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

Eleventh Meeting
Bangkok, 10-12 November 1993

PROJECT PROPOSALS: INDONESIA

This document includes:

a) Comments and Recommendations from the Fund Secretariat for the project proposals listed below; and

b) The following project proposals:

. Elimination of CFC-12 in the Manufacture of Extruded Polyethylene and Polystyrene Foam Sheet (Tulus Company)

. Elimination of CFC-12 in the Manufacture of Extruded Polyethylene and Polystyrene Foam Sheet (Intitri Muliatama Company)

. Elimination of CFC-11 in the Manufacture of Polyurethane Foams (Dasa Windu Agung Company)

. Elimination of CFC-11 in the Manufacture of Flexible Polyurethane Foam (Foamindo Industri Uretan Company)

. Technical Assistance Program for Small CFC User in the Flexible Polyurethane Foam Sector

. Safety and Technical Program to Assist Manufacturers of Hydrocarbon Propelled Aerosol Products.

PROJECT EVALUATION SHEET

COUNTRY OR REGION:	Indonesia
PROJECT TITLE:	Extruded Polyethylene/Polystyrene Foam Projects a) Tulus Company b) Intitri Muliatama Company
BUDGET:	a) US $ 75,000 (capital cost) US $276,000 (operational costs) US $351,000 (total project budget) b) US $1.3 million (capital cost) US $647,000 (operational cost savings) US $653,000 (net project budget)
INCREMENTAL COSTS[1]:	a) US $416,000 b) US $387,000[2]
ODS PHASE-OUT:	a) 100 ODP tonnes of CFC-12 - 5 ODP tonnes of HCFC-22 = 95 ODP tonnes b) 120 ODP tonnes of CFC-12 - 1 ODP tonnes of HCFC-22 = 119 ODP tonnes
COST EFFECTIVENESS[3]:	a) US $4.38 per Kg. ODP saved b) US $3.25 per Kg. ODP saved
PROJECT DURATION:	1 year
IMPLEMENTING AGENCY:	The World Bank

NATIONAL COORDINATING AGENCY : Indonesian Ministry of the Environment (LH)

TECHNICAL REVIEW COMPLETED: YES _X_ NO _

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1 Including contingency (15 per cent) and Financial Agent Fee (3 per cent).

2 The incremental costs differ from the budget by accounting for 50 per cent transnational ownership.

3 Determined as the ratio of incremental costs to the estimated annual saving of ODP ($/$ODP_{Kg}$). For CFC-12, ODS=ODP but for HCFC-22, ODP = 0.055 x ODS

SECRETARIAT'S COMMENTS

1. Both companies are involved in the manufacture of extruded polyethylene and polystyrene foams. The Tulus Company will substitute CFC-12 by using HCFC-22, and Intitri Muliatama Company will substitute CFC-12 by using a combination of HCFC-22 and carbon dioxide.

2. Hydrocarbons cannot be used in these companies due to the layout of the production facility.

3. Since carbon dioxide technology has only been developed for use in the manufacture of polystyrene foam, the Tulus Company will not use this technology since its main product is polyethylene foam. The major cost component of the Intitri Muliatama Company project is the cost of the license for the carbon dioxide technology.

4. The total budget for the Intitri Muliatama Company project is adjusted as a result of incremental operational savings in the amount of US $647,000 because the cost of carbon dioxide is less than CFC-12. Positive incremental operational costs are claimed for the Tulus Company project because the cost of the substitute, HCFC-22, is more expensive than CFC-12.

SECRETARIAT'S RECOMMENDATION

5. The Secretariat recommends final approval for these two sub-projects for the amounts requested, i.e., US $416,000 for the Tulus Company and US $387,000 for the Intitri Muliatama Company.

PROJECT EVALUATION SHEET

COUNTRY OR REGION:	Indonesia
PROJECT TITLE:	Elimination of CFC-11 in the Manufacture of Polyurethane Foams a) Dasa Windu Agung Company b) Foamindo Industri Uretan Company
BUDGET:	a) US $640,000 (capital costs) US $843,000 (operational costs) US $1,483,000 (total project budget) b) US $307,000 (capital costs) US $ 15,000 (operational cost savings) US $292,000 (net project budget)
INCREMENTAL COSTS[1]:	a) US $1,757,000 b) US $176,000[2]
ODS PHASE-OUT:	a) 125 ODP tonnes of CFC-11 - 3 ODP tonnes of HCFC-22 = 122 ODP tonnes b) 80 ODP tonnes of CFC-11
COST EFFECTIVENESS[3]:	a) US $14.40 per Kg. ODP saved b) US $2.20 per Kg. ODP saved
PROJECT DURATION:	a) 18 months b) 12 months
IMPLEMENTING AGENCY:	The World Bank

NATIONAL COORDINATING AGENCY : Indonesian Ministry of the Environment (LH)

TECHNICAL REVIEW COMPLETED: YES _X_ NO _

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1 Including contingency (15 per cent) and Financial Agent Fee (3 per cent).

