,000..................USD	60,000
	3t cleaning solvent USD @ 750..........USD	2,250
After:	36t Isocyanate @ USD 1,850..............USD	66,000
	INCREMENTAL OPERATING COSTS/Y...........USD	3,750

In addition some material savings (less waste) can be expected from more efficient material use.

In conclusion, the proposed system conversion is not expected to result in any significant incremental operating cost.

6.3 UNIT ABATEMENT COST

a)	ODS reduction project costs	US$ 185,000
b)	Annual incremental benefits	-
c)	Project useful life	10 years
d)	ODS reduction/year	30,000 kg
e)	Capital recovery factor (10%)	0.16275

Unit abatement cost [(a(e) + b)/d] = US$ 1.00/kg/y

7. FINANCING PLAN

The company requests the financing of the total project costs, estimated at:

US$ 185,000

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 and provide technical assistance.

8.3 SCHEDULE

Implementation schedule will start with MLF approval of the project and will end after trials have confirmed that acceptable product can be made under the new production system. A detailed activity schedule is provided below:

TASK	TIME FOR COMPLETION (MONTHS)											
	1	2	3	4	5	6	7	8	9	10	11	12
Preparation												
MLF Approval	x											
Procurement Prep.		x										
Vendor selection			x									
Installation												
Arrival, Customs							x					
Installation								x				
Start-up,												
Machine Start-up									x			
Trials, Training										xxxxxxx		
Certification												x

9. PROJECT IMPACT

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

10. ANNEXES

Annex A: Technical Assessment

TECHNICAL REVIEW

PREPARED BY: Bert Veenendaal
UNDP Foam Sector Expert

DATE: June 13, 1994

1. COUNTRY OF ORIGIN: MALAYSIA

2. PROJECT TITLE: EVER SOFT - Elimination of CFC-11 in the manufacture of Cold Cure molded Flexible Polyurethane Foams

3. (SUB)SECTOR Foamed Plastics

4. CP RELATIONSHIP: Not known

5. TECHNOLOGY: The choice of technology of the company is the use of water based formulations. This is accepted technology that is world- wide applied. In the USA this technology almost exclusively used in flexible molded PUF. The use of water increases the use of isocyanate. In case of TDI the effect does generally not trigger increased formulation cost. In case of MDI there may be a cost increase based on the unfavorable replacement ratio (10 parts of CFC-11 replaced by 14-16 parts of MDI).

6. ENVIRONMENTAL IMPACT: Water based foams emit chemically generated carbon dioxide. Although this substance is frequently mentioned in global warming discussion, the actual impact is more related to the emissions from vehicles and the generation of electric energy. the impact from foams is negligible

7. PROJECT COSTS: The unit abatement cost are reasonable for this type of operation (1.50 - 5.00)

8. IMPLEMENTATION: Adequate

9. RECOMMENDATION: The project is recommended for approval

PROJECT COVER SHEET

COUNTRY:	Malaysia
PROJECT TITLE:	**Nian Aik Foam Sdn. Bhd** - Elimination of CFC-11 in the manufacture of Cold Cure Molded Flexible Polyurethane Foams
SECTORS COVERED:	Foamed plastics
ODS USE IN SECTOR:	600 MT in 1991 - foam
PROJECT IMPACT:	Elimination of 30 MT of CFC-11
PROJECT DURATION:	One year
TOTAL PROJECT COST:	US$ 248,000 Incr. Capital Costs US$ 3,000 Incr. Recurrent Benefits
PROPOSED MLF GRANT:	US$ 245,000
COST EFFECTIVENESS:	US$ 1.31/kg/yr
NATIONAL COORDINATING AGENCY:	Department of Environment (DOE)
IMPLEMENTING AGENCY:	UNDP
APPRAISAL DATE:	7 June 1994

PROJECT SUMMARY

Nian Aik Foam is a 100% Malaysian-owned private company established in 1965. It manufactures high quality bedding products including mattresses, cushions, pillows and bolster for the domestic market and for export to other Asian markets. CFC-11 is currently used in the foam production line as a blowing agent as well as a viscosity cutter. This project will eliminate the use of 30 MT of CFC-11 through conversion to a full water-blown process using the MDI system.

Prepared by: Mr. Tommy Lauridsen, Foam Consultant
Reviewed by: Mr. Bert Veenendaal, UNDP Sector Expert (Foams)

PROJECT OF THE GOVERNMENT OF MALAYSIA

NIAN AIK FOAM SDN. BHD. - PHASE OUT OF THE USE OF CFCs IN THE MANUFACTURE OF MOULDED COLD-CURE FLEXIBLE FOAM

1. PROJECT OBJECTIVE

The objective of this project is to phase out the use of CFC-11 in the manufacture of molded cold-cure flexible foam at Nian Aik Foam Sdn. Bhd.

2. SECTOR BACKGROUND

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

3. ENTERPRISE BACKGROUND

Nian Aik Foam Industries is a 100% Malaysian owned private company established in 1965. The company manufactures high quality bedding products including mattresses, cushions, pillows and bolsters. Nian Aik currently operates 2 high pressure foam dispensers for molded parts. CFC-11 is hand-mixed for production of mattresses under a unique homemade formula that includes solid chemicals (mechanical equipment does not handle solids very well). The company has experimented with methylene chloride but would like to pursue other technological options.

4. PROJECT DESCRIPTION

Nian Aik utilized in 1993 about 30 tons of CFC-11 in the manufacture of flexible cold-cure foam products for the bedding industry. Under the project, the company will eliminate the use of CFC-11 through conversion to a water-blown MDI system.

5. TECHNOLOGY

5.1 OVERVIEW AND SELECTION

CFC-11 is used in this application to soften the foam. Available replacements are:

- o Alternative blowing agents (Methylene Chloride, HCFC-141b, HCFC-123)
- o Softening agents
- o Reduced index/additive technology
- o extended range polyols

For cold-cure systems, the most suitable ODS replacement technology is to change to a water blown system. This will involve the use of more MDI and will increase the viscosity considerably. To allow for the resulting higher viscosity of the polyol components, a special foaming unit with a slurry feeding system is required to ensure an optimal mixing to maintain the production of this kind of a high quality product. This system conversion requires numerous trials before product quality can be brought to an acceptable standard.

5.2 PRODUCTION PROCESS

The use of an all water blown system, causing higher viscosities, will cause no problems on the existing high pressure equipment. This is not the case for the mattress production line where solid additives are used and the viscosity is now already very high. The polyol/calcium carbonate slurry cannot be metered by conventional equipment and-most likely-not anymore mixed by hand. A special dispenser with a slurry metering system is needed to maintain the current high product quality. In addition substantial trials will be needed to implement the CFC-free filled foam technology.

6. PROJECT COST

6.1 TOTAL CAPITAL COSTS

The following is a summary of the expected investment costs:

DESCRIPTION	COST IN US$
Foam equipment	
. special purpose foam dispenser	180,000
. Freight & installation	20,000
Trials & start up	15,000
Technology transfer	10,000
Contingency & Rounding	23,000
TOTAL	**US$ 248,000**

The prices are calculated from available price lists and direct enquiries at suppliers.

6.2 OPERATING COST

It is expected that the proposed conversion will result in a small recurrent impact, based on the following calculations:

Before:	30 MT of CFC-11 @ US$ 2.00................	US$ 60,000
After:	40 MT of MDI @ US$ 1.85....................	US$ 74,000
	Foam yield improvement.....................	US$ 15,000
RECURRENT INCREMENTAL BENEFITS....................		**US$ 1,000**
NET PRESENT VALUE (4y;10%).........................		US$ 3,000

6.3 UNIT ABATEMENT COST

a)	ODS reduction project costs	US$ 248,000
b)	Annual incremental benefits	1,000
c)	Project useful life	10 years
d)	ODS reduction/year	30,000 kg
e)	CAPITAL RECOVERY FACTOR (10%)	0.16275
	Unit abatement cost [(a(e) + b)/d] =	**US$ 1.31/kg/y**

7. FINANCING PLAN

The company requests the financing of the total project costs, estimated at:

US$ 245,000

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 and provide technical assistance.

8.3 SCHEDULE

Implementation schedule will start with MLF approval of the project and will end after trials have confirmed that acceptable product can be made under the new production system. A detailed activity schedule is provided below:

TASK	TIME FOR COMPLETION (MONTHS)											
	1	2	3	4	5	6	7	8	9	10	11	12
Preparation												
MLF Approval	x											
Procurement Prep.		x										
Vendor selection			x									
Installation												
Arrival, Customs							x					
Installation								x				
Start-up,												
Machine Start-up									x			
Trials, Training										xxxxxxx		
Certification												x

9. PROJECT IMPACT

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

10. ANNEXES

Annex A: Technical Assessment

TECHNICAL REVIEW

PREPARED BY: Bert Veenendaal
UNDP Foam Sector Expert

DATE: June 13, 1994

1. COUNTRY OF ORIGIN:	MALAYSIA
2. PROJECT TITLE:	NIAN AIK - Elimination of CFC-11 in the manufacture of Cold Cure molded Flexible Polyurethane Foams
3. (SUB)SECTOR	Foamed Plastics
4. CP RELATIONSHIP:	Not known
5. TECHNOLOGY:	The choice of technology of the company is the use of water based formulations. This is accepted technology that is world- wide applied. In the USA this technology almost exclusively used in flexible molded PUF. The use of water increases the use of isocyanate. In case of TDI the effect does generally not trigger increased formulation cost. In case of MDI there may be a cost increase based on the unfavorable replacement ratio (10 parts of CFC-11 replaced by 14-16 parts of MDI).
6. ENVIRONMENTAL IMPACT:	Water based foams emit chemically generated carbon dioxide. Although this substance is frequently mentioned in global warming discussion, the actual impact is more related to the emissions from vehicles and the generation of electric energy. the impact from foams is negligible
7. PROJECT COSTS:	The unit abatement cost are very reasonable for this type of operation (1.50 - 5.00)
8. IMPLEMENTATION:	Adequate
9. RECOMMENDATION:	The project is recommended for approval

PROJECT COVER SHEET

COUNTRY:	Malaysia
PROJECT TITLE:	**PHOENIX BASE** - Elimination of CFC-11 in the Manufacture of Flexible Polyurethane Foam
SECTORS COVERED:	Foamed plastics
ODS USE IN SECTOR:	600 MT in 1991 - foam
PROJECT IMPACT:	Elimination of 61 MT of CFC-11
PROJECT DURATION:	One year
TOTAL PROJECT COST:	US$ 165,000 Incremental Capital Cost
PROPOSED MLF GRANT:	US$ 165,000
COST EFFECTIVENESS:	US$ 0.44 kg/yr (unit abatement cost)
NATIONAL COORDINATING AGENCY:	Department of Environment (DOE)
IMPLEMENTING AGENCY:	UNDP
APPRAISAL DATE:	7 June 1994

PROJECT SUMMARY

Phoenix Base is a 100% Malaysian-owned private company founded in 1972. Its main products consist of packaging foams, acoustic insulation foam and mattresses. CFC-11 is used as a blowing agent. Under the project, the company will phase out the use of 61 MT of CFC-11 through conversion to methylene chloride technology. Under the project, the metering system for catalyst which feeds the existing continuous foam line and two box units will be replaced and a vacuum-cure system will be installed. In addition, the ventilation and control systems will be upgraded and process training will be provided. Formulation trials??? not costed in.

Prepared by: Mr. Tommy Lauridsen, Foam Consultant
Reviewed by: Mr. Bert Veenendaal, UNDP Sector Expert (Foams)

PROJECT OF THE GOVERNMENT OF MALAYSIA

PHOENIX BASE SDN. BHD. - PHASE OUT THE USE OF CFC-11 IN THE MANUFACTURE OF FLEXIBLE POLYURETHANE FOAM

1. PROJECT OBJECTIVE

The objective of this project is to phase out the use of CFC-11 in the manufacture of flexible PUF slabstock at Phoenix Base SDN. BHD.

2. SECTOR BACKGROUND

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

3. ENTERPRISE BACKGROUND

Pheonix Base SDN. BHD. was founded in 1972 and is 100% Malaysian-owned. This company is currently operating out of a new plant that was built in 1992 and manufactures flexible polyurethane foam on one continuous foam line and two box foam units. Pheonix's product line consists of packaging foams, furniture, mattresses, acoustic foams and miscellaneous foams.

4. PROJECT DESCRIPTION

Phoenix used approximately 61 tons of CFC-11 in 1993. Because of requirements for CFC-free PUF foam placed on them by their customers, they have begun using methylene chloride in their manufacturing process. Since the implementatiion of merhylene chloride, Pheonix Base has been experiencing problms with low density foams and reverted to hand mixing with CFC-11 and box pouring. Also due to poor ventilation on the foam machine, employees are complaining about the use of methylene chloride. The company could not complete the phase out of CFC. For 1994 a redidual use of about 20 tons is expected. Under this project, the company will receive technical assistance to implement a complete phaseout of CFC.

5. TECHNOLOGY

Pheonix Base decided to use methylene chloride as replacement for CFC-11. The use of MC will allow replacement of CFCs in a cost effective way, without unacceptable losses in performance and processing. Pre-condition is however a well planned reformulation program to implement adjustments in the amount of blowing agent as well as in amount and type of catalysts. Aslo, workplace concentrations of methylene chloride have to be limited to acceptable industrial hygenic standards.

6. PRODUCTION PROCESS

6.1 CAPITAL COSTS

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

DESCRIPTION	TOTAL (USD)
-Metering System for Catalyst	5,000
-Ventilation System and Control	30,000
-Training on Safety and Process Technical Transfer	20,000
-Vacum Curing System	70,000
-Trials	25,000
-Contingency	15,000
TOTAL	165,000

6.2 OPERATING COSTS

It is expected that the operating cost through the use of metylene chloride will decline, however, this will onlly happen when the company has obtained sufficient experience in processing with methylene chloride. This will take several years. Therefore, it is assumed that no recurrent incremental cost will be incurred. Annex- A provides more information on incremental recurrent cost.

6.3 UNIT ABATEMENT COST

a)	ODS reduction project costs	165,000
b)	Annual incremental cost	-
c)	Project useful life	10 years
d)	ODS reduction/year	61.000 kg
e)	Capital Recovery Factor	.16275

Unite Abatement Costs [a(e) + b]/d = USD/kg/yr 0.44

7. FINANCING PLAN

The company requests the financing of the complete project cost estimated at

USD 165,000

8. PROJECT IMPLEMENTATION

8.1 MANAGEMENT

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

8.2 PROCUREMENT

UNDP will oversee the procurement and provide assistance.

