



**United Nations
Environment
Programme**



Distr.
LIMITED

UNEP/OzL.Pro/ExCom/25/47
2 July 1998

ORIGINAL: ENGLISH

EXECUTIVE COMMITTEE OF
THE MULTILATERAL FUND FOR THE
IMPLEMENTATION OF THE MONTREAL PROTOCOL
Twenty-fifth Meeting
Montreal, 29-31 July 1998

PROJECT PROPOSALS: THAILAND

This document includes the comments and recommendations of the Fund Secretariat on the following project proposals:

Aerosol

- Mary Manufacturing Co. Ltd. conversion UNDP
- Standard Manufacturing Co. Ltd. conversion UNDP

Foam

- Conversion to water based and HCFC-141b technology in the manufacture of polyurethane foam at World Plaster/Euro Plan Furniture Co. UNDP
- Phaseout of CFC-11 by conversion to LCD technology (FMF) and water based technology (ISF) in the manufacture of polyurethane foam at Duriflex UNDP
- Conversion to low index/additive (LIA) technology and methylene chloride in the manufacture of flexible PU boxfoam (FBF) at Cityfoam UNDP
- Conversion to CFC-free technology in the manufacture of cold store PU panels at Somerville World Bank

Fumigant

- Demonstration project: alternatives to the use of methyl bromide in grain storage (rice, maize, tapioca, feed grains and pulses) UNIDO

Refrigeration

- Umbrella project to convert CFC-12 commercial refrigeration to HFC-134a, and CFC-11 to HCFC-141b as the blowing agent for foam insulation at 224 small and medium sized enterprises. World Bank

PROJECT EVALUATION SHEET THAILAND

SECTOR: AEROSOL ODS use in sector (1992): 600 ODP tonnes

Sub-sector cost-effectiveness thresholds: Aerosols 4.40 US \$/kg

Project Titles:

(a) Standard Manufacturing Co. Ltd. conversion

(b) Mary Manufacturing Co. Ltd. conversion

Project Data	Hydrocarbons	
	Standard Manufacturing	Mary Manufacturing
ODS phase-out (ODP tonnes)	41.0	40.0
Proposed project duration (months)	24	24
Incremental capital cost (US \$)	138,380	136,400
- including contingency (%)	10	10
Incremental operational cost (US \$)	-	-
Total project cost (US \$)	138,380	136,400
Local ownership (%)	100	100
Export component (%)	-	-
Amount requested (US \$) {Original}	168,080	172,700
{Revised}	138,380	136,400
Cost effectiveness (US \$/kg)	4.10	4.32
National Coordinating Agency	Department of Industrial Works (DIW) Ministry of Industry	
Implementing Agency	UNDP	
Technical review completed?	Yes	
Secretariat's Recommendations:		
Amount recommended (US \$)	138,380	136,400
Project impact (ODP tonnes)	41	40
Cost effectiveness (US \$/kg)	3.37	3.41
Implementing Agency support cost (US \$)	17,989	17,732
Total cost to Multilateral Fund (US \$)	156,369	154,132

PROJECT DESCRIPTION

(a) Standard Manufacturing Co. Ltd. conversion

(b) Mary Manufacturing Co. Ltd. conversion

1. In 1992, the total consumption of CFCs in the aerosol sector in Thailand amounted to 600 tonnes. The Executive Committee has approved four investment projects for the phase out of 423 tonnes of CFCs used in the manufacturing of aerosol products, equivalent to 70.5% of the total CFC consumption in this sector.

2. The Government of Thailand is submitting two additional projects which would lead to elimination of an additional 81 tonnes of CFCs, namely, Standard Manufacturing (41 tonnes of CFCs) and Mary Manufacturing (40 tonnes). Both enterprises operate as contract fillers.

3. In total, 504 tonnes of CFCs would be eliminated once all the projects become operational, equivalent to 84 per cent of the CFC consumption in the sector. The project proposals state that "the ODS consumption for 1995 and 1996 was 8,779 and 6,041 ODP tonnes, respectively. It is estimated that ODS consumption in 1997 will be the average of 1995 and 1996 at 7,420 ODP tonnes. Therefore, the average annual consumption for the three years 1995, 1996, 1997 will be 7,420 ODP tonnes. Forecast consumption in 1999, based on unconstrained demand and 6% GDP annual growth rate using 1997 as the starting point, would lead to an estimated consumption of 8,337 ODP tonnes. In order to meet the obligations of the Montreal Protocol in 1999, Thailand must eliminate at least 917 ODP tonnes per annum. Approval of these project proposals would eliminate some 81 ODP tonnes and make a significant contribution to enable Thailand to meet its obligations under the Montreal Protocol commencing in 1999".

4. The projects under consideration are for the replacement of CFCs with hydrocarbon propellant used in manufacturing different types and sizes of aerosol products. Standard Manufacturing, the third largest contract filler in Thailand, produces room fresheners (340,000 cans/year), and Mary Manufacturing produces only perfumes in glass bottles and aluminum tubes (2.5 million cans/year).

5. The aerosol filling process under operation at Standard Manufacturing utilises two automatic filling machines manufactured by Coster (purchased in 1994). They are currently filling in what could be considered a modified open air filling room that will require small modifications to use HAPs. Conversion entails replacement of one automatic gas filling machine with a propellant handling system and transfer pumps, water bath for testing filled cans, HAP storage system, gas detectors and a fire control system.

6. Mary Manufacturing's filling operations are performed with an automatic filling machine (combined Coster/locally made in 1993). Conversion to HAPs entails replacement of the filling machine including vacuum crimper, propellant filler and transfer pump, a manually operated hot water bath system and a conveyor, and construction of a modified open air filling room.

7. Technical assistance will be provided for equipment installation and commissioning of the plant, and plant safety training.