2 The incremental costs differ from the budget by accounting for 49 per cent transnational ownership.

3 Determined as the ratio of incremental costs to the estimated annual saving of ODP ($/ODP$_{Kg}$). For CFC-11, ODS=ODP

SECRETARIAT'S COMMENTS

1. The P.T. Dasa Windu Agung Company produces moulded, integral skin, rigid spray, and rim foam. The P.T. Foamindo Industri Uretan Company produces slabstock and moulded foam. Both companies will substitute moulded foam by water blown foam systems. The Dasa Windu Agung Company will substitute CFC-11 with HCFC-22 for the remainder of its foam production. The Foamindo Industri Uretan Company will use methylene chloride instead of CFC-11 for the production of slabstock.

2. HCFC-22 was chosen for the Dasa Windu Agung Company as an intermediate step yet since a feasible alternative for the production of rim and rigid spray foams has not yet been proven successful. However, water blown foam systems might be used for the manufacturing of integral skin foams. This potential should be considered during final appraisal, and costs should be adjusted accordingly..

3. The total budget for the Foamindo Company project is adjusted as a result of incremental operational savings in the amount of US $15,000 because the cost of methylene chloride is less than that of CFC-11. Positive incremental operational costs are claimed for the Dasa Windu Agung Company project because the cost of the substitute, HCFC-22, is higher than CFC-11.

4. The technical review indicated that the two per cent increase in scrappage costs, i.e., costs incurred from product defects, is exaggerated in the costs for the Foamindo Company project and it should be reassessed during final appraisal.

SECRETARIAT'S RECOMMENDATION

5. The Secretariat recommends final approval in the amount requested, i.e., US $1,757,000 for the P.T. Dasa Windu Agung Company and US $176,000 for the P.T. Foamindo Industri Uretan Company. It is also recommended that the concerns raised in the technical review and Secretariat's comments should be addressed during final appraisal, especially those concerning a water blown foam system for Dasa Windu Agung Company and the related costs.

PROJECT EVALUATION SHEET

COUNTRY OR REGION:	Indonesia
PROJECT TITLE:	Technical Assistance Program for Small CFC User in the Flexible Polyurethane Foam Sector
BUDGET:	US $1,351,000
INCREMENTAL COSTS:	US $1,600,000[1]
ODS PHASE-OUT:	100 tonnes of CFC-11
COST EFFECTIVENESS[2]:	US $16.00 per Kg. ODP saved
PROJECT DURATION:	2 years
IMPLEMENTING AGENCY:	The World Bank

NATIONAL COORDINATING AGENCY : Indonesian Ministry of the Environment (LH)

TECHNICAL REVIEW COMPLETED: YES _X_ NO _

SECRETARIAT'S COMMENTS

1. This is a two phase project to identify users and their assistance needs in the first phase and to convert about 50 small users from CFCs to methylene chloride in the second phase. This project includes four workshops, funds for international and local foam expert technical assistance, and investment costs. The primary cost is US $1 million for safety measures associated with the use of methylene chloride for the 50 small user conversions anticipated for the second phase of the project.

2. The lessons learned from this project should be considered for potential use in the implementation of phase out for small CFC users in the foam sector.

SECRETARIAT'S RECOMMENDATION

3. The Secretariat recommends final approval in the amount requested, i.e., US $1.6 million, and recommends that the lessons learned from this project are considered in the phase out strategy for small foam users in other countries.

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1 Including contingency (15 per cent) and Financial Agent Fee (3 per cent).