8.3 SCHEDULE

The 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 methylene chloride can be detected.

TASK	TIME FOR COMPLETION (MONTHS)											
	1	2	3	4	5	6	7	8	9	10	11	12
Preparation												
MLF Approval	x											
Procurement Prep.		x										
Vendor selection			x									
Installation												
Arrival, Customs								x				
Installation								x				
Start-up,												
Machine Start-up										x		
Trials, Training											xx	
Certification												x

9. PROJECT IMPACT

This project will eliminate the use if at least i61 tons of CFCs in the first year of implementation and ensure safety in plants that have already transferred to non-ODS technology on their own. The project employs commercially and environmentally acceptable technology.

Annex A: Incremental Recurrent Cost
Annex B: Technical Assesment

ANNEX - A

RECURRENT INCREMENTAL COSTS

For conversion from CFC-11 to methylene chloride, it is generally assumed a drop of about 5% net in prime yield during the first year, and 2.5% during the second year. After that, yield figures normally return to standard.

In the process, 61 tons/year of ODS is replaced by an equal tonnage of methylene chloride. In addition, the catalysts and polyol have to be changed, recurrent safety training, operating costs for the forced cooling and increased maintenance will be needed. This will impact on the operating costs as follows:

ITEM	BEFORE	AFTER
61 T/Y CFC-11 @ US$ 2.0/kg	USD 122,000	
61 T/Y Methylene Chloride @ US$ 0.7 /kg		USD 42,700
3 T/Y Softening Additive @ 7.50/kg		22,500
1 T/Y Extra Amine Catalyst @ 15.00/kg		15,000
1 T/Y Extra Tin Catalyst @ 8.00/kg		8,000
? T/Y BHT free polyol @		pm
Annual electricity for forced cooling		8,000
Training, Maintenance		USD 7,000
TOTAL	**USD 122,000**	**USD 106,200**
DIFFERENCE		**USD** 18,800

INCURRED COSTS FROM PRIOR CONVERSION EFFORTS:

First year yield:
Incremental Gain = USD 18,800
Loss = 5% x 800T/Y @ 1500 = 60,000
- 42,200 x 1.0000 = USD - 42,200

Second year yield:
Incremental Gain = USD 18,800
Loss = 2.5% x 800 T/Y @ 1500 = - 30,000
- 11,200 x 0.9090 = USD - 10,181

Third year yield:
Incremental Gain = USD 18,800
Loss = 0% x 800 T/Y @ 1500 = - 0
+ 18,800 x 0.8260 = USD + 15,529

Fourth year yield:
Incremental Gain = USD 18,800
Loss = 0% x 800 T/Y @ 1500 = - 0
+ 18,800 x 0.7513 = USD + 14,121

NET FOUR YEAR TOTAL................USD -22,731

On the balance, a slight increase in incremental recurrent costs appears to exist over the 4 year transitional period. However, it is acknowledged that subsequent years would turn the balance . Based on this, recurrent incremental costs should not be considered.

TECHNICAL REVIEW

PREPARED BY: Bert Veenendaal
UNDP Foam Sector Expert

DATE: June 13, 1994

1. COUNTRY OF ORIGIN: MALAYSIA

2. PROJECT TITLE: PHOENIX BASE - Elimination of CFC-11 in the Manufacture of Flexible Polyurethane Foam

3. (SUB)SECTOR Foamed Plastics

4. CP RELATIONSHIP: Not known

5. TECHNOLOGY: The choice of technology of the company is the use of methylene chloride (MC) as a blowing agent. This is accepted technology that is predominantly applied in North America, but also to a lesser extend in some European countries and in Japan. It is very cost-effective, but requires a long learning curve for the recipients--sometimes several years. many companies start to apply this technology without MLF funds, but revert later entirely or partly because of process problems. Also, workers safety is very often compromised by not providing adequate ventilacion or fire safety

6. ENVIRONMENTAL IMPACT: MC has a relative short retention time in the atmosphere. It contributes consequently negligible to ozone depletion and to global warming. The problem with this substance is its perceived toxicity. Although MC is only classified as a suspected human carcinogen and even this classification is contested, measures to ensure proper worker protection to avoid exposure above acceptable standards (about 50 ppm TWA in most industrialized countries) should be part of any MLF project involving MC. This project addresses this problem adequately.

7. PROJECT COSTS:	The unit abatement cost are reasonable for this type of operation (1.14 versus generally 0.50 - 1.50). There is no detailed calculation of IRCs. However, the conclusion is supported through several projects from Egypt, Ghana. Indonesia and Malaysia
8. IMPLEMENTATION:	Adequate
9. RECOMMENDATION:	The project is recommended for approval

PROJECT COVER SHEET

COUNTRY:	**Malaysia**
PROJECT TITLE:	**LIAN PANG - Elimination of CFCs in the manufacture of commercial refrigeration products**
SECTOR COVERED:	**Foamed Plastics/Refrigeration**
ODS USE IN SECTOR:	**600 MT CFCs in foams (1991) 1,500 MT in refrigeration (1991)**
PROJECT IMPACT:	**13 MT per year (base 1993)**
PROJECT DURATION:	**One year**
PROJECT USEFUL LIFE:	**10 years**
TOTAL PROJECT COSTS:	**USD 155,000 Incremental Capital Cost USD 87,000 Incremental Operating Cost**
PROPOSED MLF GRANT:	**USD 242,000**
COST EFFECTIVENESS:	**USD 6.78 (unit abatement cost)**
NATIONAL COORDINATING AGENCY:	**Malaysia Department of Environment (DOE)**
IMPLEMENTING AGENCY:	**UNDP**
APPRAISAL DATE:	**April 28/June 7,1994**

PROJECT SUMMARY

Lian Pang Refrigerator & Electrical SDN. BHD ("LIAN PANG") is a 100% Malaysian-owned private company manufacturing commercial refrigerator equipment such as insulation panels, refrigerators and display cabinets. Under this project the company will phaseout the use of CFCs in its process, using HCFC-141b (foam) and HFC-134a (refrigerant) as the respective ODS-replacement. The existing foaming unit will be repalced by a high pressure machine. The evacuation and charging equipment will also be replaced.

Prepared by: Mr. Tommy Lauridsen, Foam Consultant
Reviewed by: Mr. Bert Veenendaal, UNDP Sector Expert (Foams)

PROJECT OF THE GOVERNMENT OF MALAYSIA

LIAN PANG - ELIMINATION OF CFCs IN THE MANUFACTURE OF COMMERCIAL REFRIGERATION PRODUCTS

1. PROJECT OBJECTIVE

The objective of this project is to phase out the use of CFCs in the manufacture of commercial refrigeration products at LIAN PANG.

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. Refrigeration and Air-Conditioning (RAC) is Malaysia's largest ODS consuming sector--1,500t in 1991--with CFC-12 as the main substance.

3. ENTERPRISE BACKGROUND

Liang Pang Refrigerator & Electrical Sdn. Bhd. ("LIAN PANG") was founded in 1978, with a production facility in Skuda, Johor. It manufactures commercial refrigeration products such as insulation panels, refrigerators/freezers and display cabinets. It employs 30 persons. The enterprise used in 1993 10t CFC-11 in the production of rigid insulation foam, and 3t ODS (mainly CFC-12, some R-502) in refrigeration systems. From the latter about 10% was used in after sales service. The foam is currently hand-mixed and -poured. About 10,000 units/year production provide the base for annual sales of M$ 2,500,000 (1993).

4. PROJECT DESCRIPTION

Under this project LIAN PANG will phaseout the use of CFCs in the manufacture of its products. A combination of reduced CFC technology and HCFC-141b is selected as the replacement of choice. A high pressure foam dispenser will have to be installed. Some additional cost for trials will occur. For the refrigerator units HFC-134a is selected triggering the need to replace evacuation and charging equipment. Recurrent incremental cost are expected related to the price of HFC-134a and the change in refrigeration hardware.

5. TECHNOLOGY

5.1 OVERVIEW AND SELECTION

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

- **CFC - 11 > partial water/HCFC-141b > ?**
- **CFC - 11 > partial water/HCFC-22 > HFC-134a, 152a**
- **CFC - 11 > partial water/(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 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 is this process is seen as the introduction of (gaseous) HFCs. The high diffusion rate of HCFC-22 limits its use to encapsulated systems.

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

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

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

The choice of high pressure equipment will facilitate the step to a truly ODP-free system at a later stage.

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 commissioning will be performed to assure safe working levels.

The current manual mixing method should be replaced by the use of customized or standardized blends. This will save up to 10% ABA (auxiliary blowing agent) that are now lost in the blending operation. The Company is too small to justify in-house blending.

6. PROJECT COSTS

The following is the summary of the expected cost (USD) of the investment and related activities.

6.1 CAPITAL COST

DESCRIPTION	SUBTOTAL (USD)	TOTAL (USD)
Foam Equipment		
1 High pressure foaming Unit	120,000	
- Freight	10,000	
- Installation	10,000	
- Spare parts	10,000	150,000
Trials		10,000
Technology transfer/training		10,000
Sub-total:		**170,000**
Refrigerating System		
Charging & vacuum system		25,500
Prototyping		2,500
Technology transfer/training		10,000
SUB-TOTAL		**38,000**
Contingency		22,000
TOTAL: Project Cost		**230,000**
% Company participation in the equipment purchase		75,000
INCREMENTAL CAPITAL COST		155,000

6.2 OPERATING COSTS

The use of HCFC-141b and HFC 134a generates incremental recurrent cost:

FOAM

Before:	10t CFC-11 @ 2,000	USD 20,000
After:	7t MDI @ 1,850	USD 12,950
	6t HCFC-141b @ 4,000	USD 20,000
	Saving of 2t CFC-11 by abandoning hand- mixing	USD 4,000
	SUB-TOTAL	USD 8,950

REFRIGERANT

Before:	2.5t CFC-12 @ 2,500	USD 6,250
After:	2.25t HFC-134a @ 8,000	USD 10,000
	Higher cost of compressors, drier capillaries: 10,000 @ 3.00	USD 30,000
	SUB-TOTAL	USD 41,750

TOTAL INCREMENTAL RECURRENT COST...........USD 50,700

This amounts to a NPV (2yrs; 10% discount) of USD 87,204, say:

USD 87,000

6.3 UNIT ABATEMENT COST

a)	ODS Reduction Project Costs	USD 230,000
b)	Annual Incremental Costs	USD 50,700
c)	Project Useful Life	10 years
d)	ODS reduction/year	13,000 kg

Unit Abatement Costs [(a/c + b)]/d USD/Kg/y 6.78

7. FINANCING PLAN

Because of the change from hand-mixing to machine dispensing, the company will experience an improvement in foam quality and foam processing. The company agrees therefore to participate in the cost of the foam dispenser to the amount of 50% or USD 75,000.The company requests the financing of

USD 242,000

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 and provide technical assistance.

8.3 SCHEDULE

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

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

9. PROJECT IMPACT

This project will eliminate the use of at least 13 tons of CFCs in the first year of implementation. The Project employs commercially and environmentally acceptable technology.

Annex: Technical Assessment

JSL/eo 24/6/94/003

TECHNICAL REVIEW

PREPARED BY: Bert Veenendaal
UNDP Foam Sector Expert

DATE: June 13, 1994

1. COUNTRY OF ORIGIN: MALAYSIA

2. PROJECT TITLE: LIAN PANG - Elimination of CFC-11 in the Manufacture of commercial refrigeration products

3. (SUB)SECTOR Foamed Plastics/Refrigeration

4. CP RELATIONSHIP: Not known

5. TECHNOLOGY: The choice of technology of the company is the use of HCFC-141b as a blowing agent. This is accepted interim technology that is predominantly applied in North America, but also to a lesser extend in some European countries and in Japan. In the case of LIAN PANG, an option involving flammable substances such as (cyclo)pentane is for safety reasons not feasible. The selection is supported.

   The choice of HFC-134a as refrigerant is also supported.

6. ENVIRONMENTAL IMPACT: HCFC-141b is moderately flammable. No specific precautions are likely needed, but the project should include an safety and industrial hygienic audit to assure compliance with safety and exposure standards.

   Also, the company should be aware that HCFCs are interim substances that ultimately have to be replaced. The equipment is capable to process LBBAs, which means that most likely no additional retrofitting will be needed

7. PROJECT COSTS: The unit abatement cost are reasonable for this type of operation (LIAN PANG: 8.84; Unimagna: 8.85; Sanden: 12.78)

The fact that the company participates in the cost of the foam dispenser contributes to this. As the company currently does not have a foam dispenser, but works with hand-made batches, this seems to be justified as a compensation for the better foam quality and yields. Another approach would be to include this impact in the IRCs. The information provided in the project document does not allow such a calculation, but based on experience values, savings between 50,000 and 75,000 could be expected, which is similar to the contribution that the company will provide to the dispenser.

The cost related to the retrofit of the refrigerant system is, based on a suggestion from the technical reviewer, taken from the Unimagna/Philippines project. This company provided an excellent, throughly researched and modestly priced proposal

8. IMPLEMENTATION: Adequate

9. RECOMMENDATION: The project is recommended for approval

PROJECT COVER SHEET

COUNTRY:	Malaysia
PROJECT TITLE:	**UNITED** - elimination of CFCs in commercial refrigeration products
SECTOR COVERED:	Foamed Plastics/Refrigeration
ODS USE IN SECTOR:	600 MT CFCs in foams (1991) 1,500 MT in refrigeration (1991)
PROJECT IMPACT:	71t ODS (base 1993) : CFC-11: 67t; CFC-12 4t
PROJECT DURATION:	One year
PROJECT USEFUL LIFE:	10 years
TOTAL PROJECT COSTS:	USD 280,000 incremental capital cost USD 135,000 incremental recurrent cost
PROPOSED MLF GRANT:	USD 415,000
COST EFFECTIVENESS:	USD 1.75 kg/yr (unit abatement cost)
NATIONAL COORDINATING AGENCY:	Department of Environment (DOE)
IMPLEMENTING AGENCY:	UNDP
APPRAISAL DATE:	April 28/June 10, 1994

PROJECT SUMMARY

United Refrigerator Sdn. Bhd. ("UNITED") manufactures commercial refrigerator equipment such as insulation panels, refrigerators, display cabinets and ice boxes. Under this project the company will phaseout the use of CFCs in its process, using HCFC-141b (foam) and HFC-134a (refrigerant). The two existing foaming units will be replaced by high pressure machines. New evacuation and charging units will also be provided.