SECRETARIAT'S COMMENTS AND RECOMMENDATIONS

COMMENTS

1. The Fund Secretariat requested UNDP to provide updated information on the aerosol sector in Thailand since consumption figures reported in the project documents were for 1992. In this regard, UNDP's local consultant informed that there is no updated information available on CFC consumption in the country. However, information received in the Secretariat from the Government of Thailand for the Summary status report on ODS phase-out in Article 5 countries (UNEP/OzL.Pro/ExCom/25/16), indicates that CFC consumption in the aerosol sector was 445 tonnes in 1997.
2. UNDP's consultant indicated that, besides the two enterprises covered under this project proposal, two other small aerosol fillers are still using CFC propellant, each consuming less than 4 tonnes of CFC. UNDP has requested confirmation from the Government on the size of the remaining aerosol sector.
3. On 13 October 1997, the Secretariat received an official communication from the Ministry of Industry stating that effective 24 March 1997, the Government "will not allow any aerosol companies/factories to produce aerosol cans using CFC substances any more" (Ministry of Industry Decree No. 3/2540, approved by the Cabinet).
4. The Secretariat and UNDP discussed the feasibility of retrofitting the existing filling equipment at each plant, considering that it is relatively new. UNDP informed the Secretariat that the use of on off-line gassing equipment could be used instead of the originally proposed automatic filling lines. This represented a cost adjustment of US \$15,000 for each plant.
5. The Secretariat discussed with UNDP the level of funding requested for some pieces of equipment (water baths, conveyors and filling system) and for local work needed for converting to HAPs. Based on quotations from projects under implementation, the costs were adjusted accordingly.
6. Operational savings were not considered since both plants operate as contract fillers (the Secretariat requested UNDP for an official confirmation from the Government that the plants operate as contract fillers).
7. Each project lists the equipment to be destroyed (brand name, capacity and date of purchase) once the conversion is completed. Also, each project attached a "letter of commitment" by the enterprises accepting, inter alia, the project as proposed in the project document, to completely phase out CFCs upon project completion, to dispose of any equipment that has been replaced in accordance with stipulations that have been drawn in the project document, and to

provide additional financial resources to cover some other equipment included in the project document but, which will not be funded through the Multilateral Fund.

RECOMMENDATION

1. The Fund Secretariat recommends blanket approval of the projects at the funding levels indicated below:

Project Title	Project Cost US \$	Support Cost US \$	Implementing Agency
(a) Standard Manufacturing Co. Ltd. conversion	136,400	17,732	UNDP
(b) Mary Manufacturing Co. Ltd. conversion	138,380	17,989	UNDP

PROJECT EVALUATION SHEET THAILAND

SECTOR: FOAM ODS use in sector (1991): 1510 ODP tonnes

Sub-sector cost-effectiveness thresholds: Flexible Slabstock US \$6.23/kg
 Integral Skin US \$16.86/kg
 Rigid US \$7.83/kg

Project Titles:

- (a) Conversion to Low Index/Additive (LIA) Technology and Methylene Chloride in the manufacture of Flexible PU Boxfoam (FBF) at CityFoam.
- (b) Conversion to CFC-free technology in the manufacture of cold store PU panels at Somerville.
- (c) Phase out of CFC-11 by Conversion to LCD Technology (FMF) and Water based technology (ISF) in the Manufacture of Polyurethane Foam at Duriflex.
- (d) Conversion to Water based and HCFC-141b Technology in the Manufacture of Polyurethane Foam at World Plaster/Euro Plan Furniture Co.

Project Data	Flexible Slabstock	Integral Skin		Rigid
	CityFoam	Duriflex	World Plaster/Euro Plan Furniture Co.	Somerville
ODS phase-out (ODP tonnes)	42	23.56	13.5	18.3
Proposed project duration (months)	24	24	24	36
Incremental capital cost (US \$)	225,500	269,500	187,000	148,500
- including contingency (%)	10	10	10	10
Incremental operational cost (US \$)	48,350	9,300	16,000	33,060
Total project cost (US \$)	273,850	278,800	203,000	181,560
Local ownership (%)	100	100	100	100
Export component (%)	0	0	0	0
Amount requested (US \$) {Original}	261,700	277,000	203,000	141,957
{Revised}		278,800		
Cost effectiveness (US \$/kg)	6.23	13.20	15.04	7.83
National Coordinating Agency	Hazardous Substances Control Division - Department of Industrial Works (DIW)			
Implementing Agency	UNDP	UNDP	UNDP	World Bank
Technical review completed?	Yes	Yes	Yes	Yes

Secretariat's Recommendations:

Amount recommended (US \$)		278,800		141,957
Project impact (ODP tonnes)		21.12		18.13
Cost effectiveness (US \$/kg)		13.20		7.83
Implementing Agency support cost (US \$)		36,244		18,454
Total cost to Multilateral Fund (US \$)		315,044		160,411

PROJECT DESCRIPTION

- (a) Conversion to Low Index/Additive (LIA) Technology and Methylene Chloride in the manufacture of Flexible PU Boxfoam (FBF) at CityFoam.
- (b) Conversion to CFC-free technology in the manufacture of cold store PU panels at Somerville.
- (c) Phase out of CFC-11 by Conversion to LCD Technology (FMF) and Water based technology (ISF) in the Manufacture of Polyurethane Foam at Duriflex.
- (d) Conversion to Water based and HCFC-141b Technology in the Manufacture of Polyurethane Foam at World Plaster/Euro Plan Furniture Co.