2 Determined as the ratio of incremental costs to the estimated annual saving of ODP ($/$ODP_{kg}$). For CFC-11, ODS=ODP

PROJECT EVALUATION SHEET

COUNTRY OR REGION:	Indonesia
PROJECT TITLE:	Safety and Technical Program to Assist Manufacturers of Hydrocarbon Propelled Aerosol Products
BUDGET:	US $201,000
INCREMENTAL COSTS:	US $238,000[1]
ODS PHASE-OUT:	n/a
COST EFFECTIVENESS:	n/a
PROJECT DURATION:	2 years
IMPLEMENTING AGENCY:	The World Bank

NATIONAL COORDINATING AGENCY : Indonesian Ministry of the Environment (LH)

TECHNICAL REVIEW COMPLETED: YES _X_ NO _

SECRETARIAT'S COMMENTS

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

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

3. The technical review indicated that a training manual should be available before the project is implemented. To address this concern, the World Bank should closely co-ordinate with UNEP which is currently producing a manual on safe conversion to LPG in the aerosol sector.

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[1] Includes 15 per cent contingency and 3 per cent financial institution fee.

SECRETARIAT'S RECOMMENDATION

4. The Secretariat recommends final approval for the requested funding amount, US $238,000 and recommends that the concerns of the technical reviewer and the Secretariat should be addressed during final appraisal. It further recommends that the manual under development by UNEP should be used during the execution of the projects, and further refined for possible use in other Article 5 countries.

INDONESIA - ODS PHASE OUT INVESTMENT PROJECT

Proposed Subprojects - Summary Table and Descriptions

Company	End Use	Indones. Ownership (%)	ODS Consumption in 1992 (MT ODS)	ODS Used (type)	ODS Reduction End of 1995 (MT ODS)	Investment Cost (US$ million)	Net Recurring Costs (4 years)[1] (US$ million)	Proposed GTF Grant (US$ million)[2]
Investment Projects								
Dasa Windu	Non-Insul. Foam	100	125	CFC-11	122	0.620	0.843	1.734
Technical Assistance for Small Manufacturers of Flexible PU Foam	Non-Insul. Foam	N/A	200	CFC-11	100	1.351	0	1.600
Subtotal						1.371		3.334
Work Program Amendments								
Tulus Bakti Sempurna	Non-Insul. Foam	100	100	CFC-12	95	0.075	0.276	0.420
Intiri Multiama	Non-Insul. Foam	50	120	CFC-12	120	1.300	(0.647)	0.300
Technical Assistance for Aerosol Fillers	Aerosols	N/A	1,000[3]	CFC-12	1,000	0.201	0	0.240
Financial Agent Technical Assistance	All End Uses	N/A	N/A	N/A	N/A	0.050	0	0.050
Foamindo Industri	Non-Insul. Foam	51	80	CFC-11	80	0.307	(0.015)	0.175
Subtotal						1.933		1.275
GRAND TOTAL						3.924		4.609

[1] Net present value (NPV) of first four years of operating costs/savings discounted at 10%. Negative numbers indicate operating savings.

[2] Grant amount equals incremental costs multiplied by percent Indonesian ownership. Includes 15% contingency and 3% financial agent fee.

[3] This reduction was achieved in 1992. This subproject will ensure its continuation by creating a safe environment for using hydrocarbon aerosol propellants.

COUNTRY:	Republic of Indonesia	
PROJECT TITLE:	Elimination of CFC-11/12 in the manufacture of extruded polyethylene and polystyrene foam sheet	
SECTOR COVERED:	Foam-Blowing	
ODS USE IN SECTOR:	Approximately 1,250 MT of CFC-11 and CFC-12 in all foam-blowing applications in 1993 (1,250 ODP-weighted MT). Of this, about 200 MT of CFCs is consumed by small users in the non-insulating foam industry.	
PROJECT IMPACT:	Phaseout of 100 MT of CFC-12 (100 ODP-weighted MT). Because HCFC-22 is the chosen substitute, net ODS phaseout is 95 ODP-weighted MT based on 1993 consumption.	
PROJECT DURATION:	1 year	
PROJECT ECONOMIC LIFE:	7 years	
TOTAL PROJECT COST:	ODS Reduction Investment Costs: Incremental Operating Cost : Total Project Costs:	US$ 75,000 US$276,000 US$351,000
COST EFFECTIVENESS:	US$0.65/ODP-weighted kg of ODS phased out	
PROPOSED OTF FINANCING:[1]	US$420,000 as grant	
IMPLEMENTING ENTERPRISE:	P.T. Tulus Bakti Sempurna	
COORDINATING MINISTRY:	Indonesian Ministry of the Environment (LH)	

PROJECT SUMMARY

This project will phaseout 100 MT of CFC-12 consumption in the production of extruded polystyrene (EPS) and polyethylene (EPE) foam sheet at PT. Tulus Bakti Sempurna by converting the production line to the use of HCFC-22. The enterprise will use an international process specialist to supervise and to assist the conversion and start-up to capitalize on existing international accumulated experience in the use of HCFC-22 for the production of EPS/EPE. The use of hydrocarbons was considered but not pursued because the plant lay-out precludes implementation from a safety standpoint. The enterprise is aware that the use of an HCFC constitutes an interim solution, and intends ultimately to convert at its own expense to HFC-134a at a time that price and availability allows such a move.