Prepared by: Mr. Tommy Lauridsen, Foam Consultant
Reviewed by: Mr. Bert Veenendaal, UNDP Sector

PROJECT OF THE GOVERNMENT OF MALAYSIA

UNITED SDN. BHD. - ELIMINATION OF CFCs IN COMMERCIAL REFRIGERATION PRODUCTS

1. PROJECT OBJECTIVE

The objective of this project is to phase out the use of CFCs in the manufacture of commercial refrigeration products at UNITED.

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. Refrigeration and Air-Conditioning (RAC) is Malaysia's largest ODS consuming sector--1,500t in 1991--with CFC-12 as the main substance.

3. ENTERPRISE BACKGROUND

United Refrigerator Sdn. Bhd. ("UNITED") was founded in 1978. It is 100% Malaysian owned The company operates two facilities in Tampoi, Johor Baru. It manufactures commercial refrigeration products such as insulation panels, refrigerators/freezers, display cabinets and ice boxes. It employs 150 persons. The enterprise used in 1993 67t CFC-11 in the production of rigid insulation foam, and 4t CFC-12 (also some R-502 and HCFC-22) in refrigeration systems. From the latter, about 10% was used in after sales service. The foam is currently hand-mixed and -poured fir all products except panels, where a low pressure foam dispenser is used.

4. PROJECT DESCRIPTION

Under this project UNITED will phaseout the use of CFCs in the manufacture of its products. For the foam production, a combination of reduced CFC technology and HCFC-141b is selected as the replacement of choice. Two high pressure foam dispensers will have to be installed. Some additional cost for trials will occur. For the refrigerator units HFC-134a is selected. Evacuation and charging equipment will have to be replaced. Recurrent incremental cost are expected related to material prices and the change in product parts.

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 > **partial water/(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 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 is this process is seen as the introduction of (gaseous) HFCs. The high diffusion rate of HCFC-22 limits its use to encapsulated systems.

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

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

- 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 truly ODP-free system at a later stage, at no additional equipment alterations.

HFC-134a is internationally the most widely employed and accepted technology to replace CFC-12 as a refrigerant.

5.2 IMPACT ON PRODUCTION PROCESS

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

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

The current manual mixing method should be replaced by the use of customized or standardized blends. This will save up to 10% ABA (auxiliary blowing agent) that are now lost in the blending operation.

6. PROJECT COSTS

The following is the summary of the expected cost (USD) of the investment and related activities.

6.1 CAPITAL COST

DESCRIPTION	TOTAL (USD)
FOAM INSULATION	
1 High pressure foaming unit (panels) (Freight, installation, spare parts incl.)	150,000
1 High pressure foaming unit (cabinets)	80,000
Trials	10,000
Technology transfer/training	10,000
SUB-TOTAL	**250,000**
REFRIGERATING SYSTEM	
Charging & vacuum system	25,000
Prototyping	10,000
Technology transfer/training	5,000
SUB-TOTAL	**40,000**
Contingency	30,000
TOTAL:	**280,000**
MINUS COMPANY SHARE IN THE COST OF ONE MACHINE	**40,000**
TOTAL INCREMENTAL COST	**280,000**

6.2 OPERATING COSTS

The use of HCFC-141b and HFC 134a generates incremental recurrent cost:

	FOAM INSULATION	
Before:	67t CFC-11 @ 2,000	USD 134,000
After:	40t MDI @ 1,850	USD 74,000
	21t HCFC-141b @ 4,000	USD 84,000
	SUB-TOTAL	USD 24,000
	REFRIGERATION SYSTEM	
Before:	3.64t CFC-12 @ 2,500	USD 9,000
After:	3.42t HFC-134a @ 8,000	USD 27,360
	Higher cost of compressors, drier capillaries: 12,000 @ 3.00	USD 36,000
	SUB-TOTAL	USD 54,360
	TOTAL INCREMENTAL RECURRENT COST	**USD 78,360**

This amounts to a NPV (2yr; 10% discount) of

USD 135,000
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6.3 UNIT ABATEMENT COST

a)	ODS Reduction Project Costs	USD 280,000
b)	Annual Incremental Costs	USD 78,360
c)	Capital Recovery Factor(10 years)	0.16275
d)	ODS reduction/year	71,000 kg
	Unit Abatement Costs [(a(c) + b)]/d	**USD/Kg/y 1.75**

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7. FINANCING PLAN

Because of the change from hand-mixing to machine-dispensing in the cabinet production, the company will experience an improvement in foam quality and foam processing. The company agrees to participate in the investment cost of this foam dispenser in the amount of 50% or USD 40,000. Thus, the company requests the financing of

USD 415,000
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8. PROJECT IMPLEMENTATION

8.1 MANAGEMENT

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

8.2 PROCUREMENT

UNDP will oversee the procurement and provide technical assistance.

8.3 SCHEDULE

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

TASK	**TIME FOR COMPLETION**					
	Q1	Q2	Q3	Q4	Q5	Q6
1. Preparation						
MLF Approval	x					
Visit Consultant		x				
Order Confirmation		x				
2. Installation						
Arrival, Customs			x			
Installation				x		
3. Start-up, Training						
Machine Start-up				x		
Safety/Process Training				x		
4. Certification/commissioning				x		

9. PROJECT IMPACT

This project will eliminate the use of at least 71 tons of CFCs in the first year of implementation. The Project employs commercially and environmentally acceptable technology.

Annex: Technical Assessment

JSL/eo 23/06/94/003

TECHNICAL REVIEW

PREPARED BY: Bert Veenendaal
UNDP Foam Sector Expert

DATE: June 13, 1994

1. COUNTRY OF ORIGIN: MALAYSIA

2. PROJECT TITLE: UNITED - Elimination of CFC-11 in of commercial refrigeration products

3. (SUB)SECTOR Foamed Plastics/Refrigeration

4. CP RELATIONSHIP: Not known

5. TECHNOLOGY: The choice of technology of the company is the use of HCFC-141b as a blowing agent. This is accepted interim technology that is predominantly applied in North America, but also to a lesser extend in some European countries and in Japan. In the case of UNITED, an option involving flammable substances such as (cyclo)pentane is for safety reasons not feasible. The selection is supported.

   The choice of HFC-134a as refrigerant is also supported.

6. ENVIRONMENTAL IMPACT: HCFC-141b is moderately flammable. No specific precautions are likely needed, but the project should include an safety and industrial hygienic audit to assure compliance with safety and exposure standards.

   Also, the company should be aware that HCFCs are interim substances that ultimately have to be replaced. The equipment is capable to process LBBAs, which means that most likely no additional retrofitting will be needed

7. PROJECT COSTS: The unit abatement cost are difficult to compare with other operations as the company makes panels (UAC: 1.50- 3.00) as well as display cabinets (UAC over 8.00). Either way, the cost effectiveness seems reasonable or even excellent

The fact that the company participates in the cost of one of the foam dispensers contributes to this. As the company currently does not have a foam dispenser for the production of the display cabinets, but works with hand-made batches, this seems to be justified as a compensation for the better foam quality and yield.

Another approach would be to include this impact in the IRCs. The information provided in the project document does not allow such a calculation, but based on experience values, savings similar to the companies' contribution to the machine could be expected

The cost related to the retrofit of the refrigerant system is, based on a suggestion from the technical reviewer, taken from the Unimagna/Philippines project. This company provided an excellent, thoroughly researched and modestly priced proposal

8. IMPLEMENTATION: Adequate

9. RECOMMENDATION: The project is recommended for approval

PROJECT COVER SHEET

COUNTRY:	**PANAMA**
PROJECT TITLE:	The Elimination of CFC-11 in the Manufacture of Flexible and Rigid Polyurethane Foams in Plastifom S.A., Profomsa and Thermofoam S.A.
SECTOR COVERED:	Polyurethane Foams
ODS USE IN SECTOR:	26 tons (1993)
PROJECT DURATION:	One year
PROJECT ECONOMIC LIFE:	10 years
PROJECT IMPACT:	Phaseout of the use of 26 t/y of CFC-11 (1993)
TOTAL PROJECT COST:	USD 155,000
PROPOSED MLF FUND:	USD 155,000
COST EFFECTIVENESS:	USD 0.97 per kg per year (Unit Abatement Cost)
IMPLEMENTING AGENCY:	UNDP
COORDINATING NATIONAL BODY:	Comision Gubernamental del Ozono

PROJECT SUMMARY

This project will phase out CFC-11 consumption in the manufacture of Flexible and Rigid Polyurethane Foam in Panama by converting to mature non-ODS technologies (Methylene Chloride / HCFC-141b). Three companies, PLASTIFOM S.A. , PROFOMSA and THERMOFOAM S.A. who share the Panamanian Polyurethane Foam production will participate in this project.

PROJECT PREPARATION AND TECHNICAL ASSESSMENT

The project proposal was prepared by Mr. Aristides Gabella in collaboration with the Comision Gubernamental del Ozono and Mr. Jacques van Engel of UNDP. The project has been reviewed and is supported by Mr. Bert Veenendaal, UNDP's Foams Sector Expert. His comments are attached.

PROJECT OF THE GOVERNMENT OF PANAMA

THE ELIMINATION OF CFC-11 IN THE MANUFACTURE OF FLEXIBLE AND RIGID POLYURETHANE FOAMS IN PLASTIFOM S.A., PROFOMSA AND THERMOFOAM S.A.

1. PROJECT OBJECTIVE

The objective of this project is to phaseout the use of CFC's in the production of rigid and flexible PU foams and to assure safe workplace conditions in the use of methylene chloride as a CFC-replacement technology.

2. SECTOR BACKGROUND

The CFC-11 consumption in the Foams sector is 88 tons. Flexible and Rigid foams manufacturing consumed 26 tons. Refrigerating foams manufacturing consumed the remaining 62 tons.

3. ENTERPRISES BACKGROUND

a) PLASTIFOM S.A. has a low pressure Martin Sweet machine for the manufacture of flexible PU foam. The company was founded to supply foam to a furniture company. Due to lack of business in this area, the furniture company was replaced by a mattresses plant that consumes over 80% of the foam production. They buy chemicals in form of Components A & b from North Carolina Foam Industries in Mount Airy, NC, USA and use Freon 11 in the production process. They tried to replace Freon 11 by Methylene Chloride in the past year with bad results. They also own a spraying Rigid foam machine Gusmer. Their Freon 11 consumption is 5 tons per year.

b) PROFOMSA also has a low pressure Martin Sweet machine for the manufacture of flexible foam. For the production of rigid foam, which amounts to 10% of the total foam production, they use the molded slab type of fabrication. The components for the rigid foam are blended in open containers at ambient temperature. Given the average temperature of 80 degrees Fahrenheit, 20% of Freon 11 is lost in this operation. The consumption of Freon 11 is 5 tons per year.

c) THERMOFOAM S.A. was founded in the early 1980s to produce Flexible PU foam. During the upheavel of 1989 in Panama, it was burned down to the ground. It was rebuilt and reopened as a Rigid Spray PU Foam Operation, thanks to a chemical engineer with a good knowledge of chemistry of polyurethane foam, and who therefore does his own formulations. This company has a Gusmer spraying machine and is the most active of the country in this type of activities. Its business is mainly in buildings and trucks. The consumption of

Freon 11 is 16 tons a year.

4. PROJECT DESCRIPTION

a) PLASTIFOM S.A. tried to replace Freon 11 with Methylene Chloride two years ago, but they were not successful in the trials. They need Technical Assistance in order to succeed in this area. Trials to achieve a good formulations need to be performed. Since at present they do not have a ventilation system, a new one should be installed. Their Spray machine, an old Gusmer machine, which is in poor condition and should be replaced by a new one that is capable of using HCFC-141b.

b) PROFOMSA needs Technical Assistance in modifying foams formulas that can be allow the replacement of Freon 11 by Methylene Chloride. Also they need technical assistance in their Rigid PUF production to replace Freon 11 with a 50% blend of Freon 11 and afterwards with HCFC-141b. The ventilation system, which currently does not exist, should be installed.

c) THERMOFOAM S.A. owns an old Gusmer machine which is not capable of working with a ratio needed for using HCFC 141b instead of Freon 11. A new machine is therefore mandatory. Trials are needed to familiarize the personnel with the machine as well as with HCFC 141b.

5. TECHNOLOGY

5.1 OVERVIEW AND SELECTION

There are numerous technologies to replace the use of Freon 11 in flexible foams by non 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 can be applied where process, industrial hygienic and regulatory conditions allow.

Technologies to replace Freon 11 in the production of rigid PUF include:

- o Freon 11 > partial water/HCFC - 141b
- o Freon 11 > partial water/HCFC-22, 152a
- o Freon 11 > Cyclopentane

The first choice was retained since HCFC-141b is a well tested product and used widely in the USA. The companies involved in this project are aware that this is an interim replacement until a better product is found.

5.2 REQUIRED MODIFICATIONS

In all areas 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 with the minimum standards. In the production of Rigid PUF with HCFC 141b as a blowing agent, the ratio between the components is different than when Freon 11 is used. In addition, the pressure should be high in order to have adequate equipment when the final ODP=0 blowing agent becomes available.

6. PROJECT COSTS

6.1 CAPITAL COSTS

The following capital costs are expected related to this project:

a) **PLASTIFOM S.A.**

o Technical Assistance	USD	10.000
o Trials	USD	5.000
o Ventilation	USD	17.500
o Machine	USD	30.000
o Contingency	USD	3.500
Total Plastifom S.A.	USD	66.000

b) **PROFOMSA**

o Technical Assistance	USD	10.000
o Trials	USD	5.000
o Ventilation	USD	17.500
o Contingency	USD	3.500
Total Profomsa	USD	36.000

c) **THERMOFOAM S.A.**

o Technical Assistance	USD	10.000
o Trials	USD	5.000
o Machine	USD	30.000
o Contingency	USD	5.000
Total Thermofoam S.A	USD	50.000
GRAND TOTAL	USD	155.000

6.2 OPERATING COSTS

The companies do not have a breakdown on how much CFC is currently used in Flexible Foams and how much in Rigid (Spray) Foams. If detailed information would have been available, calculations would most likely show that operational savings are almost equal to operational costs, so that both would balance each other out. In addition it should be noted that in other projects that focus on technical assistance to a subsector, recurrent costs were not taken into account. It is therefore recommended that the same be done in this case.