1. UNDP and the World Bank reported in the project proposals inter alia that "Thailand's ODS consumption for 1995 and 1996 are 8,779 and 6,041 ODP tonnes respectively (these amounts do not include consumption of HCFC and methyl bromide). It is estimated that ODS consumption in 1997 will be the average of 1995 and 1996 at 7,420 ODP tonnes. Forecast consumption in 1999, based on unconstrained demand and 6% GDP annual growth rate using 1997 as the starting point, would lead to an estimated consumption of 8,337 ODP tonnes. In order to meet the obligation of the Montreal Protocol in 1999, Thailand must eliminate at least 917 ODP tonnes per annum."
2. However, Thailand's ODS consumption for 1996 (reported to the Ozone Secretariat) was 6,039 ODP tonnes excluding consumption of HCFCs and methyl bromide. CFC consumption for the same year was 5,550 ODP tonnes. 31 projects have been approved in the foam sector to phase out 1,525 tonnes CFC-11, out of which 300 tonnes has been phased out. The 31 projects include 19 rigid foam projects to phase out 657 tonnes.
3. The World Bank and UNDP state in the projects that approval of the elimination of the targeted quantities of CFC-11(a total of 54.7 ODP tonnes) from the three projects would help Thailand to meet its obligations under the Montreal Protocol commencing in 1999.

Flexible Slabstock

- (a) Conversion to Low Index/Additive (LIA) Technology and Methylene Chloride in the manufacture of Flexible PU Boxfoam (FBF) at CityFoam.**

4. City Foam, a 100% Thai owned, was established in 1989. It produces flexible boxfoam for furniture, toilet sponges, clothing and other applications. It used 600 tonnes chemicals in 1996 with 42 tonnes CFC-11. The company also used methylene chloride to produce some of its low density foams. It operates a locally-made boxfoam unit purchased in 1991. The company will phase out CFC-11 through the use of methylene chloride, softening additive and low index additive.
5. It is proposed to replace the existing boxfoam configuration with a semi-automatic low pressure foaming unit with a closed loop additive and auxiliary blowing agent premixing at the cost of US \$110,000. Other capital cost items include temperature conditioning (US \$20,000), extra exhaust system to improve safety in the use of methylene chloride.(US \$25,000), trials (US \$20,000) and technology transfer (US \$20,000). Incremental

operational cost recalculated on the basis of approved methylene chloride methodology resulted in the amount of US \$13,100.

Rigid Foam

(b) Conversion to CFC-free technology in the manufacture of cold store PU panels at Somerville.

6. Somerville (Siam) Ltd. was founded in 1977. It has a 51% Thai and 49% Chinese ownership. It manufactures insulation panels for cold stores. 20% of its production is exported to China. It used 20 tonnes of CFC-11 in 1996. The company operates one 100 kg/min OMS low pressure dispenser installed in 1992 and one 150 kg/min OMS C150 high pressure dispenser installed in 1996. The company will convert its production to the use of HCFC-141b as an interim solution. The capital cost of conversion includes the cost of 100 kg/min high pressure dispenser to replace the existing low pressure dispenser and cost of technology transfer, trials and training US \$15,000. Incremental operational cost for two years amounts to US \$33,060.

Integral Skin

(c) Phase out of CFC-11 by Conversion to LCD Technology (FMF) and Water based technology (ISF) in the Manufacture of Polyurethane Foam at Duriflex.

7. Duriflex is a 100% Thai owned company established in 1986. It manufactures flexible molded and integral skin foam for office furniture. The average (1995-1997) CFC consumption of the company was 21 tonnes (corrected for a 30% evaporation rate). 13 tonnes was used for flexible molded foams while 8 tonnes was used for the integral skin foam. Average 1.5 tonnes/year of 1,1,1 - trichloroethane was used for flushing. It operates three low pressure dispensers installed in 1992.
8. Duriflex will phase out the use of 21 tonnes of CFC-11, and 1.56 tonnes of 1,1,1-trichloroethane (used for flushing) in the manufacture of flexible molded and integral skin foam for office furniture. The production is to be converted to LCD technology for the flexible molded application, and water/in-mold coating for the integral skin. The company will replace a low pressure dispenser with a high pressure dispenser with direct LCD injection (\$160,000), and include an LCD storage and metering system (\$20,000) and civil works (\$5,000). An in-mold coating system for each integral skin foam line (\$10,000) is also included. The flushing is eliminated in the flexible molded application, and replaced by the methylene chloride in the integral skin application. Other costs include trials (\$30,000), technology transfer (\$20,000) and incremental operating costs (\$7,500).

(d) Conversion to Water based and HCFC-141b Technology in the Manufacture of Polyurethane Foam at World Plaster/Euro Plan Furniture Co.

9. World Plaster/Euro Plan Furniture Co. was established in 1993. It manufactures flexible molded and integral skin foam cushions and arm rests for furniture, cornices and automotive cushions and spoilers. It used 115 tonnes of chemicals with 14 tonnes CFC-

11. The company currently uses water-based technology for manufacturing flexible molded foams. The company has one OMS FM15 low pressure dispenser purchased in 1997 and one Cannon A40 high pressure dispenser purchased in 1996.
10. World Plaster/Euro Plan Furniture will phase out the use of CFC-11 in the manufacture of integral skin foam by converting to water based systems to the extent possible, with the balance by HCFC-141b. The company requests retroactive funding of the new high pressure dispenser purchased in 1996 (US \$45,000). It also requests funding for a new premixer (US \$85,000). Trials, training, technology transfer amount to US \$30,000, and 10% contingency is charged on the capital costs. Incremental operating cost for two years amounts to US \$16,000.

SECRETARIAT'S COMMENTS AND RECOMMENDATIONS

COMMENTS

1. The unconstrained demand of ODS of 7,420 ODP tonnes exceeds the actual consumption reported by Thailand by 1,381 ODP tonnes. The forecast consumption of 1999 estimated to be 8,337 ODP tonnes may, therefore, not reflect the actual situation. Therefore the 917 ODP tonnes per annum estimated to be the additional amount of ODS needed to be phased out for Thailand to meet its 1999 obligation may also not reflect the actual situation, which could be lower than estimated.