TECHNICAL ASSESSMENT

Comments made by the OORG technical reviewer (Dr. Michael Jeffs) during a preliminary review on August 19, 1993 on the choice of technology have been reflected in this document. The estimated costs for modifications to the extruder have been determined by the reviewer to be reasonable. The attached review from Dr. Jeffs supports the project.

[1] Includes 15 percent contingency and 3 percent financial agent fee.

PROJECT OBJECTIVE

The objective of this project is (i) to phaseout the use of CFCs in the manufacture of extruded polyethylene/polystyrene foam sheet and (ii) to maintain the process safety and product quality standards at PT Tulus Bakti Sempurna ("Tulus").

SECTOR BACKGROUND

The Indonesian non-insulating foam sector consists of approximately 15 large manufacturers, mainly concentrated on Java, and about one hundred small manufacturers, scattered over the other islands of the Republic. For the purposes of this project, large companies are defined as those using continuous foaming processes and having an ODS consumption of more than 50 MT. Among the large companies, 5 are producers of extruded polystyrene (EPS) and polyethylene (EPE) foam, 8 are flexible polyurethane foam (PUF) manufacturers (continuous process), and 2 are miscellaneous PUF manufacturers. In 1993, total consumption of CFC-11 and CFC-12 at these companies is estimated to be approximately 780 MT. Assuming that the smaller companies account for about 20 percent of the total consumption of ozone-depleting substances (ODS), total ODS consumption in all non-insulating end uses is estimated to be close to 1,000 MT. Insulating end uses such as appliance insulation are expected to account for approximately 250 MT of CFCs. Overall consumption in the foam-blowing sector is therefore estimated to be approximately 1,250 ODP MT.

ENTERPRISE BACKGROUND

Tulus was established in 1981 under the name of P.T. Masto Gunung Putri. In 1983, the company changed name to its present one. Production of EPE/EPS at the plant in Bogor started in 1982. The company has recently diversified its product line to include retreading tires. The company is 100 percent Indonesian-owned.

Tulus serves exclusively the domestic furniture market with EPE packaging. Tulus's packaging is used by this industry in products that are subsequently exported to a variety of countries. The company is the only fully local-owned supplier of EPE in Indonesia and faces competition from companies such as Taiwan and Korea that export their EPE to Indonesia. Approximately 95 percent of Tulus's output is EPE and the remaining 5 percent is EPS. Tulus has one extruder and uses extensive automatic process control throughout its extruding operation to manufacture output with a very high degree of consistency and quality.

PROJECT DESCRIPTION

In 1993, Tulus expects to utilize about 100 MT of CFC-12 in the manufacture of EPE/EPS foam sheet. Management of the company is committed to the phaseout of this compound and is willing to function as a demonstration project for the Indonesian ODS phaseout program.

HCFC-22 has been identified as the preferred replacement. The technology is available through original equipment manufacturers under support from an international foams process specialist. Adoption of HCFC-22 includes minor modifications of existing equipment followed by production trials in which the process is adjusted to the new foamant.

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

- Special storage tanks (250 psig i.s.o. 185 psig). As Tulus rents the gas cylinders from its supplier no costs are related to this change;

- Replacement of all elastomers that come in contact with the foamant (o-rings, accumulator bags, back pressure regulator diaphragms, relief valves, etc.) by compatible materials such as neoprene or butyl rubber;

- Recalibration of the foamant metering system.

- Readjustment of the cell size by talc addition or CO2 nucleation;

- Readjustment of the surface (increased air ring pressure);

- Readjustment of the density by reducing the foamant volume (80-100% of the CFC-12 volume);

- Careful control of the rollstock related to the faster diffusion of HCFC-22 resulting in less post expansion. As an alternative the introduction of anti-diffusion agents can be considered;

A significant amount of production trials will be needed to implement the above mentioned changes. The international foams expert will work with Tulus to ensure successful implementation of these changes and effective technology transfer.

The company had initially considered the use of hydrocarbons. The plant layout at Tulus would however make the implementation of the required safety standards difficult to achieve and cost prohibitive.