6.3 UNIT ABATEMENT COSTS

a)	Incremental Capital Costs	USD 155,000
b)	Project Life Time	10 years
c)	Annual Incremental Recurrent Costs/Savings	USD nil
d)	CFC Consumption	kg 26,000
f)	Capital Recovery Factor	0.16275

UNIT ABATEMENT COST [{a(f) + c}/d] ....0.97 USD/kg/y

7. FINANCING PLAN

The companies request a grant in the amount of
USD 155,000

8. PROJECT IMPLEMENTATION

8.1 MANAGEMENT

UNDP will oversee the implementation of this project

8.2 PROCUREMENT

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

8.3 SCHEDULE

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

9. REQUIRED REGULATORY ACTION

The project requires no regulatory action.

10. PROJECT IMPACT

This project will eliminate the use of at least 26 tons of CFC-11 in the first year after implementation. The project employs commercially developed and environmentally acceptable technology.

12. ANNEXES

Annex-A: Technical Assessment

TECHNICAL REVIEW

PREPARED BY: Bert Veenendaal
UNDP Foam Sector Expert

DATE: June 11, 1994

1.	COUNTRY OF ORIGIN:	Panama
2.	PROJECT TITLE:	Elimination of CFC-11 in the Manufacture of Flexible and Rigid PUF in Panama
3.	(SUB)SECTOR:	Foamed Plastics
4.	CP RELATIONSHIP:	Not Known
5.	TECHNOLOGY:	The choice of technology is acceptable. HCFC-141b is transitional but the most feasible from cost and performance in spray foams. MC safety concerns are recognized. Technology transfer addressed through external expertise to be contracted through UNDP.
6.	ENVIRONMENTAL IMPACT:	MC has a short atmospheric retention time and does not pose environmental risks if handled properly. HCFC-141b has an ODP (0.10), but much lower than the CFC-11 that is currently used.
7.	PROJECT COSTS:	UAC (unit abatement cost) not very applicable because of the large assistance component. Overall cost-effective
8.	IMPLEMENTATION:	Adequate
9.	RECOMMENDATIONS:	Acceptance of the proposal is recommended

PROJECT OUTLINE

COUNTRY:	PERU
SECTORS COVERED:	All sectors
NATIONAL ODS CONSUMPTION:	To be determined
PROJECT TITLE:	Project preparation assistance
DURATION:	Two years
PROJECT IMPACT:	Project identification/preparation in all sectors, particularly in aerosols, foams, refrigeration and solvents
PROPOSED BUDGET:	US$ 100,000
IMPLEMENTING AGENCY:	UNDP
NATIONAL COORDINATING AGENCY:	Vice Ministry of Industry with Cooperation of the Ministry of External Relations

PROJECT DESCRIPTION

Peru has recently ratified the Montreal Protocol (June 1993), and the Government is currently discussing its strategy for Country Programme preparation based on the country study which is currently being implemented by UNEP. It is anticipated that this programme will be finalized by the end of 1994.

The Working Group for the implementation of the Montreal Protocol in Peru started operating in November 1993 and is an inter-institutional group that is in charge of the elaboration of the country programme and the coordination of the ozone projects.

During UNDP's Regional Workshop on Foams held in November 1993 in Sao Paulo (Brazil), as well as during the 12th Executive Committee Meeting held in March 1994 in Montreal, representatives from the Government of Peru requested UNDP assistance in starting ODS phaseout activities. In a formal communication that followed sent through UNDP-Lima, the Government requested UNDP to include in its work programme a project preparation request for Peru. The sectors identified as requiring immediate UNDP project preparation assistance are aerosols, foams, refrigeration and solvents.

The funds requested will be utilized over a two year period to recruit international and national consultants to work with representatives from the entities concerned as well as with governmental bodies in project identification and preparation. It is anticipated that during the visits of the international consultants, they would train their local counterparts in Peru, and/or participate in national workshops as organized by the Government. Expenses related to these events will also be covered through this project.

It is expected that the completed projects will be submitted for approval during the 13th, 14th and 15th Executive Committee Meetings.

The proposed budget includes:

International Consultants:	US$ 60,000
National Consultants:	US$ 20,000
Training/Workshops:	US$ 20,000

Programa de las Naciones Unidas
para el Desarrollo

Desarrollo Mundial

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Lima, 27 de mayo de 1994

Estimado Señor Van Engel:

De acuerdo a la comunicación del 24 de mayo remitida por el Ministerio de Relaciones Exteriores hacemos llegar a usted el documento "Asistencia para la Preparación de Proyectos" para su presentación ante la Secretaría del Fondo Multilateral para la aplicación del Protocolo de Montreal.

Como Usted lo manifiesta en su comunicación de fecha 14 de mayo último, entendemos que este proyecto será ejecutado por la OPS y que los próximos serán administrados por esta oficina bajo la modalidad de ejecución nacional.

Sin otro particular, hago propicia la ocasión para expresar a Ud. los sentimientos de nuestra distinguida consideración.

Muy atentamente,

Pierre den Baas
Representante Residente

Señor
Jacques Van Engel
Environmental Specialist
1 United Nations Plaza,
New York, NY 10017
U.S.A.

1/6

No. 98-8/29.

El Ministerio de Relaciones Exteriores saluda muy atentamente al Programa de las Naciones Unidas para el Desarrollo y, tiene a honra hacerle llegar adjunto a la presente el proyecto titulado "Asistencia para la Preparación de Proyectos", a fin de que sea remitido a la Oficina del Programa de las Naciones Unidas para el Desarrollo en Nueva York, atención señor Jacques Van Engel, para su posterior presentación ante la Secretaría del Fondo Multilateral para la Aplicación del Protocolo de Montreal.

El Gobierno peruano solicita al Programa de las Naciones Unidas para el Desarrollo que incluya en su programa de trabajo la puesta en marcha de un proyecto de asistencia preparatoria dirigido a identificar y preparar proyectos destinados a cubrir los costos incrementales de la eliminación de sustancias que agotan la capa de ozono, en los sectores de aerosoles, espumas, refrigeración y solventes en el Perú.

El Ministerio de Relaciones Exteriores aprovecha la oportunidad para reiterar al Programa de las Naciones Unidas para el Desarrollo el testimonio de su más alta y distinguida consideración.

REPUBLICA DEL PERU - MINISTERIO DE RELACIONES EXTERIORES - Dirección General de ...

Lima, 24 MAYO 1994

Al Honorable Programa de las Naciones Unidas
para el Desarrollo
Lima.-

2/6

PROJECT COVER SHEET

COUNTRY:	**Philippines**
PROJECT TITLE:	**FOAMCRAFT phaseout of CFCs in the manufacture of flexible PUF (slabstock)**
SECTOR COVERED:	**Foamed Plastics**
ODS USE IN SECTOR:	**417t CFCs (=ODP) in 1991**
PROJECT IMPACT:	**Phaseout of 90t CFC-11/y (base 1993)**
PROJECT DURATION:	**One year from approval**
PROJECT ECONOMIC LIFE:	**Ten years**
TOTAL PROJECT COST:	**USD 488,608 Project Cost**
PROPOSED MLF GRANT:	**USD 185,000**
COST EFFECTIVENESS:	**USD 0.33/kg/y**
COORDINATING NATIONAL BODY:	**Department of Environment and Natural Resources (DENR)**
IMPLEMENTING AGENCY:	**UNDP**
APPRAISAL DATE	**May 5/June 10, 1994**

PROJECT SUMMARY

Under this project Foamcraft Incorporated will phaseout the use of CFCs in the manufacture of flexible polyurethane foam. The non-ODS technology of choice will be based methylene chloride. The old box foam machine will be replaced by a continuous line. Proper ventilation in the workplace and training on the safe handling of M.C. is included in the project.

TECHNICAL ASSESSMENT

Prepared by: Foamcraft Inc.
Reviewed by: Bert Veenendaal, UNDP Foam Sector Expert

PROJECT OF THE GOVERNMENT OF THE PHILIPPINES

FOAMCRAFT PHASEOUT CFCs IN THE MANUFACTURE OF FLEXIBLE POLYURETHANE FOAM (SLABSTOCK)

1. PROJECT OBJECTIVE

The objective of this project is to phase out the use of CFC in the manufacture of flexible polyurethane foam slabstock (FPUF) at Foamcraft Incorporated (FOAMCRAFT).

2. SECTOR BACKGROUND

The CFC consumption in the foam sector in the Philippines is estimated to have reached about 420t in 1991 (ref.: Table 1).

CATEGORY	CFC-11	CFC-12
Polyurethane Foams (PUF)		
Flexible PUF	25	
Rigid PUF Appliances	285	
General Insulation	90	
Extruded Polystyrene Foams		17
TOTAL	**400**	**17**

Table-1: CFC-Use in the Foam Industry in the Philippines (1991, metric tons)

The Government intends to eliminate the use of CFCs in this sector in or before 1998 through awareness programs, regulations and incentives. A specific ban on the use of CFCs in the manufacture of flexible foams is scheduled for 1994.

3. ENTERPRISE BACKGROUND

Foamcraft Incorporated is wholly Philippine owned and employs about 45 people. Foamcraft produces 700 metric tons of flexible polyurethane foam annually, for domestic use and indirect export. Its current production capacity is 2000 metric tons per year. In 1993, it used 90 metric of CFC-11 to produce 700 metric tons of flexible polyurethane foam.

4. PROJECT DESCRIPTION

This project will eliminate Foamcraft's use of CFC-11 in the manufacture of flexible polyurethane foams. Consumption of CFC-11 will be halved in Phase I by introducing half-CFC, half-methylene chloride formulations. Phase II will use all methylene chloride formulation, continuous process equipment, in the making of flexible polyurethane foam. The project will address the need to safeguard personnel against exposure of methylene chloride through ventilation and training.

The company will carry a considerable part of the cost as the continuous production line will provide capacity increase as well as quality improvement. MLF funds are only requested for measures to use methylene chloride in a safe way.

5. TECHNOLOGY

5.1 OVERVIEW AND SELECTION

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

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

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

5.2 PRODUCTION PROCESS

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

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

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

6. PROJECT COSTS

6.1 Total Capital Costs

The total budget for this project is USD 438,608.

6.2 Incremental Capital Costs

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

	DESCRIPTION	TOTAL (USD)
o	Equipment modification	
	Maxfoam Fallplate	10,000
	M.C. Metering system, pumps flow control	30,000
	Ventilation system and control	40,000
	Additive System	5,000
o	Misc Adjustments	10,000
o	Training on safety and process	20,000
o	Trial material	50,000
o	Contingency and rounding	20,000
	Total	**185,000**

6.2 OPERATING COSTS

It is expected that ultimately the operating costs may decline but that this will take considerable time. Over the customary four (4) eligible years, no decrease of cost is expected.

6.3 UNIT ABATEMENT COST

a) Capital Cost........................USD 185,000
b) Capital recovery factor....................0.16275
c) Incremental recurrent costs ....-0-
d) CFC consumption...........................90,000Kg

Unit Abatement Costs [[a(b)+c}/d] USD/kg/y 0.33

7. FINANCING PLAN

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

USD 185,000

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

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

9. ENVIRONMENTAL IMPACT

This project will eliminate the use of at least 90 tons of CFCs in the first year of implementation. The projects employs commercially and environmentally acceptable technology.

Annex-A: Incremental Recurrent Cost
Annex-B: Technical Assessment

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ANNEX - A

RECURRENT INCREMENTAL COSTS

For conversion from CFC-11 to methylene chloride, it is generally assumed a drop of about 5% net in prime yield during the first year, and 2.5% during the second year. After that, yield figures normally return to standard.

In the process, 90 tons/year of ODS is replaced by an equal tonnage of methylene chloride. In addition, the catalysts and polyol have to be changed, recurrent safety training, operating costs for the forced cooling and increased maintenance will be needed. This will impact on the operating costs as follows:

ITEM	BEFORE	AFTER
90 T/Y CFC-11 @ US$ 2.1/kg	USD 189,000	
90 T/Y Methylene Chloride @ US$ 0.7 /kg		USD 63,000
5 T/Y Softening Additive @ 7.50/kg		37,500
2 T/Y Extra Amine Catalyst @ 15.00/kg		30,000
2 T/Y Extra Tin Catalyst @ 8.00/kg		16,000
? T/Y BHT free polyol @		pm
Annual electricity for forced cooling		10,000
Training, Maintenance		USD 10,000
TOTAL	USD 189,000	USD 166,500
DIFFERENCE		USD 22,500

INCURRED COSTS FROM PRIOR CONVERSION EFFORTS:

First year yield:
Incremental Gain = USD 22,500
Loss = 5% x 700 T/Y @1550 = 54,250
\- 31,750 x 1.0000 = USD - 31,750

Second year yield:
Incremental Gain = USD 22,500
Loss = 2.5% x 700 T/Y @ 1550 = - 27,125
\- 4,625 x 0.9090 = USD - 4,204

Third year yield:
Incremental Gain = USD 22,500
Loss = 0% x 700 T/Y @ 1550 = - 0
\+ 22,500 x 0.8260 = USD + 18,585

Fourth year yield:
Incremental Gain = USD 22,500
Loss = 0% x 700 T/Y @ 1550 = - 0
\+ 22,500 x 0.7513 = USD + 16,904

NET FOUR YEAR TOTAL................USD - 4,650

On the balance, a slight increase in incremental recurrent costs appears to exist over the 4 year transitional period. However, it is acknowledged that subsequent years would turn the balance . Based on this, recurrent incremental costs should not be considered.