Flexible Slabstock: City Foam

2. The replacement of the existing boxfoam unit with a semi-automatic unit at the cost of US \$110,000 was considered an upgrade of the technology. Hence an amount of US \$65,000 was agreed as retrofit cost of the equipment. The project is being discussed between the Secretariat and UNDP with regard to the technology and the costs. The outcome of the discussion will be communicated to the Sub-Committee on project review.

Rigid Foam: Somerville

3. The project costs have been agreed.

Integral Skin:

Duriflex

4. The capital costs were agreed. To account for the 30% evaporative loss, UNDP was requested to recalculate. This will be reflected in a revised project cost.

World Plaster/Euro Plan Furniture Co.

5. With regard to the request for partial retroactive payment of the high pressure machine, the Secretariat informed UNDP that the cost of the machine is not eligible for retroactive funding.

Since the machine was purchased for use with CFC (i.e. there was no phase out), it is the baseline machine. UNDP proposed to retrofit it at the cost of US \$15,000 to use HCFC-141b.

6. With regard to the request for a multi-component premixer (at the cost of US \$85,000), based on advice received from several experts, UNDP was advised as in other similar cases that the cost of that item is not eligible for funding, as it was not necessitated by the change to substitute blowing agent. Furthermore the change results in considerable technological upgrade.

7. The issues identified are under discussion and the Sub-Committee on Project Review will be informed of the outcome.

8. The Secretariat would recommend US \$76,500 as the eligible incremental cost due to this project. The project is being submitted for individual consideration.

RECOMMENDATION

1. The Fund Secretariat recommends blanket approval of the Somerville and Duriflex projects with the level of funding and associated support cost as indicated below.

Project Title	Project Cost US \$	Support Cost US \$	Implementing Agency
Conversion to Low Index/Additive (LIA) Technology and Methylene Chloride in the manufacture of Flexible PU Boxfoam (FBF) at CityFoam	Pending	Pending	UNDP
Conversion to CFC-free technology in the manufacture of cold store PU panels at Somerville.	141,957	18,454	World Bank
Phase out of CFC-11 by Conversion to LCD Technology (FMF) and Water based technology (ISF) in the Manufacture of Polyurethane Foam at Duriflex	278,800	36,244	UNDP
Conversion to Water based and HCFC-141b Technology in the Manufacture of Polyurethane Foam at World Plaster/Euro Plan Furniture Co.	Pending	Pending	UNDP

PROJECT EVALUATION SHEET THAILAND

SECTOR: FUMIGANT ODS use in sector (1996-97): 35.8 ODP tonnes

Sub-sector cost-effectiveness thresholds: N/A

Project Title:

Demonstration project - alternatives to the use of methyl bromide in grain storage

Project Data	Methyl Bromide
	DOA (Department of Agriculture): Regulatory Division
ODS phase-out (ODP tonnes)	-
Proposed project duration (months)	24
Total incremental costs (US \$)	341,000
- including contingency (%)	10
Total project cost (US \$)	341,000
Local ownership (%)	100
Export component (%)	-
Amount requested (US \$) {Original}	385,000
{Revised}	341,000
Cost effectiveness (US \$/kg)	-
National Coordinating Agency	DIW (Department of Industrial Works, Ministry of Industry): Ozone Protection Unit
Implementing Agency	UNIDO
Technical review completed?	n/a

Secretariat's Recommendations:	
Amount recommended (US \$)	Pending decision of the Executive Committee
Project impact (ODP tonnes)	
Cost effectiveness (US \$/kg)	
Implementing Agency support cost (US \$)	
Total cost to Multilateral Fund (US \$)	

PROJECT DESCRIPTION

Demonstration project - alternatives to the use of methyl bromide in grain storage

1. In 1996-1997, approximately 510 metric tonnes of methyl bromide were consumed in Thailand, mostly to disinfest stored and export-grains (98%) and for soil fumigation (2%). UNIDO informed that according to figures given officially and available in different documents at least 160 metric tonnes of methyl bromide are used in grain storage and not for quarantine or pre-shipment measures. Methyl bromide consumption data reported to the Ozone Secretariat in 1996 was 230.4 tonnes.
2. Rice and tapioca (dried cassava) are among the most important durable commodities exported from Thailand. Rice may be stored in bulk in silos or in bags. The storage period is short, ranging from 2 to 5 months. Rice may be infested by a range of insect pests, the most common of which are the rust red flour beetle (*Tribolium castaneum*), rice and maize weevils (*Sitophilus zeamais* and *S. oryzae*), and book lice (*Psocids*). While methyl bromide and phosphine are used to disinfest rice in storage, the former is preferred for its speed of action. It is generally understood that phosphine requires longer exposure time than methyl bromide.
3. Tapioca is manufactured from dried cassava chips, that are pelletized. Pelletization involves extrusion under high pressure, thus generating considerable heat. While these combined effects make the process insecticidal, the product might become infested by rust red flour beetle (*Tribolium castaneum*) during storage; when this occurs it is fumigated in-situ, enclosed under plastic sheeting containing methyl bromide. Tapioca pellets are handled and stored in bulk in "flat" or "horizontal" storage. In general, disinfestation treatments with methyl bromide are undertaken after the product has been loaded (in bulk) into lighters/barges.
4. The project is to demonstrate alternative technologies to the use of methyl bromide as a fumigant in post harvest disinfestation of rice and tapioca. The alternative technologies selected include: phosphine (aluminium phosphide) alone, improved uses of phosphine with liquid carbon dioxide and carbon dioxide. The alternatives will be presented in combination with implementation of Integrated Commodity Management (ICM) programme.
5. Integrated commodity management (ICM) is a combination of practices to control pests in stored commodities, such as rice and tapioca taking into account all factors that could infest a crop, from pre-storage procedures, logistics of transport from the growing areas, storage design, hygiene and stock management, to means and effect of processing, end use, and market requirements. ICM provides a systematic approach for introducing alternatives to methyl bromide.
6. The proposed demonstrations will be undertaken in grain storage premises of two companies, one trading in rice and the other trading in tapioca.
7. The project will be implemented by UNIDO in close cooperation with the Regulatory Division of the Ministry of Agriculture and in co-ordination with the Ozone Protection Unit of the Ministry of Industry.