JUSTIFICATION FOR SELECTION OF ALTERNATIVE TECHNOLOGY

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

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

HCFC-22 was selected by the company as the most cost effective alternative given the specific plant situation. The production unit is currently located in a building that houses in addition a tire retreading line as well as the storage of resins, ageing material and aged material. It is impossible to achieve acceptable safety standards in case of a conversion to hydrocarbons. Erection of an additional building and relocation of the foam line has been considered but would lead to higher project costs. Annex-B lists the considered alternatives and the related costs. The use of HCFC-22 appears the most cost effective solution. This technology is:

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

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

PROJECT COSTS

The total project cost of US$351,000 equals the ODS reduction portion of the overall project (investment costs plus net incremental operating costs). This project will not provide Tulus with any incremental revenues.

Investment Costs of US$75,000 are detailed in Annex A. The most significant expenditure is modifications to the extruder.

Net Incremental Operating Costs reflect expected growth in demand for CFCs of 5 percent per year, a CFC-12 price of 5,000 rupiah (US$2.50) and an HCFC-22 price of 6,400 rupiah (US$3.20). Given a ten percent discount rate, the net present value of the incremental operating costs minus the offsetting savings over the first four years of the project results in a net costs of US$275,989. A more detailed breakdown of the operating costs and the assumptions used for each year of the project are provided in Annex B.

Other Costs. A 15% contingency (US$54,000) was also included to ensure adequate funding of project costs following project appraisal. An additional US$15,000 (3%) was added to the grant request to cover the fee for services of the financial institution (FI) that will appraise the projects and oversee procurement, disbursement and audits.

Requested Funding. The proposed OTF grant for Tulus is US$420,000 and was calculated as follows: the total investment cost was added to the present value of the incremental operating cost over the first four years of the project. This figure was increased by a 15 percent contingency to yield the grant amount. Finally, this figure was increased by 3 percent to account for the financial institution fee.

UNIT ABATEMENT COST (UAC)

As derived in Annex C, the UAC calculated over the ten year life of the project is US$0.653 per ODP-weighted kg of CFC-12 phased out. This number is derived from the incremental annualized capital costs of US$12,206, the net annual incremental operating costs of US$87,067, and average annual savings of approximately 152 ODP-weighted MT assuming a five percent annual growth rate in demand. The project is thus extremely cost effective.

SCHEDULE

TASK	Q1	Q2	Q3	Q4
Modifications to Extruder	XXXX			
Trials with new formulations		XXXX		
Follow Up Visit and Training from International Foams Expert			XX	
Start Up				XXXX

REQUIRED REGULATORY ACTIONS

At present, the Government of Indonesia levies varying duties on imported equipment. Because duties and taxes are considered transfer payments between organizations rather than true economic costs, the Multilateral Fund does not consider such costs as incremental. Hence, in order to reduce the total costs incurred by Tulus, it is recommended that the Indonesian government waive the import duty for all equipment supplied for this project.

RESULTS

This project will eliminate the use of at least 95 ODP-weighted tons of ODS in the first year of implementation. Market and company growth indicates that this may increase by 5% annually in subsequent years.

ANNEX A
Capital Costs (US$)

Modifications to the extruder	50,000
(UNEP Technical Assessment guide suggests a typical range of $25,000 to $125,000 for modifications. Tulus's extruder is fairly old)	
International process specialist	20,000
Trial materials (HCFC-22)	5,000
TOTAL COSTS	**75,000**

ANNEX B
Net Incremental Operating Costs

COST ITEM	1994	1995	1996	1997
Baseline CFC-12 costs	262,500	275,625	303,587	333,506
Post-Project HCFC-22 Anti-diffusant additive (1%)	336,000 5,250	352,800 5,513	388,080 5,788	426,880 6,078
Net Incremental Operating Costs	78,750	82,688	90,681	99,459
NPV @ 10 percent (4 years)	**275,990**			

Assumptions:

-- 5 percent growth in demand
-- price of CFC-12 is US$2.50/kg (quote from local ICI sales representative)
-- price of HCFC-22 is US$3.20/kg (quote from local ICI sales representative)
-- consumption of CFC-12 in 1993 equals 100 MT

ANNEX C
Unit Abatement Cost

A. ODS Savings

ODP of CFC-12	1.0
Annual growth in CFC-11 demand	5 percent
Use of CFC-12 in 1993	100 MT
ODP of HCFC-22	0.05
Economic Life of Project	10 years
Average Annual ODS Phased Out	152 ODP-weighted MT

B. Incremental Capital Costs

Total investment costs	75,000
Annualized incremental capital costs	12,206

C. Net Annualized Incremental Operating Costs 87,067

UAC ($/kg ODP phase out) 0.653

P.T. TULUS BAKTI SEMPURNA

These comments are intended to complement the OORG review dated 13/9/93.