TECHNICAL REVIEW

PREPARED BY: Bert Veenendaal
UNDP Foam Sector Expert

DATE: June 13, 1994

1.	COUNTRY OF ORIGIN:	THE PHILIPPINES
2.	PROJECT TITLE:	FOAMCRAFT phaseout of CFCs in the manufacture of flexible PUF (slabstock)
3.	(SUB)SECTOR	Foamed Plastics
4.	CP RELATIONSHIP:	Not Known
5.	TECHNOLOGY:	The choice of technology of the company is the use of methylene chloride (MC) as a blowing agent. This is accepted technology that is predominantly applied in North America, but also to a lesser extend in some European countries and in Japan. It is cost-effective, but requires a long learning curve for the recipients--sometimes several years. Many companies start to apply this technology without MLF funds, but revert later entirely or partly because of process problems. Also, workers safety is very often compromised by not providing adequate ventilation or fire safety
6.	ENVIRONMENTAL IMPACT:	MC has a relative short retention time in the atmosphere. It contributes consequently negligible to ozone depletion and to global warming. The problem with this substance is its perceived toxicity. Although MC is only classified as a suspected human carcinogen and even this classification is contested, measures to ensure proper worker protection to avoid exposure above acceptable standards (about 50 ppm TWA in most industrialized countries) should be part of any MLF project involving MC. This project addresses this problem adequately.

7. PROJECT COSTS:	The unit abatement cost are very reasonable for this type of operation (0.33 versus generally 0.50 - 1.50). There is no detailed calculation of IRCs. However, the conclusion is supported through several projects from Egypt, Ghana. Indonesia and Malaysia
8. IMPLEMENTATION:	Adequate
9. RECOMMENDATION:	The project is recommended for approval

TECHNICAL REVIEW

PREPARED BY: Bert Veenendaal
UNDP Foam Sector Expert

DATE: June 13, 1994

1. COUNTRY OF ORIGIN: THE PHILIPPINES

2. PROJECT TITLE: FOAMCRAFT phaseout of CFCs in the manufacture of flexible PUF (slabstock)

3. (SUB)SECTOR Foamed Plastics

4. CP RELATIONSHIP: Not Known

5. TECHNOLOGY: The choice of technology of the company is the use of methylene chloride (MC) as a blowing agent. This is accepted technology that is predominantly applied in North America, but also to a lesser extend in some European countries and in Japan. It is cost-effective, but requires a long learning curve for the recipients--sometimes several years. Many companies start to apply this technology without MLF funds, but revert later entirely or partly because of process problems. Also, workers safety is very often compromised by not providing adequate ventilation or fire safety

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8. IMPLEMENTATION:	Adequate
9. RECOMMENDATION:	The project is recommended for approval

PROJECT COVER SHEET

COUNTRY:	**Republic of the Philippines**
PROJECT TITLE:	**METAL FORMING CORPORATION phase out of the use of CFC's in the manufacture of polyurethane insulated building elements.**
ODS USE IN COMPANY:	**50 MT of CFC-11** **(50 ODP-weighted MT).**
PROJECT IMPACT:	**Phase I (1994-1996): Appr. 59 MT of CFC-11 will be eliminated per year during years 1996-1997.** **Phase II (1997-1998): Appr. 78 MT of CFC-11 will be eliminated per year during years 1998-1999 by replacing remaining CFC-11 by HCFC 141b.** **Phase III (1999-): Appr. 200 MT of HCFC-141b will be eliminated per year (22 ODP-weighted MT of HCFC-141b per year).**
PROJECT DURATION:	**Phase I: 2 years** **Phase II: 1.5 years** **Phase III: 1.5 years**
PROJECT ECONOMIC LIFE:	**10 years**
TOTAL PROJECT COSTS:	**Incremental Capital Costs: US$ 205,000** **Incremental Recurrent Costs: US$ 100,000** **Total ODS Reduction Project Costs: US$ 305,000**
PROPOSED MLF GRANT:	**US$ 305,000**
COST EFFECTIVENESS:	**US$ 1.85/kg ODP/year**
COORDINATING NATIONAL BODY:	**Philippines Department of Environment and Natural Resources (DENR)**
IMPLEMENTING AGENCY:	**UNDP**

PROJECT SUMMARY

Under this project Metal Forming Corporation will phase out the use of CFC's in the manufacture of rigid polyurethane foam for its building elements. The project contains three phases, reduced CFC, HCFC and HFC phase. The project includes equipment modification, production trials, testing, training, development and production follow-up. The company will induce incremental recurrent costs based on higher chemical costs.

PROJECT OF THE GOVERNMENT OF THE PHILIPPINES

ELIMINATION OF THE USE OF CFC's IN THE MANUFACTURE OF BUILDING ELEMENTS AT METAL FORMING CORPORATION

1. PROJECT OBJECTIVE

The objective of this project is to enable Metal Forming Corporation to achieve an immediate reduction in its consumption of CFC-11 and ultimately, to convert blowing agent totally from CFC-11 to ODP zero system.

2. SECTOR BACKGROUND

The CFC consumption in the foam sector in the Philippines is estimated to have reached about 410 MT in 1991. CFC-11 (395 MT) in rigid and flexible polyurethane foams and CFC-12 (15 MT) in polystyrene foam are the dominant substances in this sector.

The Government intends to eliminate the use of CFC's in this sector in or before 1998 through awareness programs, regulations and incentives.

3. ENTERPRISE BACKGROUND

Metal Forming Corporation, head office in Metro Manila and factory in Cavite is fully Philippine-owned and employees 500 people. Its sales in 1993 were approximately P150 million (US$ 5.5 million). One of Metal Forming Corporation's products are metal faced polyurethane insulated panels which company produced 82,000 square meters year 1993 for domestic and export markets and is the only producer of that kind of products in the Philippines at the moment. Sales of polyurethane panels was worth P70 million (US$ 2.5 million) in 1993. It used 30 MT of CFC-11 to produce 200 MT of rigid polyurethane foam and is expected to use 65 MT in 1994. It recovered none of the CFC-11 it used. Some preliminary production trials using low-CFC system has been done.

Metal Forming Corporation currently has one discontinuous line for manufacturing of polyurethane elements. Maximum length is 12 meters, maximum width is 1220 mm and minimum thickness is 37 mm. Company has high pressure foaming machine equipped with three mixing heads, one stationary for elements less than 6 meters long and two movable for longer elements. In addition company has one portable high pressure foaming machine for foaming on-site and for foaming of small size elements for special purposes. It is equipped with pour and spray gun.

4. PROJECT DESCRIPTION

This project will reduce and then eliminate Metal Forming Corporation's use of CFC-11 in the manufacture of rigid polyurethane foam. Consumption of CFC-11 will be halved in Phase I by introducing low-CFC formulations. In Phase II low-ODP HCFC-141b (ODP of 141b is 0.11) will replace the remaining CFC-11. However HCFC's are transitional substances whose use will be freezed in 1996 and phase out will be year 2030 according to Copenhagen conference in 1992. Because of uncertainty of prices and availability of HCFC's after freezing Metal Forming Corporation has decided to change to ODP-zero technology as soon as technology is commercially available and the affect to the product price is in reasonable limits. It is not advisable to choose Phase III blowing agent yet. There has been some drawbacks in long time behavior of the new candidates.

During each of the three phases, employees will be trained in the form of workshops and seminars on handling of chemicals, proper formulation etc. but according to Metal Forming Corporation's experience, adoption of new technology can only be accomplished by daily training of supervisors and operators. For this task polyurethane foam expert will be needed. Expert's duty will also include being in close contact with chemical and equipment suppliers.

Chemical mixing machine will be needed to make chemical formulation adjustments possible and fast, without disturbing production. Thermal conductivity meter when changing to complete CFC-free technology is essential to avoid negative feed-back due to inferior quality of product in long-time use. Gusmer portable foaming machine needs to be replaced from fixed-ratio to variable ratio.

Before changing to HCFC-134a, foaming machine has to be equipped with suitable mixing head and premixer.

8. TECHNOLOGY
-SELECTION
-IMPACT ON THE PRODUCTION PROCESS

Metal Forming Corporation has decided to reduce CFC's in three phases final target being non-ODP product. First step will be 50%-CFC reduced product and second HCFC-141b product. In Phase III non-ODS formulation will be selected.

Phase I: Low-CFC Foam

Low CFC-11 formulations have been widely implemented in western Europe since 1989. Fifty percent CFC-11 use can be immediately achieved without equipment modifications. (Exemption is portable foaming machine, which is fixed ratio type.). While typical CFC-11 formulation contains approximately 15 percent CFC-11 per weight, reduced formulation contains about 7.5 percent CFC-11 per weight. Disadvantage of CFC-11 reduction is that thermal conductivity of foam increases and energy losses increase unless thicker and thus more expensive elements are used.

It is most probable that chemical systems available from the suppliers do not suit as such for Metal Forming because of dimensions of products and therefore for formulation modifications proper mixing equipment is needed.

Phase II: HCFC-141b

Metal Forming Corporation selected HCFC-141b as intermediate-term substituent. To reduce formulation price it will probably be used with water. Other candidate was HCFC-22/HCFC-142b blend. HCFC-141b was selected because it can be used in existing machinery without excessive changes. HCFC-141b is flammable at certain concentration limits (7.3-16.0 volume-% in air) and therefore adequate ventilation must be installed. Also at that stage closed system for mixing of chemicals is necessary.

Phase III: HFC-134a

As told earlier the most promising Phase III alternatives are HFC-134a and cyclopentane. HFC-134a is nonflammable but has low boiling point (minus 26.5 deg C). Special mixing head and blowing agent premixer will be needed. Cyclopentane's disadvantage is flammability causing need of safety devices. Final selection of Phase III alternative will be made during Phase II.

6. PROJECT COSTS

6.1 INCREMENTAL CAPITAL COSTS

Phase I (1994-1996)

1. Equipment modification costs (US$)		
a. Mixing machine, including installation	69,000	
b. Outside testing	5,000	
c. HP Foaming machine for spray	40,000	
Sub total		114,000
2. Production trials, training and testing		
a. Production trials	5,000	
b. Training of personnel, testing, development and production follow-up		
-number of months	1	
-cost per month, including DSA's	10,000	
-travel costs	2,000	
Sub total		17,000
Total investment costs of Phase I		131,000

Phase II (1997-1998)

1. Equipment modification costs (US$)		
a. Exhaust system	10,000	
Sub total		10,000
2. Production trials, training and testing		
a. Production trials	5,000	
b. Training of personnel, testing, development and production follow-up		
-number of months	1	
-cost per month, including DSA's	10,000	
-travel costs	2,000	
Sub total		17,000
Total investment costs of Phase II		27,000

Phase III (1999-)

1.	Equipment modification costs (US$)		
	a. Mixing head modifications	10,000	
	Sub total		10,000
2.	Production trials, training and testing		
	a. Production trials	5,000	
	b. Training of personnel, testing, development and production follow-up		
	-number of months	1	
	-cost per month, including DSA's	10,000	
	-travel costs	2,000	
	Sub total		17,000
Total investment costs of Phase III			27,000
Contingency/Rounding (Phases I-III)			20,000

<u>TOTAL INCREMENTAL CAPITAL COSTS (Phases I-III) US $205,000</u>

6.2 RECURRENT INCREMENTAL COSTS/SAVINGS

The company expects recurrent incremental costs based on higher material costs from formulation changes, these costs are expected to amount to US$59,000 per year. Net present value of these costs at 10% discount for 2 years amounts to: US$ 100,000

It is assumed that customers accept slightly lower thermal resistance.

Annex 3 provides more detailed information.

6.3 UNIT ABATEMENT COSTS

a)	Incremental Capital Costs	US$ 205,000
b)	Project Life Time	10 years
c)	Incremental Recurrent Costs	US$ 59,000
d)	CFC Consumption	kg 50,000
e)	Capital Recovery Factor (@10% interest)	0.16275

UNIT ABATEMENT COSTS [{a(f) + c}/d] . . USD/kg/y 1.85

7. FINANCIAL PLAN

The company requests disbursement of US$ 305,000; representing all eligible incremental costs.

8. PROJECT IMPLEMENTATION

8.1 MANAGEMENT

It is proposed that UNDP will oversee this project.

8.2 PROCUREMENT

It is proposed that UNDP will arrange the project procurement. UNDP would cooperate with the local UNDP office and with DENR.

8.3 SCHEDULE

TASK	Year 1	Year 2	Year 3	Year 4	Year 5
Phase I:					
Equipment modification	xx				
Production trials of low-CFC foam	xx	xxxx			
Production with low-CFC foam		xx	xxxx	xxxx	
Phase II:					
Equipment modification			xx		
Production trials of HCFC-141b foam				xxxx	xx
Production with HCFC-141b foam					xxxx

Note: x = one quarter of the year

The schedule does not include Phase III.

9. REQUIRED REGULATORY ACTIONS

The project requires no regulatory actions.

10. RESULTS

Direct Project Impacts

During Phase I of the project appr. 59 ODP-weighted MT of CFC-11 will be eliminated per year as a result of shifting to low-CFC formulation. Implementation of Phase II will result in a further phase out of 78 MT of CFC-11 per year from Metal Forming Corporations manufacturing process by replacement to HCFC-141b. Once Phase III is implemented a further 200 MT (22 ODP-weighted MT) of HCFC-141b will be eliminated. Figures include the estimated production growth (Annex1). However UAC is calculated using CFC-use in 1994.

Indirect Project Impacts

Assuming that grant is provided to cover the incremental costs in Phases I and II, there will be no impact (or minor depending on the price of HCFC-141b) on product price in short term. Impacts on price in the medium and long term will be dependent upon availability of financing for costs incurred in Phase III. Consumer demand and production levels are expected to remain unaffected by the project assuming that customers accept increase in energy consumption.

ANNEX 1

Polyurethane Panel Production Growth

	1993	1994	1995	1996	1997	1998	1999	2000
Square meters per year	82,000	178,000	237,000	295,000	355,000	412,000	453,000	500,000
Polyurethane chemicals use	200 MT	433 MT	573 MT	713 MT	853 MT	987 MT	1087 MT	1193 MT
Percentage growth over previous year	0	117	33	24	20	16	10	10

ODP Phased Out Per Year

		Phase I	Phase I	Phase I	Phase II	Phase II	Phase III	Phase III	Phase III
	1993	1994	1995	1996	1997	1998	1999	2000	2001 and after
ODP used without reduction project	30 MT	65 MT	86 MT	107 MT	128 MT	148 MT	163 MT	179 MT	200 MT
Annual ODP avoided	0 MT	0 MT	22 MT	53 MT	64 MT	132 MT	145 MT	170 MT	200 MT
Annual ODP remaining	30 MT	65 MT	64 MT	54 MT	64 MT	16 MT	18 MT	9 MT	200 MT
Percent of ODP phased out	0	0	25	50	50	89	89	95	100

ANNEX 2

UNIT ABATEMENT COST (UAC) CALCULATION FORMULA

$$A = \frac{C(F) + (OC - OS/R)}{ODP}$$

Where:

A =	Unit abatement cost, US$/Kg ODP/Year
C =	ODS reduction investment cost, including all initial one time costs such as technology and training.
F =	Capital recovery factor; the annualized capital cost charges, discounted at a standard rate of 10% per year, over the economic life of the investment.
OC =	The annual incremental operating costs in the first year of full operation.
OS/R =	The annual incremental operating savings or revenue in the first year of full operation.
ODP =	The annual ODS reduction at the first year of full operation expressed in ODP units.