8. The expected results from project implementation are: (i) a practical technical and economic analysis, at full commercial scale, of the utilization of phosphine and carbon dioxide supported by an ICM system in disinfestation of rice and tapioca; (ii) at least thirty fumigators fully trained in the technologies implemented during the course of the demonstration project; and (iii) dissemination of the results among qualified representatives of the local and international grain storage industry.

9. A national project coordinator will be recruited for managing and supervising the demonstration project, including designing the tests, collecting and analyzing the data, supervising field activities and coordinating the services of project personnel. The total cost for human resources is US \$128,000 including a subcontract for expert services (US \$27,800), and the cost of the equipment is US \$158,200. A cost breakdown is attached to the project evaluation sheet.

SECRETARIAT'S COMMENTS AND RECOMMENDATIONS

COMMENTS

1. The project concept follows the Executive Committee's guidelines. Thailand ratified the Copenhagen Amendment on 12 January 1995.

2. UNIDO informed the Secretariat that, during project preparation, special emphasis has been put in working with the institutions, organizations, professionals and agro-industries which are transferring the technology to the farmers.

3. The Secretariat asked if UNIDO had contacted Article 2 countries with a view to recruiting government experts from those countries (as per Decision 24/18). In this regard, UNIDO indicated that "the use of external expertise is needed only when the local institutions require advice in using state of the art techniques of which there is only a theoretical knowledge in Article 5 countries".

4. Based on discussions between the Fund secretariat and UNIDO, cost of some of equipment items were adjusted. Also, UNIDO agreed that the national co-ordinator should be on a part-time basis, resulting in project savings of US\$ 30 000.

5. Notwithstanding the emphasis placed by UNIDO on working with local institutions and on seeking to reduce salary costs, the concept and cost structure of this project is similar to projects initially approved by the Executive Committee. Taking this into consideration, the Executive Committee may consider whether it wishes to approve the project with associated support costs at the funding level shown in the table below:

Project Title	Project Cost US \$	Support Cost US \$	Implementin g Agency
Demonstration project - alternatives to the use of methyl bromide in grain storage	341,000	44,330	UNIDO

ANNEX A

A1. PRELIMINARY EQUIPMENT SPECIFICATIONS FOR THE PROJECT

No of items	DESCRIPTION	TOTAL COST US\$
2 sets	PVC fumigation sheets to enclose 200 tonne bag stacks for "fumigation under gas proof sheets", material for patching, glue, wide sand snakes, etc.	8,000
2 sets	Fumigation sheets to enclose one 20 ft freight container.	1,500
2 sets	PVC sheets for sealed stack storage of 200 tonne bag stacks, (cover sheets, floor sheets), material for patching, glue etc.	10,000
2 sets	Pressure testing equipment for sealed stacks, including vacuum cleaner, Contestor, U tube manometer, etc.	8,000
2	Sets of miscellaneous equipment for sealed stack disinfestation	8,000
2	20 ft freight containers, selected after pressure testing	10,000
5	Electronic phosphine detectors, calibrated for fumigation concentrations, without cross sensitivity to carbon monoxide.	10,000
5	Electronic phosphine detectors, calibrated for workspace concentrations, specific to hydrides or known cross sensitivities.	5,000
3	Electronic carbon dioxide detectors, calibrated for fumigation concentrations.	20,000
5	Hand pump sets for detecting fumigants with detector tubes.	3,000
1,000	Phosphine detector tubes.	10,000
1,000	Carbon dioxide detector tubes.	10,000
	Total	103,500

A2. COST OF GASES TO BE USED DURING THE DEMONSTRATIONS

	DESCRIPTION	COST US\$
	Cost of phosphine generating preparations to be used during the demonstrations.	450
1.	Bagged rice under gas proof sheets	450
2.	Bagged rice in sealed stacks	275
3.	Bagged rice in freight containers	275
4.	Bulk rice in freight containers	550
5.	Bulk rice in silos	1,200
6.	Bulk tapioca in lighters/barges	3,200
	Total	
	Cost of food grade carbon dioxide to be used during the demonstrations.	4,800
7.	Bagged rice in sealed stacks	
	Cost of food grade carbon dioxide to be used during the demonstrations.	3,000
8.	Bagged and bulk rice in freight containers	
	Cost of phosphine in carbon dioxide (including freight) to be used during the demonstrations.	27,000
9.	Phosphine in carbone dioxide (two treatments)	
	Cost of tailored cotton&sheet for one 200 mt stack and residual insecticide treatment. For post fumigation treatment.	1,000
	Total	39,000

**A3. EQUIPMENT SPECIFICATIONS FOR DISINFESTATION WITH PHOSPHINE IN
CARBON DIOXIDE**

No of items	DESCRIPTION	TOTAL COST US\$
1 set	System equipment: including dispenser, flow unit, concentration controller, hoses, manifold, pies and fittings	5,500
1	Air fan	700
1 set	Inlet ducting, return ducting.	4,000
	Miscellaneous ancillary equipment,	2,500
	Installation costs	3,000
	TOTAL	15,700

ANNEX B

PROJECT BUDGET

	w/m	US\$
11-50 ICM and Grain Fumigation Specialist	4.0	68,000
15-00 Project travel		12,000
17-01 National Project Coordinator	24.0	60,000
21-00 Subcontract (Annex C)		27,800
33-00 Study tour (6)		18,000
35-00 Workshop (3 days)		6,000
42-00 Equipment	158,200	
TOTAL	350,000	
Contingencies (10%)	35,000	
TOTAL PROJECT COST	385,000	
Overheads of executing agency (13%)	50,050	
<u>Funds requested from the Montreal Protocol</u>		<u>US\$ 435,050</u>

ANNEX C

C1. PRELIMINARY TERMS OF REFERENCE FOR THE SUBCONTRACT

The subcontractor is expected to provide the following services or inputs:

The services of the following local experts:

One National part time scientist (biologist) OR socio economist:
to implement the integrated commodity management demonstration under direction of an ICM consultant.