- I have examined the project timetable and find it to be satisfactory.
- Annex A is known to the reviewer who concurs with it.
- The details of the extruder modification will be developed with a quotation at the appraisal stage. I am satisfied with this procedure.

RECOMMENDATION

The project is supported.

GMFJ/kd/20/9/93

P.T. TULUS BAKTI SEMPURNA

SCOPE

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

RECOMMENDATION

The project is supported, subject to the comments below.

RELEVANCY AND ADEQUACY OF INFORMATION

Generally good. It is noted that Annex A is missing. In addition, information for the extruder modification, such as an estimate, is not included. A project timetable should be developed.

TECHNICAL SOUNDNESS

Comments here include environmental and safety issues. The choice of HCFC 22 rather than zero ODP technologies has been well investigated. Normally, HCFCs are not to be used in packaging applications. However, safety considerations are prime and rule out the use of hydrocarbon technology. In addition, proprietary CO_2-technology cannot be used since the level of polyethylene foam production is high.

The process to select an appropriate zero ODP replacement to HCFC 22 should continue.

LESSON FROM EXPERIENCE

None.

ENVIRONMENTAL ISSUES

As noted under technical soundness.

SAFETY ISSUES

As noted under technical soundness.

COST EFFECTIVENESS

The UAC is very low. No other issues.

OTHERS

None.

GMFJ/kd/13/9/93

COUNTRY:	Republic of Indonesia	
PROJECT TITLE:	Elimination of CFC-12 in the manufacture of extruded polyethylene and polystyrene foam sheet	
SECTOR COVERED:	Foam-Blowing	
ODS USE IN SECTOR:	Approximately 1,250 MT of CFC-11 and CFC-12 in all foam-blowing applications in 1993 (1,250 ODP-weighted MT). Of this, about 200 MT of CFCs is consumed by small users in the non-insulating foam industry.	
PROJECT IMPACT:	Phaseout of 120 MT of CFC-12. Because HCFC-22 is the partial substitute for EPE, net ODS phaseout is 119 ODP-weighted MT based on 1993 consumption.	
PROJECT DURATION:	1 year	
PROJECT ECONOMIC LIFE:	10 years	
TOTAL PROJECT COST:	ODS Reduction Investment Costs: Incremental Operating Costs/(Savings): Total Project Costs:	US$1,300,000 US$ (647,000) US$ 653,000
COST EFFECTIVENESS:	US$0.04/ODP-weighted kg of ODS phased out	
PROPOSED OTF FINANCING:[1]	US$390,000 as grant	
IMPLEMENTING ENTERPRISE:	P.T. Intitri Muliatama	
COORDINATING MINISTRY:	Indonesian Ministry of the Environment (LH)	

PROJECT SUMMARY

This project will phaseout 120 MT of CFC-12 consumption in the production of extruded polystyrene (EPS) and polyethylene (EPE) foam sheet at PT. Intitri Muliatama by converting the production line to the use of carbon dioxide for EPS and carbon dioxide supplemented with HCFC-22 for EPE. The enterprise will work under license from DOW Chemical for the carbon dioxide technology and use support from a process specialist to implement the use of HCFC-22. The requested grant takes into account the local content of the enterprise (50%). This will be the first project in a developing country that will DOW's relatively cost effective technology. As such, it will serve as a demonstration model for possible future utilization of this technology in other projects under the Montreal Protocol Multilateral Fund.

TECHNICAL ASSESSMENT

Comments made by the OORG technical reviewer (Dr. Michael Jeffs) during a preliminary review on August 19, 1993 have been reflected in this document. A written proposal from the technology supplier has been obtained, reviewed, and deemed acceptable. The attached review by Dr. Jeffs supports the project.

[1] Includes 15 percent contingency and 3 percent financial agent fee.

PROJECT OBJECTIVE

The objectives of this project are:

- to phaseout the use of CFCs in the manufacture of extruded polyethylene/polystyrene foam sheet at P.T. Intitri Muliatama ("Intitri") and
- to demonstrate the use of a recently industrialized proprietary CFC replacement technology in a project under the Montreal Protocol.