ANNEX 3

INCREMENTAL RECURRENT COSTS

Transferring to low-CFC/HCFC-141b alternatives increases formulation price as follows:

ASSUMPTIONS

CFC-11 price	US$ 2.5/kg
MDI price	US$ 2.2/kg
HCFC-141b price	US$ 4.8/kg

1 part CFC-11 replaced by water requires about 1.6 parts of MDI

MATERIAL COST

Before:	50.0t CFC-11	@ 2,500....................................	US$ 125,000
After:	40.0t MDI	@ 2,200....................................	US$ 88,000
	20.0t HCFC-141b	@ 4,800....................................	US$ 96,000

Additional material costs/year...US$ 59,000

This amounts at a discount rate of 10% over two years of operation to a Net Present Value (NPV) of:

US$ 100,000

ANNEX 4

ENVIRONMENTAL ASSESSMENT

This project will not result in any additional emissions, effluents or wastes being produced at Metal Forming Corporation's plant.

TECHNICAL REVIEW

PREPARED BY: Bert Veenendaal
UNDP Foam Sector Expert

Date: June 13, 1994

1. COUNTRY OF ORIGIN: THE PHILIPPINES

2. PROJECT TITLE: METAL FORMING CORPORATION (MFC) phaseout of the use of CFCs in the manufacture of polyurethane insulated building elements

3. (SUB)SECTOR: Foamed Plastics

4. CP RELATIONSHIP: Not Known

5. TECHNOLOGY: The choice of technology of the company is the use of HCFC-141b as an interim solution, followed by HFC-134a, although the door is kept open for adjustments if emerging technologies would justify such a move. This choice is supported.

Under normal circumstances the recommendation would be to combine step one and two and to provide in this step enough hardware and technology transfer that the enterprise can take the final step on its own. However, MFC's production process is somewhat off standard.

The company produces panels for prefabricated buildings. The gauge is considerable less (1.5') than for cold storage (3-4') and the production process is technically very challenging. A special device mixing head moves literally in the panel sheeting and fills it while retracting. This process needs considerable more precision than the production of a standard panel. for that reason the 3-step approach with considerable technical transfer cost is supported.

6. ENVIRONMENTAL IMPACT: HCFC-141b is moderately flammable. The company has addressed this issue, but in the opinion of the reviewer, it is somewhat over-designed (see cost).

The status as an interim technology is adequately addressed.

7. PROJECT COSTS: The unit abatement cost is reasonable (USD 1.85 compared with a customary range of 1.50-3.00) although it should be emphasized that the application is rather unique under the MLF (only one comparable application in Egypt).

8. IMPLEMENTATION: Adequate, but acceleration should be attempted.

9. RECOMMENDATION: The project is recommended for approval with the budget changes as mentioned.

PROJECT COVER SHEET

COUNTRY:	**Philippines**
PROJECT TITLE:	Elimination of the residual use of CFCs in the manufacture of extruded polystyrene foam sheets (Additional Company - Styrotech Corporation)
SECTOR COVERED:	Foamed Plastics
ODS USE IN SECTOR:	417t CFCs (417t ODP) in 1991.
PROJECT IMPACT: occurred)	25 mt of CFC-12 (Phase-out has already
PROJECT DURATION:	1 year.
TOTAL COST:	$US 60,000
PROPOSED MLF GRANT:	$US 60,000
NATIONAL COORDINATING BODY:	Department of Environment and Natural Resources (DENR)
IMPLEMENTING AGENCY:	UNDP

PROJECT SUMMARY

This project will establish internationally acceptable production safety conditions at an extruded polystyrene foam sheet (XPS) plant that has converted to non ODS technologies -- after the Philippines signed the Montreal Protocol. The company involved, Styrotech Corporation, was not included in the previous Philippines XPS manufacturing project proposal, approved at the 12th Executive Committee, because of its reported foreign ownership. Actually, the company was already sold to domestic interest at that time and was completely Filipino owned. This project will expand the previously approved project for three other companies to include the Styrotech corporation. This will further realize the economic efficiency gained from scale. The project will be implemented in cooperation with the "Polystyrene Packaging Council of the Philippines" and all companies involved will collaborate closely.

PROJECT PREPARATION AND TECHNICAL ASSESSMENT

This project proposal was prepared by Mr. Ko Swee Hee in collaboration with the Department of Environment and Natural Resources. The project has been reviewed and is supported by Mr.

PROJECT OF THE GOVERNMENT OF THE PHILIPPINES

ELIMINATION OF THE RESIDUAL USE OF CFCs IN THE MANUFACTURE OF EXTRUDED POLYSTYRENE SHEETS IN THE PHILIPPINES

The following are information specific to the Styrotech corporation, sectoral and other general information are not presented again but can be found in the previous proposal.

1. PROJECT OBJECTIVE

The objective of this project is to establish safe workplace conditions in a plant that has already converted to non-ODS technologies but is insufficiently protected against the related fire risks.

2. PROJECT DESCRIPTION

Styrotech corporation has converted to using LPG as a blowing agent in its Taiwan made XPS screw extruder. The company has some basic safety equipment, such as static eliminators and humidifiers, but not enough to maintain an acceptable safety level. Additional equipment such as gas detectors, blowdown fans, exhaust fans and fire extinguisher are needed.

3. PROJECT COSTS

DESCRIPTION	COST (USD)
• Gas detection and sensing system (4 pcs)	18,000
• Industrial blow down fans (8 pcs)	8,000
• Exhaust fans (10 pcs)	10,000
• Portable gas detector (1 unit)	4,000
• Fire extinguisher:	
(i) hand-held CO_2 type 10 lbs (10 pcs)	2,000
(ii) Trolley mounted CO_2 type, 45kg (4 units)	8,000
• Water sprinkler system with emergency on/off switch at tank area	8,000
• Contigencies and rounding	2,000
Total	60,000

4. FINANCING PLAN

The Styrotech company request a grant in the amount of <u>USD 60,000</u>

5. IMPLEMENTATION

The project will be implemented in conjunction with activities for the three other companies in the previously approved project. Project schedules and implementation arrangements will be the same.

TECHNICAL REVIEW

PREPARED BY: Bert Veenendaal
UNDP Foam Sector Expert

DATE: June 13, 1994

1.	COUNTRY OF ORIGIN:	THE PHILIPPINES
2.	PROJECT TITLE:	Elimination of the residual use of CFCs in the manufacture of polystyrene foam sheet (additional company - Styrotech Corporation
3.	(SUB)SECTOR	Foamed Plastics
4.	CP RELATIONSHIP:	Previously omitted while thought to be foreign owned
5.	TECHNOLOGY:	The has implemented butane technology. Only some adjustments in safety features have to be made. this project should be seen as an extension of the previously approved umbrella project for XPS in the Philippines
6.	ENVIRONMENTAL IMPACT:	See umbrella project
7.	PROJECT COSTS:	The project cost are reasonable and in line with the umbrella project. Items such as training and safety audit will be covered under existing cost in the umbrella project
8.	IMPLEMENTATION:	Adequate (faster should be possible!)
9.	RECOMMENDATION:	The project is recommended for approval with the stipulation to be implemented in coordination with the companies covered under the umbrella project. This will save cost

PROJECT COVER SHEET

COUNTRY:	Thailand
PROJECT TITLE:	**PONSRI** - Elimination of the use of CFCs in the Manufacture of Extruded Polystyrene Foam Sheet
SECTOR COVERED:	Foamed Plastics
ODS USE IN SECTOR:	1510t CFCs (=ODP) in 1991
PROJECT IMPACT:	125 TONS CFC-12/y (BASE 1993)
PROJECT DURATION:	One year
PROJECT ECONOMIC LIFE:	10 Years
TOTAL PROJECT COSTS:	USD 580,000 Incremental Capital Cost USD 240,000 Incremental Operating Benefit
PROPOSED MLF GRANT:	USD 340,000
COST EFFECTIVENESS:	USD 0.14 /kg/y (unit abatement cost)
NATIONAL COORDINATING BODY:	Department of Industrial Works (DIW), Ministry of Industry
IMPLEMENTING AGENCY:	UNDP
APPRAISAL DATE:	6 December 1993/7 Jan. & 18 April 1994

PROJECT SUMMARY

This project will eliminate the use of CFCs in the manufacture of extruded polystyrene foam sheet (XPS) at Ponsri by introducing the use of butane. The project includes safety measures to address the flammable nature of butane. This project will complete the two-phased CFC elimination program for XPS applications in Thailand.

Prepared by: Mr. Ko Swee Hee, Polysytrene
Reviewed by: Mr. Bert Veenendaal, UNDP Sector Expert (Foams)

PROJECT OF THE GOVERNMENT OF THE THAILAND

PONSRI - ELIMINATION OF THE USE OF CFCs IN THE MANUFACTURE OF EXTRUDED POLYSTYRENE FOAM SHEET

1. PROJECT OBJECTIVE

The objective of this project is to phase out the use of CFCs in the manufacture of XPS foam sheet at Ponsri Co. Ltd.

2. SECTOR BACKGROUND

ODS are used as blowing agents in the production of five types of foams in Thailand--appliance insulation, flexible foams, rigid insulating foams used in construction,polystyrene packeging and miscellaneous foams. With the exception of polystyrene and polyethylene foams, CFC-11 is used to some extent in the production of all these foam types. producers of foam products in Thailand used almost 1,600t of ODS in 1991, Primarily CFC-11 and CFC-12.

The flexible foam (polyurethane foam) sub-sector has already substantial phased out the use of CFCs by replacing it with methylene chloride.

In other sub-categories CFC is, as before, the blowing agent of choice and replacement efforts were so far restricted to investigations, trials and project preparations.

3. ENTERPRISE BACKGROUND

Ponsri is one of the largest polystyrene & polyethylene foam sheet manufacturers in Thailand. Its products are primarily for food packaging industry. Together, these companies are believed to produce the as much as 80% of the XPS. Under a separate project, MLF assistance has been granted to the other two companies (Food Box and Polyseal).

Ponsri had previously converted its three extruders to butane use but reversed that decision after a fire incident in its storage area caused by inadequate safety measures from the system conversion. The January mission confirmed the non-feasibility of switching to hydrocarbon solution due to serious space limitations at the factory. The company has now decided to use butane as the CFC-replacement and will be relocating its XPS/EPE production to a newly built plant in September 1994.

4. PROJECT DESCRIPTION

Ponsri utilized 125 MT of CFC-11/12 in 1993. Under the project, Ponsri will eliminate the use of CFCs through conversion to the use of butane. The project includes adequate safety features to assure the responsible use of a flammable substance. An international process expert will oversee the implementation of the project, provide technology transfer, safety manuals and perform safety training.

5. TECHNOLOGY

5.1 OVERVIEW AND SELECTION

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

- o Atmospheric gases (Nitrogen, Carbon Dioxide),
- o Hydrocarbons (LPG, butanes, pentanes),
- o HCFCs (-22; -142b),
- o HFCs (-134a; -152a),

Summaries of these technologies, their potentials and their limitations are provided through the UNEP Technical Options Committee's bi-annual review and through review papers from UNDP. Hydrocarbons, specifically butane is selected by the Thai companies as an alternatives that is:

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

A draw back of hydrocarbons is the high flammability, requiring extensive safety precautions.

Users of hydrocarbons are subject to stringent fire regulations. The emission of hydrocarbons is not regulated in Thailand, nor are restrictions expected in the foreseeable future.

5.2 PRODUCTION PROCESS

The use of hydrocarbons will require substantial changes in the production process and storage facilities. Required equipment modifications and additions may include:

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

- **Feeding systems**
  - Injection systems for additives (anti-diffusion and anti-static agents),
  - Replacement of the foamant metering pump and injection system,
  - New gaskets and seals.
  - New pressure gauges

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

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

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

Production and aging areas are to be separated from other working areas and to be protected against fire hazards. Production and maintenance personnel has to be trained in the safe handling of hydrocarbons, in addition to production training. Start-up trials will be necessary to adjust for foamant volume and permeability. It is anticipated that the company, in the light of its past fire incident, will sustain unusually high insurance costs.

6. PROJECT COSTS

6.1 Total Capital Costs

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

Description	Cost (US$)
2 units of 7.5 kg butane tanks (including civil works, piping, installation, etc...)	80,000
Fire safety & alarm system	
. Water sprinkler system	20,000
. Gas detection & sensing system	35,000
. Portable gas detection system (1 unit)	4,000
. Industrial blow-down fans (30 units)	30,000
. Ventillation & exhaust system	40,000
. 45-kg trolley mounted CO2 fire extinguishers (8 units)	13,000
. 10-lb handheld CO2 fire extinguishers (20 units)	4,000
. Static eliminators (4 units)	8,000
Machine modification (3 units)	240,000
Technology transfer	20,000
Safety training/pre & post audit	20,000
Trials	15,000
Contingency & rounding	51,000
Total:	US$ 580,000

6.2 OPERATING COSTS

The proposed system conversion is expected to result in incremental operating benefits, calculated as follows:

Incremental Material cost:

Before:	125 MT CFC-12 @ US$ 2.10 /kg		US$ 262,500
After:	125 MT butane @ US$ 0.80 /kg ...	US$ 100,000	
	6.25 MT anti-shrinkage/static agents @ $5.0/kg	US$ 31,250	
Incremental material savings.........................			**US$ 131,250**

Other Incremental operating costs:

Training (annual)	US$ 5,000	
Higher insurance - building	US$ 20,000	
- transport ...	US$ 10,000	
Higher maintenance (5% of capital costs)	US$ 20,000	
Incremental operating benefits		US$ 76,250

Net present value (4 yrs, 10% discount) .... US$ 240,000

6.3 UNIT ABATEMENT COST

a)	ODS Reduction Project Costs	USD 580,000
b)	Annual Incremental Benefits	USD 76,250
c)	Project Useful Life	10 years
d)	ODS reduction/y	125,000 kg
f)	Capital Recovery Factor (10% discount)	0.16275

Unit Abatement Costs [(a(f) + b)/d] USD/kg/0.14 kg/yr

7. FINANCING PLAN

The company requests the financing of the net project cost calculated to be:

USD 340,000
===========

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 machines or in the working areas unsafe levels of hydrocarbons can be detected.