One national technician with experience in grain fumigation and grain pest management, with appropriate qualifications and at least 5 years of practical hands-on experience in grain fumigation and grain storage. (6 months).

One National agro-economist.

Introduce and implement an integrated commodity management plan in one rice storage plant and one tapioca storage plant over the duration of the project.

Conduct a series of demonstrations with phosphine at a number of selected rice storage and tapioca storage facilities in the Bangkok area of Thailand.

Conduct a series of demonstration fumigations with carbon dioxide at a number of selected rice storage and tapioca storage facilities in the Bangkok area of Thailand.

Provide the following services or inputs for an open topped (unsealed) 2-4 cell silo installation to demonstrate a flow through disinfestation system using a phosphine in carbon dioxide formulation:

- Conduct a series of demonstrations with phosphine in carbon dioxide on bulk (in-silo) stored rice at a selected rice storage plant in the Bangkok area of Thailand.
- Install all equipment (to be purchased by UNIDO) relating to phosphine in carbon dioxide dispensing, flow control, concentration control, pipe fittings, air fan, manifolding, etc.
- Install all equipment (to be purchased by UNIDO) relating to inlet and return ducting.
- Install all other miscellaneous equipment (to be purchased by UNIDO) required for the flow through system.
- Undertake five demonstrations of the technique during a two year project.
- Prepare a report for presentation and publication at a workshop at the completion of this project.

PROJECT EVALUATION SHEET

THAILAND

SECTOR: Refrigeration ODS use in sector (1997) 750 ODP tonnes (Commercial)

Sub-sector cost-effectiveness thresholds: US\$15.21/kg ODP

Project Titles:

Umbrella Project to Convert CFC-12 Commercial Refrigeration to HFC-134a, and CFC-11 to HCFC-141b as the Blowing Agent for Foam Insulation at 224 Small- and Medium-Sized Enterprises

Project Data	Commercial
	Umbrella
ODS phase-out (ODP tonnes)	207
Proposed project duration (Mths)	24
Incremental capital cost (US\$)	3,596,270
Contingency (%)	10
Incremental operational cost (US\$)	5,214,265
Total project cost (US\$)	8,810,535
Local ownership (%)	100
Export component (%)	
Amount requested (US\$) { Original	3,148,470
{ Revised	
Cost effectiveness (US\$/kg)	15.21
National Coordinating Agency	Dept. of Industrial Works, Ministry of Industry
Implementing Agency	The World Bank
Technical review completed?	Yes

Secretariat's Recommendations	
Amount recommended (US \$)	
Project impact (ODP tonnes)	
Cost effectiveness (US \$/kg)	
Implementing Agency support cost (US\$)	
Total cost to Multilateral Fund	

PROJECT DESCRIPTION

Umbrella Project to Convert CFC-12 Commercial Refrigeration to HFC-134a, and CFC-11 to HCFC-141b as the Blowing Agent for Foam Insulation at 224 Small- and Medium-Sized Enterprises.

1. The commercial refrigeration sub-sector of Thailand is composed of approximately 15 large and a number of medium and small enterprises. Total consumption in the sector is estimated at about 750 tonnes of ODP used for manufacturing of new refrigeration equipment. Additionally, about 250 ODP tonnes is used for servicing the installed equipment. The Executive Committee has approved 6 projects for large enterprises in the sub-sector leading to phase out of 86.7 ODP tonnes.
2. This project was deferred from the 24th Meeting of the Executive Committee.
3. The project document contains the following statement: "Implementation of the project will contribute to helping Thailand to achieve the 1999 ODS consumption freeze."
4. This is a terminal umbrella project to eliminate the use of CFC's in the production of commercial refrigeration equipment at 224 small - and medium-sized enterprises. Each enterprise will be provided with technical assistance and the necessary machinery and equipment to phase out CFC-11 in foam blowing operations and CFC-12 as a refrigerant. It is estimated that the conversion will be completed at all participating companies within two years. After completion of the project at each facility, the company's old equipment will be destroyed.
5. It is estimated that these 224 enterprises, with a combined annual production level of 129,000 units, represent all manufacturers of new equipment in the commercial refrigeration sub-sector. The main products of these enterprises include refrigeration units, water coolers, retail food display cases and freezers that are sold to small grocery stores, schools and restaurants. A number of these 224 enterprises provide servicing of installed refrigeration equipment. They consume 168 tones of CFC-12. It is estimated that 50% of total CFC-12 consumption or 84 MT is for new equipment and the rest for servicing operations. CFC-12 consumption for servicing is not included in the total figure of ODP phase out. Total consumption of CFC-11 for foam insulation is estimated at approximately 128 MT.
6. The proposal contains general information on the production level of the group of 224 enterprises. No breakdown of the share of each enterprise in the total production figure of the 129,000 is given. A table is provided as part of the project document with the list of the CFC-12 consumption data per enterprise, number of vacuum pumps, pressure gauges and leak detectors installed in each which are needed to handle refrigerant charging operations. The project document indicates that each company currently utilizes hand mixing and pouring the foam. The proposal does not contain consumption data on CFC-11 for foam insulation.
7. The following justification was provided for the selection of the HCFC-141b transitional substitute: "HCFC 141b was selected as the blowing agent for the small - and medium - sized

enterprises that are part of this project. Cyclopentane would have been ideal from an environmental point of view, but was rejected as uneconomical and impractical given the scope and nature of the operations at these enterprises. The enterprises understand and agree not to seek further funding from the Multilateral Fund to switch to a non-ozone depleting technology, such as cyclopentane, in the future".