SECTOR BACKGROUND

The Indonesian non-insulating foam sector consists of approximately 15 large manufacturers, mainly concentrated on Java, and about one hundred small manufacturers, scattered over the other islands of the Republic. For the purposes of this project, large companies are defined as those using continuous foaming processes and having an ODS consumption of more than 50 MT. Among the large companies, 5 are producers of extruded polystyrene (EPS) and polyethylene (EPE) foam, 8 are flexible polyurethane foam (PUF) manufacturers (continuous process), and 2 are miscellaneous PUF manufacturers. In 1993, total consumption of CFC-11 and CFC-12 at these companies is estimated to be approximately 780 MT. Assuming that the smaller companies account for about 20 percent of the total consumption of ozone-depleting substances (ODS), total ODS consumption in all non-insulating end uses is estimated to be close to 1,000 MT. Insulating end uses such as appliance insulation are expected to account for approximately 250 MT of CFCs. Overall consumption in the foam-blowing sector is therefore estimated to be approximately 1,250 ODP MT.

ENTERPRISE BACKGROUND

P.T. Intitri Muliatama is a joint venture company among the following enterprises:

Juraya Enterprises Pte. Ltd., Singapore	50%
Yolita Plasindo Pratama, Indonesia	25%
Santosa Putra Langgeng, Indonesia	25%

The company was founded in 1991. Production of extruded polystyrene (EPS) and polyethylene (EPE) foam sheet was started in October 1992. A substantial part of its production is processed into vacuum formed containers and trays for food packaging. The addition of a laminating line for LDPE sheet is in progress. The development of Intitri's activities is shown in the following production statistics:

PERIOD	4.Q'92	1.Q'93	2.Q'93 (proj)	3.Q'93 (proj)	4.Q'93 (proj)	1993
PS RESIN USE	34	55	100	120	125	400
PE RESIN USE	15	30	45	60	65	200
CFC-12 USE	8	15	25	38	42	120

Based on these statistics as well as on the rapid development of the use of EPS containers in the food industry, an annual increase in production of about 10 percent is expected in the coming years. The growth in the use of blowing agent may even exceed this estimate as the current product densities in Indonesia are rather high and expected to drop, causing a relative increase in blowing agent. The company employs 30 factory workers and 7 staff workers.

PROJECT DESCRIPTION

As discussed above, in 1993, Intitri will utilize about 120 MT of CFC-12 in manufacturing EPE and EPS foam sheets. The management of the company is committed to eliminating its use of CFC-12 and is willing to function as a demonstration project for the introduction of a recently industrialized proprietary CFC replacement technology utilizing carbon dioxide as a blowing agent. This technology is specifically developed for EPS and is not yet capable of replacing ODS completely in EPE. Supplementary use of HCFC-22 is therefore included in the project for EPE.

The carbon dioxide technology is available from Dow Chemical under license. Minor modifications of existing equipment will be necessary.

HCFC-22 technology is available from original equipment suppliers and implementation of HCFC-22 technology will be facilitated through the use of independent process consultants. Production and safety training is included in the project to guarantee a smooth and safe operation implementation of HCFC-22. The company will be supported by a process specialist who is experienced in retrofitting foam extruders for use with HCFCs.

The use of CO_2 will require, according to the licensor, only minor modifications of equipment. Carbon dioxide cylinders are usually leased from the supplier company. Description of the required equipment changes are part of the license package and disclosed after signature of a pre-license agreement. Modifications and start-up trials are made with assistance from and under supervision of DOW engineers.

The use of HCFC-22 will also require only minor changes in production process and storage procedures. Recommended equipment modifications include:

- Gas storage
- Higher pressure rating of the storage tank
- Feeding systems
- Injection system for anti diffusion additive
- Replacement of all seals and gaskets by compatible materials (neoprene, butyl rubber)
- New pressure gauges
- Re-calibration of the pump
- Extrusion system
- Replacement of gaskets, o-rings etc,

The following process modifications will be required:

- Readjustment of the cell size by talcum addition or CO2 nucleation
- Readjustment of the density by reducing the foamant volume (80-100% of the CFC-12 volume)
- Readjustment of the surface by increased air ring pressure
- Careful control of the rollstock related to the faster diffusion of HCFC-22 resulting in less post-expansion, or as an alternative, the introduction of anti diffusion agents.

Start-up trials will be necessary to make the mentioned adjustments. This will be done with guidance from an international process specialist.