TASK	TIME FOR COMPLETION					
	Q1	Q2	Q3	Q4	Q5	Q6
1. Preparation						
MLF Approval	x					
Pre Audit	x					
Order Confirmation(s)		x				
2. Installation						
Arrival, Customs			x			
Machine Modifications			x			
Tank Installation			x			
Safety Devices			x			
3. Start-up, Training						
Machine Start				x		
Safety Training				x		
Post Audit/Commissioning				x		

8.3 PROCUREMENT

UNDP will oversee the procurement. UNDP expects at about the same time to procure for 3-5 similar projects, resulting in procedural and cost efficiencies.

9. PROJECT IMPACT

This project will eliminate the use of 125 tons of CFCs in the first year of implementation. The project employs commercially and environmentally acceptable technology.

ANNEX: Technical Assessment

TECHNICAL REVIEW

PREPARED BY: Bert Veenendaal
UNDP Foam Sector Expert

DATE: June 13, 1994

1.	COUNTRY OF ORIGIN:	THAILAND
2.	PROJECT TITLE:	PONSRI - Elimination of the use of CFCs in the manufacture of extruded polystyrene foam sheet
3.	(SUB)SECTOR	Foamed Plastics
4.	CP RELATIONSHIP:	Not Known
5.	TECHNOLOGY:	The company intends to replace CFC-12 by butane. This technology is supported, provided sufficient safety measures are included. The company tried to switch to butane before on its own and had a serious fire. it was excluded from the first batch of XPS conversions under the Fund in Thailand to allow a thorough review of the cause of the fire and the design of an improved implementation plan. The proposal is based on implemen tation at a new facility build by the company from its own financial means
6.	ENVIRONMENTAL IMPACT:	Butane is highly flammable. The project takes this into account. Butane is also photochemically active. There is currently no legislation on this matter in Thailand
7.	PROJECT COSTS:	The project cost are very reasonable. Unit abatement cost are low compared with most other projects (0.50-1.50 usual)
8.	IMPLEMENTATION:	Adequate
9.	RECOMMENDATION:	The project is recommended for approval

PROJECT COVER SHEET

COUNTRY:	**URUGUAY**
PROJECT TITLE:	Conversion to CFC-free Technology in the Manufacture of Flexible Polyurethane Foam
SECTOR COVERED:	Foam Plastics
ODS USE IN SECTOR:	88.2 tons (1993)
PROJECT ECONOMIC LIFE:	10 years
PROJECT IMPACT:	Phaseout of the use of 17.4 t/y of CFC-11 (1993) in the manufacture of Flexible Polyurethane Foam
TOTAL PROJECT COST:	USD 200,000 Incremental Capital Cost
PROPOSED MLF FUND:	USD 200,000
COST EFFECTIVENESS:	1.87 USD per kg per year (Unit Abatement Cost)
IMPLEMENTING AGENCY:	UNDP
COORDINATING NATIONAL BODY:	Comision Tecnica Gubernamental de Ozono, Ministerio de Vivienda, Ordenamiento Territorial y Medio Ambiente

PROJECT SUMMARY

Under this project, 100% of the Uruguayan Flexible PUF industry will convert to CFC-free systems. Five foam manufacturers and two chemical suppliers will cooperate in this conversion project that is environmentally friendly and cost effective in investment as well as in operating costs

PROJECT PREPARATION AND TECHNICAL ASSESSMENT

The project was prepared by Mr. Aristides Gabella in collaboration with the Comision Tenica Gubernamental de Ozono and Mr. Jacques van Engel of the UNDP. The project has been reviewed and is supported by Mr. Bert Veenendaal, UNDP's Foams Sector Expert. His comments are attached.

PROJECT OF THE GOVERNMENT OF URUGUAY

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

1. PROJECT OBJECTIVE

The objective of this project is to phase out the use of CFCs in the manufacture of Flexible Polyurethane Foams (PUF) in Uruguay.

2. SECTOR BACKGROUND

The Uruguayan Polyurethane Foam Industry consumed 88.2 tons of Freon 11 in 1993. The manufacture of Flexible PUF was responsible for 17.4 tons of Freon 11. The remaining 70.8 tons were used by seven companies involved in spray applications.

3. BACKGROUND OF THE FLEXIBLE FOAM INDUSTRY AND ENTERPRISES INVOLVED

The manufacturers of Flexible PUF in Uruguay consumed 17.4 tons of Freon 11 in 1993. Two companies, Divino S.A. and Poliflex Ltda. are responsible for around 80% of the total production. All the companies are located in Montevideo except Sudamtex, which is located in Colonia. The Flexible PUF production is achieved by using a slab foam machine in the 50% of the manufacturers, the remaining 50% is produced in the intermittent molding operations ("Golden Bucket"). By and large, the companies buy the raw materials and blend them according to their own formula. Profiles of the enterprises are provided in Annex-A.

4. PROJECT DESCRIPTION

The project is intended to convert all flexible PUF manufacturers in Uruguay to CFC-free systems. The company names are:

- o Sudamtex del Uruguay S.A.
- o Ronit Ltda.
- o Maxi
- o Divino S.A.
- o Poliflex Ltda.

Another company (Denot) already phased out all use of CFCs.

Bayer S.A. and Dow Chemical are the chemicals supplying companies in Uruguay. They have expressed their willingness to fully cooperate in the execution of this project.

Because of the excellent access to international standard chemicals in Uruguay, it is thought that through this project, all companies can be converted to non-CFC technologies. However, two companies (Sudamtex and Divino) operate continuous lines that cause higher temperatures at lower density foams. During the technical assistance which will be provided during this project, it will be decided whether further action is needed to ensure sufficient product quality.

5. TECHNOLOGY

5.1 OVERVIEW

There are numerous technologies to replace the use of Freon 11 in the manufacture of Flexible PUF. We refer to publications by UNEP and documentation available through UNDP for summaries of these technologies.

5.2 SELECTION

The enterprises intend to phaseout Freon 11 in the flexible PUF through replacement by methylene chloride which is considered the most economic solution. The use of forced cooling is required to address the problem of discoloration at low densities.

5.3 REQUIRED MODIFICATIONS

In all areas where methylene chloride and isocyanate are processed, adequate vapor containment and ventilation will have to be installed to assure safe working conditions. Regular checkups should be performed to ensure continued compliance.

6. PROJECT COSTS

6.1 CAPITAL COSTS

The following incremental capital costs are expected:

Sudamtex del Uruguay S.A. (Continuous)

o Ventilation Improvement............	USD	30,000
o Trials.........................	USD	7,500
Total Sudamtex del Uruguay S.A........	USD	37,500

Ronit Ltda. (Box)

o Ventilation Improvement.............	USD	10,000
o Accelerated Cure System.............	USD	20,000
o Trials..............................	USD	5,000
Total Bonit Ltda......................	USD	35,000

Maxi (Mold)

o Trials, ...	USD	10,000
Total Maxi............................	USD	10,000

Divino S.A. (Continuous)

o Ventilation Improvement............	USD	30,000
o Trials,............................	USD	7,500
Total Divino S.A.....................	USD	37,500

Poliflex Ltda. (Box)

o Ventilation Improvement............	USD	10,000
o Accelerated Cure System............	USD	20,000
o Trials, ...	USD	5,000
Total Poliflex Ltda..................	USD	35,000

Total Ventilation, Accelerated Cure and Trials

for the five companies...............	USD	155,000
Central Training and follow up visits.	USD	25,000
Grand Total..........................	USD	180,000

Contingencies........................	USD	20,000

Grand Total..........................	USD	200,000

6.2 OPERATING COSTS

For conversion from CFC-11 to methylene chloride, it is generally assumed a drop of about 5% net in prime yield during the first year, and 2.5% during the second year. After that, yield figures normally return to standard.

In the process, 17.4 tons/year of ODS is replaced by an equal tonnage of methylene chloride. In addition, the catalysts and polyol have to be changed, recurrent safety training, operating costs for the forced cooling and increased maintenance will be needed. This will impact on the operating costs as follows:

ITEM	BEFORE	AFTER
17 T/Y CFC-11 @ US$ 2.1/kg	USD 39,000	
17 T/Y Methylene Chloride @ US$ 0.7 /kg		USD 13,000
1 T/Y Softening Additive @ 7.50/kg		7,000
Extra Amine Catalyst @ 15.00/kg		4,000
Extra Tin Catalyst @ 8.00/kg		2,000
? T/Y BHT free polyol @		pm
Training, Maintenance		USD 5,000
TOTAL	**USD 39,000**	**USD 31,000**
DIFFERENCE		**USD 8,000**

INCURRED COSTS FROM PRIOR CONVERSION EFFORTS:

First year yield:
Incremental Gain = USD 8,000
Loss = 5% x 200 T/Y @1550 = 15,500
\- 7,500 x 1.0000 = USD - 7,500

Second year yield:
Incremental Gain = USD 8,000
Loss = 2.5% x 2500 T/Y @ 1550 = - 7,750
\- 250 x 0.9090 = USD - 230

Third year yield:
Incremental Gain = USD 8,000
Loss = 0% x 2500 T/Y @ 1550 = - 0
\+ 8,000 x 0.8260 = USD + 6,600

Fourth year yield:
Incremental Gain = USD 8,000
loss = 0% x 2500 T/Y @ 1550 = - 0
\+ 8,000 x 0.7513 = USD + 6,000

NET FOUR YEAR TOTAL...............USD + 4,900

On the balance, a very slight decrease in incremental recurrent costs may be expected to occur over the 4 year transitional period. Based on this, recurrent incremental costs should not be considered.

6.3 UNIT ABATEMENT COSTS

a) Incremental Capital Costs..................USD 200,000
b) Project Life Time.............................10 years
c) Annual Incremental Recurrent Costs/Savings.USD nil
d) CFC Consumption...........................kg....17,400
f) Capital Recovery Factor.........................0.16275

UNIT ABATEMENT COST [{a(f) + c}/d]......1.87 USD/kg/y

7. FINANCING PLAN

The companies request a grant in the amount of

USD 200,000
=============

8. PROJECT IMPLEMENTATION

8.1 MANAGEMENT

UNDP will oversee the implementation of this project

8.2 PROCUREMENT

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

8.3 SCHEDULE

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

9. REQUIRED REGULATORY ACTION

The project requires no regulatory action.

10. PROJECT IMPACT

This project will eliminate the use of at least 17.4 tons of CFC-11 in the first year after implementation. The project employs commercially developed and environmentally acceptable technology.

As mentioned on page 3, the project may need follow-up for the two companies operating continuous foam production machines.

11 ANNEXES

Annex-A: Company profiles

Annex-B: Technical Assessment

ANNEX - A

PROFILES OF THE FIVE COMPANIES INVOLVED IN THIS PROJECT

o Sudamtex del Uruguay was founded in 1964 with 3% of uruguayan capital. From the total of 850 employees 20 are involved in the foam production. This company is dedicated mainly to the fabrication of fabrics. Their main product in the foam area are mattresses. They have a home-made pouring machine. The Freon 11 consumption during 1993 was 1.6 tons.

o Ronit Ltda. was founded in 1990 with 100% uruguayan capital. From the total of 10 employees 4 are involved in the foam operations. They produced foam for mattresses and furniture. An intermittent mold operation is used (Golden Bucket). The Freon consumption during 1993 was 1.2 tons.

o Maxi was founded in 1971 with 100% uruguayan capital. From a total of 35 employees, 15 are involved in foam production. This company is quite diversified: Hot and Cold Molded Bucket Seats, Arm and Headrests with integral skin, furniture parts with integral skin and rigid foam inserts for their buckets seats. They have an Admiral MH 8 foam machine. The Freon 11 consumption during 1993 was only 0.6 tons.

o Divino S.A. has 100% of uruguayan capital. They did not report neither the date of foundation or the number of employees. They have a Ladenberg foam machine. Mattresses are their main product. The Freon 11 consumption was 6 tons during 1993.

o Poliflex Ltda. has to report date of foundation, capital origin and number of employees. They have an intermittent molding operation (Golden Bucket).Mattresses are their final product. The Freon 11 consumption during 1993 was 8 tons.

Note: For a more complete and detailed information about these companies, please see attached additional information.