8. The project covers the capital cost for equipment that will need to be rebuilt or replaced and costs associated with technology transfer and training. The equipment requested for conversion include vacuum pumps, pressure gauges, charging cylinders and leak detectors. Of the total capital costs of US\$ 3.6 million, US\$ 2.24 million is for technology transfer and training. Technology transfer and training will be provided by Kulthorn Engineering, a subsidiary company of Kulthorn Kirby, which is a major supplier of compressors.

9. Incremental operating costs (IOC) are calculated at US\$ 5.2 million for two year duration. The major portion of IOC is related to the cost of HFC-134a compressors, sourced from Kulthorn Kirby Compressor Company at US\$ 3.00 million which is calculated on the basis of incremental cost of US\$ 16.1 per compressor.

10. The total project cost is US\$ 8.8 million. However, the funding requested is for US\$ 3.1 million, which is the maximum allowed given the ODS consumption claimed in the project and the cost-effectiveness threshold established for the commercial refrigeration sub-sector.

SECRETARIAT'S COMMENTS AND RECOMMENDATIONS

COMMENTS

1. In Decision 24/53 the Executive Committee decided:
 - (a) To defer consideration of this project;
 - (b) That, on an exceptional basis, the project should be retained in the 1997 business plan of the World Bank;
 - (c) That information on the methodology used to calculate corroborated data on CFC consumption be provided to the Executive Committee as a basis for a funding decision, as well as details of the assurances given by the Government of Thailand concerning its commitment to the implementation of the phase-out.
2. The World Bank has provided a draft note on this project for the 25th Meeting. The note is included as Annex 1 to this evaluation sheet.
3. The note provides information as to the methodology used by the World Bank in gathering and presenting the data it included in the project document presented to the 24th Meeting, in particular the data related to figures claimed as representing the ODS consumption.

4. The project was submitted for the first time in September 1997. This original submission covered 90 enterprises with total production figure of 129,000 units per year and ODP phase out of 204.4 ODP tonnes. An additional 134 enterprises were identified at a later stage. The proposal submitted to the 24th Meeting covered 224 enterprises but the total production, 129,000 units/year, and the total ODP phase out, 207 ODP tonnes, did not change.
5. No additional data is provided to corroborate the information presented to the 24th meeting. No changes have been made to the project document.
6. The note also provides information on the assurances on phase out given by the Government of Thailand.
7. At the 13th Meeting of the Sub-Committee on Project Review the Fund Secretariat noted that if no additional data was provided, there would be no better basis for estimating eligible project costs. This is now the case. The approximations that were used to arrive at the consumption (such as, an assumption that for each enterprise, one half of the CFC-12 consumption is for servicing and one half for refrigeration manufacture) remain uncorroborated.
8. The Secretariat's comments on the project as presented to the 24th Meeting of the Executive Committee are included as Annex 2.
9. The World Bank continues to ask that funding be approved on the basis of the same assumptions used in the project as submitted to the 24th Meeting. The data (and thus the eligible cost) is proposed to be finally established by the Bank in the course of project implementation.
10. This represents a departure from the basic principles of project review and approval used by the Executive Committee to date. The Fund Secretariat is unable to make a recommendation to approve the project on this basis.
11. CFC -11 consumption was re-estimated on the basis of the quantities of foaming chemicals used by 224 enterprises. Subsequently, the level of funding was calculated on the basis of ODP consumption and the threshold to be US \$2,631,486.

A DRAFT NOTE ON

THAI COMMERCIAL REFRIGERATION TERMINAL UMBRELLA PROJECT

JUNE 1998

PRESENTED TO THE
25th EXECUTIVE COMMITTEE MEETING

INTRODUCTION

At the 24th meeting, the Sub-Committee recommended that this project be deferred and that information on the methodology used to calculate corroborated data on CFC consumption be provided to the ExCom as basis for a funding decision, as well as details of the assurance given by the Government of Thailand concerning its commitment to implementation of the phaseout.

SCOPE OF THE PROJECT

Provide technical and financial assistance to small and medium scale commercial refrigeration manufacturers (SME's) in Thailand in order to enable them to meet the phaseout target set by the Thai Government in the Montreal Protocol Country program.

POLICY SUPPORT AND NATIONAL COMMITMENT.

In accordance with the Thai country program, use of CFCs in the production of new commercial refrigerators will be banned by year 1998 through a Ministerial Order issued by the Ministry of Industry.

The proposed ministerial order will require that a condition prohibiting the use of CFCs in the production of commercial refrigerators be attached to all factory licenses issued by the Department of Industrial Works (DIW). Similar condition will also be included in the factory licenses issued for compressor manufacturers and those supplying pre-mix polyols. Moreover, the Ministry of Industry would seek the Cabinet's approval to ban the import of CFC commercial refrigerators and compressors, similar to the earlier Cabinet approval to ban the import of CFC domestic refrigerators. In addition, DIW will reduce the import quotas for CFC-11 and CFC-12 by similar amounts to be phased out by this project.

IMPLEMENTAION MODALITY

Kulthorn Kirby Refrigeration Engineering Company, which provides technical support to most of the commercial refrigeration companies in Thailand has agreed to undertake the job as a project manager for the implementation of this project. Its role and obligations as a project manager is described in details in the project document. Upon approval of the project, KKE will sign the standard sub-grant agreement with the Thai Financial Intermediary and the funds will be disbursed on the basis of actual documented costs and the agreed schedule.

The WB will monitor the implementation of the project through its supervision work.