TECHNICAL REVIEW

PREPARED BY: Bert Veenendaal
UNDP Foam Sector Expert

DATE: June 11, 1994

1.	COUNTRY OF ORIGIN:	URUGUAY
2.	PROJECT TITLE:	Conversion to CFC-free Technology in the Manufacture of Flexible polyurethane Foam
3.	(SUB)SECTOR:	Foamed Plastics
4.	CP RELATIONSHIP:	Not Known
5.	TECHNOLOGY:	The choice of technology is acceptable (maximized water, complemented by methylene chloride). This constitutes also the most economical solution. The implementation is based on support by chemical suppliers and an external expert provided through UNDP, which is a suitable solution
6.	ENVIRONMENTAL IMPACT:	Methylene chloride has a short atmospheric lifetime and does not pose an environmental risk if handled properlyly. The companies should check on the regulatory status of methylene chloride, which is restricted in some countries
7.	PROJECT COSTS:	UAC (unit abatement cost) standard for F-PUF projects is about 0.50-2.50 US$/kg/y. This project exceeds this, based on the small scale of the companies. Compared with projects for small scale companies in Indonesia, Malaysia and The Philippines, the costs are acceptable
8.	IMPLEMENTATION:	Adequate (very fast!!)
9.	RECOMMENDATIONS:	To accept unchanged

TECHNICAL REVIEW

PREPARED BY: Bert Veenendaal
UNDP Foam Sector Expert

DATE: June 11, 1994

1.	COUNTRY OF ORIGIN:	URUGUAY
2.	PROJECT TITLE:	Conversion to CFC-free Technology in the Manufacture of Flexible polyurethane Foam
3.	(SUB)SECTOR:	Foamed Plastics
4.	CP RELATIONSHIP:	Not Known
5.	TECHNOLOGY:	The choice of technology is acceptable (maximized water, complemented by methylene chloride). This constitutes also the most economical solution. The implementation is based on support by chemical suppliers and an external expert provided through UNDP, which is a suitable solution
6.	ENVIRONMENTAL IMPACT:	Methylene chloride has a short atmospheric lifetime and does not pose an environmental risk if handled properlyly. The companies should check on the regulatory status of methylene chloride, which is restricted in some countries
7.	PROJECT COSTS:	UAC (unit abatement cost) standard for F-PUF projects is about 0.50-2.50 US$/kg/y. This project exceeds this, based on the small scale of the companies. Compared with projects for small scale companies in Indonesia, Malaysia and The Philippines, the costs are acceptable
8.	IMPLEMENTATION:	Adequate (very fast!!)
9.	RECOMMENDATIONS:	To accept unchanged

PROJECT OUTLINE

COUNTRY:	URUGUAY
SECTORS COVERED:	Foams and halons
NATIONAL ODS CONSUMPTION:	314.16 tonnes ODP in 1992
PROJECT TITLE:	Project preparation assistance
DURATION:	Six months
PROJECT IMPACT:	Preparation of projects in the foams and halons sectors
PROPOSED BUDGET:	US$ 30,000
IMPLEMENTING AGENCY:	UNDP
NATIONAL COORDINATING AGENCY:	Ministry of Housing, Land Uses and Environmental Affairs

PROJECT DESCRIPTION

The Uruguay Country Programme (CP) for the phaseout of ozone depleting substances (ODS) under the Montreal Protocol was prepared with the assistance of UNDP. The CP was presented and approved at the 10th Executive Committee held in Montreal in June 1993. Uruguay has designated UNDP as the implementing agency for the technical assistance and investment projects in the foams and halons sectors.

Accordingly, the Government has requested UNDP to include in its work programme a project preparation request for the following projects and technical assistance activities:

a) Phasing-out of CFC use in rigid insulation and flexible foams.
b) Halon-1211 banking project.
c) Halon-1301 technical assistance project.

The US$ 30,000 preparatory assistance funds will be utilized over a six-month period to recruit international and national consultants to work with national staff in the preparation of these project proposals. Various local expenses incurred during the preparation of these project proposals will also be covered.

In fact, the Government had requested UNDP to urgently send two consultants (halons, foams) immediately, so that some of the funds requested herewith were temporarily charged to another Uruguayan poject activity, and will be transferred back to the presently requested project on a retroactive basis, once approved.

The completed project proposals will form part of UNDP's work programme that will be submitted for Executive Committee approval at the 13th and subsequent meetings of the Executive Committee.

PROJECT COVER SHEET

COUNTRY: URUGUAY

PROJECT TITLE:	Technical Assistance for the Implementation of the National Programme for the Management and Banking of Halon 1211.
SECTOR COVERED:	Halon sector
ODS USE IN SECTOR:	1.8 tons per year of Halon 1211. (Installed Halon 1211 is 10 tons)
ODS CONSUMPTION:	5.4 tons ODS (ODP=3 for Halon 1211)
PROJECT DURATION:	2 years and 3 month
LIFETIME OF PROJECT:	10 years
PROJECT IMPACT:	Eliminating the importation of Halon 1211, and withdrawal from the market of 10 tons Halon 1211
PROPOSED MLF GRANT:	U$S 272,000
TOTAL PROJECT COST:	U$S 272,000
UNIT ABATEMENT COST:	US$ 7.9 per kg ODS
IMPLEMENTING AGENCY:	Government Technical Commission for the Ozone Layer (COGO) of Ministry of Housing, Territorial Regulation and Environment.
COMPANIES INVOLVED:	The importers/distributors of Halon 1211 (Tornay & Mori and Izeta Lopez)
IMPLEMENTING AGENCY:	UNDP.

PROJECT SUMMARY:

The project is to provide technical assistance to the users sector for awareness and training purposes with regard to control measures in halon handling as well as to avoid emissions of halon in stock.

The project is also to recover Halon 1211 from users in order to utilize the existing stock of Halon 1211 in Uruguay for critical uses only. This part of the programme will be aimed at covering the cost of substituting Halon 1211 fire extinguishers by others extinguishers filled with alternative substances.

In addition, the project will assist in ensuring the good functioning of the Halon 1211 Bank, both with respect to the actual physical deposit of the Halons, which will be located at the two fire equipment companies, Tornay & Mori and Izeta Lopez' premises, and to the monitoring of the existing stock of Halons, which will be centralized at the Government Technical Commission for the Preservation of the Ozone Layer. The operation of the Halon 1211 physical Bank includes the utilization of recycling equipment to be shared by the two companies responsible for "banking" activities.

PROJECT OF THE GOVERNMENT OF URUGUAY

TECHNICAL ASSISTANCE FOR THE IMPLEMENTATION OF THE NATIONAL PROGRAMME FOR THE MANAGEMENT AND BANKING OF HALON 1211

I) PROJECT OBJECTIVES

The three project objectives are:

1. To provide technical assistance to users with regard to the necessary control measures to be adopted to reduce discharges throughout the different steps of Halon 1211 handling, as well as to avoid accidental discharge from installed equipment.

2. To provide technical and economic assistance to enable the operation of the Halon 1211 Bank, including the cost of the necessary installations for the physical bank, transport cost of Halons too and from the physical bank for a period of two years, and the operating expenses of the Registry Unit in charge of controlling Halon 1211 stocks and of the Committee for Critical Uses of Halon 1211, which will act within the scope of the Government Technical Commission for the Preservation of the Ozone Layer.

3. Economic assistance to cover costs arising from the implementation of a method for the replacement of Halon 1211 fire extinguishers presently used for none critical uses and where alternative fire extinguishing agents can be used.

II) SECTOR BACKGROUND

Uruguay's Country Programme for the Reduction of Ozone Depleting Substances (ODS), approved in July 1993 includes measures for the recovery and recycling of Halon 1211.

As from September 1992 the Uruguayan Government began to adopt measures for the control of Halon 1211 consumption through the signing of bilateral agreement with the US Government through its Environment Protection Agency (USEPA).

As from that date, the Government Technical Commission for the Preservation of the Ozone Layer, with the advice of the Firemen's Bureau and USEPA'S support have developed the preliminary stages of the Halon 1211 Handling Programme, which included the installation of a Halon recycling unit, the holding of a Training Workshop for the Handling of Halon (aimed at the distributors and users including the military sector) and the carrying out of an Inventory of Halon 1211 Uses, Stocks and their corresponding geographical distribution by type of company.

Once the above stages were completed, the Uruguayan Government deemed it convenient to approve a decree defining the framework to regulate imports, exports and internal consumption of Halon 1211 through the implementation of the corresponding National Halon 1211 Administration Programme, mainly dealing with the operation of the Halon 1211 Bank. This decree will have to be amended so as to prevent Halon emissions from stocks in the hands of private users who do not wish to participate in the bank.

III) PROJECT JUSTIFICATION

In September 1992, through a bilateral agreement with USEPA, Uruguay accorded to participate in the Programme for the Installation of a Halon 1211 Recovery Plant. Subsequently, through the training of the local COGO and Firemen Bureau technicians at Talleres Beaufort's premises (September 1992) and the technical support of USEPA, the Training and Awareness Workshop was held, aimed at the different sectors dealing with Halon handling.

After publicizing the subject and carrying out a Survey of Halon 1211 Stocks and Uses, the Uruguayan Government decided to set up the regulations controlling the marketing of these substances through a decree establishing the obligation to obtain prior authorization from the Ministry of the Environment for all kind of local transactions, imports and exports of Halon 1211.

Since compliance with the above regulations - which will be enforced shortly - is aimed at concentrating Halon 1211 stocks, and since the participation of the importers and distributors in the Halon 1211 Bank is of utmost importance, it is necessary to obtain financial support for the implementation of the Halon Bank.

In addition, to ensure full participation of present halon users, and since the aim is to obtain substitution of these halons for another type of fire extinguisher, financial support for an extinguisher replacement programme is also very important.

For the above reasons, while it is clear that Uruguay has undertaken the preliminary steps for the installation of its Halon 1211 Bank, it should be noted that only through the support of the Montreal Protocol Multilateral Fund it will be possible to effectively apply the control measures, to ensure proper operation of the Halon Bank, to eliminate none essential uses and to ensure supply Halon for critical uses during the coming years, resulting in the corresponding reduction in the use of these substances. It furthermore makes it possible to avoid further import of new Halons.

IV) PROJECT ACTIVITIES

1) Training of technicians in the users sector

This type of assistance is aimed at training technicians in the users sector with a view to instructing them on the controls necessary to reduce intentional discharges during maintenance and servicing of Halon fire extinguishers, as well as to prevent accidental discharge from installed equipment. This training programme requires the presence of an international expert for a period of 10 days to carry out the corresponding activities in Montevideo. This above training programme is oriented to the following sectors:

a) the technicians of the eight companies distributing Halons in the country;
b) the state and private sector personnel responsible for safety and maintenance at the companies utilizing Halons.

On the other hand, a special event will be held for the military sector personnel (Air Force and Army) also responsible for the use of Halons.

In accordance with the conclusions of the Halon Awareness and Diffusion Workshop held in Montevideo in December 1993, the time to carry out the training programme at civil sector level has been estimated as one week, and as three days for the military sector.

2) Operation of the Halon Bank

2.1) Implementing the operation of the Registry Unit, controlling stocks at the Halon Bank and of the Committee for the Review of Critical Uses of Halons, which will meet periodically to evaluate the authorization of Halon requisitions. Both units will operate within the scope of the Government Technical Commission for the Preservation of the Ozone Layer of the Ministry of Housing, Territorial Order and Environment.

2.2) Implementation of the Halon Physical Bank, which will be located at the Tornay & Mori and Izeta Lopez' premises, where stocks of Halon 1211 will be concentrated to cover subsequent requirements for essential purposes, with prior authorization by the competent offices. This covers the use by the above-mentioned two companies of the Halon 1211 Recycling Equipment owned by the Uruguayan Government, under the corresponding agreement.

2.3) Monthly control on the part of the Government Technical Commission for the Preservation of Ozone, with the support of the National Firemen Bureau of the stock at the Halon Physical Bank, and of the operating conditions of the recycled equipment.

3) Implementation of a system for the substitution of the Halon in the hand of users by an alternative product, the cost of which should be covered through assistance from the Multilateral Fund.

By means of a more direct contact with users of Halon 1211 on the part of the Firemen Bureau and the technicians of the distributing companies, the type of substitute to be employed in each particular case will be determined.

4) Quality control

In order to avoid mixing of pure Halons with polluted Halons, a quality system will be introduced utilizing existing laboratory facilities in Montevideo. The cost of the laboratory control with be covered through the operation cost of the bank.

V) EXPECTED PROJECT RESULTS

- Training of the technical personnel responsible for safety and maintenance at the companies directly handling Halons, so as to draw their attention to the need to preserve domestic stocks of Halon 1211.

- Elimination of imports of Halon 1211, which amounted in 1993 to 1.8 tons.

- Rationalization in the consumption of the domestic Halon 1211 stock
(estimated at 10 tons) through recycling and critical use only.

VI) PROJECT COSTS

VI.1) Training and Capital cost

The project duration is two years and 3 month and consists of the following elements:

a. Training programme:

	1994	1995	1996	Total
Foreign expert:	8,000	0	0	8,000
Workshop Materials:	4,000	0	0	4,000
Workshop Infrastructure:	2,000	0	0	2,000
	14,000	0	0	14,000

b. Setting up a banking-secretariat for operation of the halon bank.

	1994	1995	1996	Total
Manpower	1,500	6,000	6,000	13,500
Legal assistance	5,000	0	0	5,000
Hardware	2,500	0	0	2,500
Software:	1,000	0	0	1,000
	10,000	6,000	6,000	22,000

c. Operation of the bank, including registration of uses, evaluation of critical uses, collection of halons and fire extinguisher exchange programme:

	1994	1995	1996	Total
Subcontracts with 2 companies	0	15,000	15,000	30,000
Quality control Testing	0	1,500	1,500	3,000
Storage tanks for halon 1211	10,000	0	0	10,000
Accessories	4,000	0	0	4,000
1,500 ABC powder extinguishers	0	37,500	37,500	75,000
500 CO2 extinguishers	0	50,000	50,000	100,000
Two Recycling machines	--> see Note **			
Miscellaneous	2,000	6,000	6,000	14,000
	16,000	110,000	110,000	236,000
Grand Total	38,000	116,000	116,000	272,000

Note ** : One machine already procured through the Global Halons Project, a second one will be procured through that same project.

VI.2) Operational Costs

There are no operational costs or savings in this project. Eventual savings resulting from not buying halons will be offset by transportation costs related to the operation of the bank.

VI.3) Unit Abatement Cost

a)	Incremental Capital Costs......................USD	272,000
b)	Economic Life Time..................................	10 years
c)	Annual Incremental Recurrent Costs/Savings......USD	-,-
d)	Annual Halons Consumption ....kg	5,600
f)	Capital Recovery Factor...........................	0.16275

UNIT ABATEMENT COSTS [{a(f)+ c}/d].............USD/kg/y 7.9

VII. PROJECT IMPLEMENTATION

VII.1 MANAGEMENT

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

The Coordinating National Body will be the Government Technical Commission for the Preservation of Ozone, with the technical support of the National Firemen Bureau and of the commercial importers and distributors of Halons in Uruguay.

VII.2 PROCUREMENT

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

VIII) TIMETABLE

The training of the technical personnel is foreseen to start in October 1994, once first-level contacts have been carried out with the distributor sectors, and through them, with the users sector.

Installation of the Registry Bank and of the Critical Use Review Committee is scheduled for October 1994, once the corresponding software and equipment are installed and the Critical Uses Review is agreed upon with the different sectors.

Installation of the Physical Bank and starting of operations of same is scheduled for November 1994, once the physical site has been determined and the corresponding contracts established with the two selected companies.

IX. REQUIRED REGULATORY ACTION

The project requires no regulatory action.

X. PROJECT IMPACT

This project will eliminate the use of at least 1.8 tons of Halons 1211 in the first year after implementation which corresponds to 5.4 tons ODS.