Baseline information for each enterprise (ODS consumption and existing equipment) will as a first step be verified through on-site visits by KKE technical staff. Necessary replacement of equipment and changes/modifications for converting to HFC 134a and HCFC-141b will be assessed and specified for each participating enterprise. KKE will order the equipment for the enterprises and provide on site training and technical assistance to each enterprise. A foam expert hired by KKE will assist the enterprises in using HCFC-141b in a safe manner.

In accordance with the existing ExCom policies and guidelines, the overall eligible funding is based on identified incremental eligible costs, ODS consumption and the threshold for the sector based on average country specific figures for the subsector. The maximum funding for each enterprise are limited by the threshold plus 100% consistent with guidelines for terminal umbrella projects. While it is expected that the overall funding will be approved up front consistence with present practice, the disbursement to each individual participating enterprise will be based on actual verifiable baseline information.

A status report on the baseline information will be provided by KKE. The bank will audit the information through its normal project supervision activities.

SECTOR AND ENTERPRISE BASELINE INFORMATION

General sub-sector information are available in Thailand through the refrigeration association and within KKE. The information includes annual number of new units produced, overall information on types of refrigerators produced and average ODP consumption per units. The number of units produced are checked against consumption of compressors by the sector, taking into account experiences on the number of compressors used for replacement of existing refrigerators.

SUB SECTOR ODS CONSUMPTION

As the eligible grant amount most likely will be controlled by the threshold for the sub sector, verified ODS consumption figures are a major concern. As the number of enterprises participating are large, geographically withspread and are of SME's the normal procedure having a consultant visiting each single enterprise are not cost-effective for the MLF. ODS consumption has been established through following ways:

Method A: National statistics and trade associations provided information on the estimated annual production.
Average ODS consumption per unit established based on an industrial norm for the type of application.

- Method B:** Specific sector information from suppliers of ODS and other easily traceable indicators. In this case suppliers of loaded CFC compressors provided CFC-12 and CFC-11 sub-sector consumption figures.
- Method C:** Specific information from enterprises based on questionnaires and visits to a random selection of enterprises.

Based on the above, ODS consumption based on the three sets of information were evaluated and a conservative number for the ODS consumption established. For the Thai umbrella project, information on CFC-12 procurement was available at the enterprise level. However, most of them also provided servicing and refilling of refrigeration systems, a ratio of 1:1 between CFC-12 used for new refrigerators and servicing was established based on industry information and verified against the consumption figures established through Methods A and B.

ELIGIBLE PROJECT COSTS.

The incremental project costs was established based on approved costs items for similar projects in the sector and sub-sector templates. The costs of the Thai umbrella project includes capital costs, technical assistance, and operating costs based on present guidelines.

Umbrella Project to Convert CFC-12 Commercial Refrigeration to HFC-134a, and CFC-11 to HCFC-141b as the Blowing Agent for Foam Insulation at 224 Small- and Medium-Sized Enterprises.

1. The project proposal indicates that implementation of the project will contribute to achieve the 1999 freeze in Thailand.
2. The Secretariat sought clarification from the World Bank on a range of issues concerning the CFC consumption of the enterprises included in the project. In particular, the Secretariat indicated to the World Bank that the data provided on the production level and CFC consumption for each enterprise may not be adequate to establish the eligibility of the funds requested. In particular, there is no information on the number of refrigeration units manufactured by each enterprise to support the total production figure of 129,000 units per year. Annual production levels are used to determine the CFC consumption of an enterprise. Thus, the CFC consumption used for manufacture, as opposed to servicing, cannot be established, and no basis is provided for the figure of 50% of total CFC, used for servicing equipment (which is not eligible). The Secretariat requested additional information to ascertain that all the listed 224 enterprises are producers of new refrigeration equipment, to establish the consumption of each enterprise. The World Bank had advised that it was not possible to obtain specific information on the production level of each enterprise. The World Bank confirmed that all the 224 are commercial refrigerator producers. Only aggregate information was available which was based on a survey conducted by the Thai Department of Industrial Work and by Kulthorn Kirby Engineering.
3. The consumption of each enterprise is also needed to establish compliance with Decision 19/32 related to umbrella projects. Decision 19/32 which stipulates that no individual enterprise proposal in a terminal umbrella project may have a cost-effectiveness value more than 100 per cent above the threshold. The World Bank proposed that the requirements of Decision 19/32 could be met by prorating the CFC consumption for each enterprise and calculating a cost-effectiveness value. Under this methodology, each enterprise would be funded exactly at the threshold level.
4. Additionally, the Secretariat pointed out that on the basis of the quantities of foaming chemicals used by each enterprise, the CFC-11 consumption in total was around 50% of that indicated in the project document. This would effect the total grant level which is calculated for this group of enterprises on the basis of the cost-effectiveness threshold value of the sector multiplied by the CFC consumption.

Capital Cost

5. The major portion of capital cost (US\$ 2.24 million) is for technology transfer and training which is calculated by multiplying US\$ 10,000 by the number of enterprises. US\$ 2.24 million is proposed to be allocated to Kulthorn Kirby Engineering as a provider of technology. (It is to be noted that Kulthorn Kirby Engineering is a subsidiary of Kulthorn Kirby Co. Ltd., which received

US\$ 1,494,234 from the Multilateral Fund including cost of technology transfer for the conversion of its compressor plant).

Operating Cost

6. Regarding operating costs, the Secretariat questions the very high incremental cost for HFC 134a compressors of US\$ 16.1/unit given the fact that the main products covered by the project are (refrigerators, freezers and water coolers used in small grocery shops, schools and restaurants.) These products require small capacity compressors at much lower incremental cost per unit.

7. The eligibility of these cost items was not pursued as they will not be included within the level of funding available under the cost-effectiveness threshold.

8. The Secretariat and the World Bank are still discussing the eligibility and the level of funding of incremental costs in the above mentioned project. The Sub-Committee on the project review will be informed accordingly.