JUSTIFICATION FOR SELECTION OF ALTERNATIVE TECHNOLOGY

Intitri has selected carbon dioxide as its primary non-ODS technology. The CO_2 used in this type of process is recovered (i.e., not additionally generated) and thus does not pose an environmental risk or contribute to global warming. Carbon dioxide is:

- Non-toxic
- Non-flammable
- Low in cost
- Environmentally friendly, and
- Soluble in polystyrene.

The DOW technology is not yet suited to completely replace ODS in the production of EPE foam sheet. This deficiency is based on the larger use requirement (up to 40% compared to 15% in EPS) as well as on the lower solubility of CO_2 in LDPE. The company has therefore HCFC-22 selected as a supplementary blowing agent for EPE that is:

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

One drawback of HCFC-22 is that, in Indonesia, it costs about 30% higher than CFC-12 and because it has an ODP of 0.055 it can be viewed as an interim solution only. The company ultimately expects to be able to replace HCFC-22 by CO_2 through using LDPE resins that can absorb more atmospheric gases. Such resins are currently in development.

LPG was also seriously considered in the technology selection process. However, the plant lay-out that includes production and post- treatment in the same space would make such a solution more expensive and difficult to implement from a safety standpoint.

PROJECT COSTS

The total project cost of US$653,000 covers the investment costs plus net incremental operating costs (in this case net incremental savings) over the first four years. This project will not provide Intitri with any incremental revenues.

Investment Costs of US$1,300,000 are detailed in Annex A. Despite the overall cost effectiveness of the project, negotiations are on going with the supplier of the carbon dioxide technology to reduce investment costs.

Net Incremental Operating Savings reflect expected growth in demand for CFCs of 10 percent per year, a CFC-12 price of 5,000 rupiah (US$2.50), an HCFC-22 price of 6,400 rupiah (US$3.20), and a price for food grade carbon dioxide of 1,000 rupiah (US$0.50). Given a ten percent discount rate, the net present value of the incremental operating costs minus the offsetting savings over the first four years of the project results in a net incremental operating savings of US$647,000. A more detailed breakdown of the operating costs and the assumptions used for each year of the project are provided in Annex B.

Local Ownership Fraction of 50% was considered to determine the amount of eligible OTF grant financing. The total project cost was multiplied by the fraction of local ownership to determine the proposed grant amount.

Other Costs. A 15% contingency (US$50,000) was also included to ensure adequate funding of project costs following project appraisal. An additional US$13,000 (3%) was added to the grant request to cover the fee for services of the financial institution (FI) that will appraise the projects and oversee procurement, disbursement and audits.

Requested Funding. The proposed OTF grant for Intitri is US$390,000 and was calculated as follows: the present value of the net incremental operating savings over the first four years of the project were subtracted from the total investment costs. The resulting total project cost was multiplied by the percentage of Indonesian ownership (50 percent). This figure was increased by a 15 percent contingency to yield the grant amount. Finally, this figure was increased by 3 percent to account for the financial institution fee.

UNIT ABATEMENT COST (UAC)

As derived in Annex C, the UAC calculated over the ten year life of the project is US$0.04 per ODP-weighted kg of ODS phased out. This number is derived from the incremental annualized capital costs of US$211,569, the net annual incremental operating savings of US$204,196 and average annual savings of approximately 208 ODP-weighted MT assuming a ten percent annual growth rate in demand.

SCHEDULE

TASK	Q1	Q2	Q3	Q4
Equipment modifications	XXXX	XX		
Trials with new formulations		XX		
Follow Up Visit and Training from International Foams Expert			XX	
Start Up				XXXX

REQUIRED REGULATORY ACTIONS

At present, the Government of Indonesia levies varying duties on imported equipment. Because duties and taxes are considered transfer payments between organizations rather than true economic costs, the Multilateral Fund does not consider such costs as incremental. Hence, in order to reduce the total costs incurred by Intitri, it is recommended that the Indonesian government waive the import duty for all equipment supplied for this project.

RESULTS

This project will eliminate the use of at least 119 ODP-weighted tons of ODS in the first year of implementation. Market and company growth indicates that this may increase by 10% annually in subsequent years.

ANNEX A
Capital Costs (US$)

Licensing costs of carbon dioxide technology	1,100,000
Equipment modifications to accommodate use of CO_2	75,000
Equipment modifications to accommodate use of HCFC-22	50,000
Trials with new formulations for both EPS and EPE	50,000
Technology transfer (international process specialist)	25,000
TOTAL COSTS	**1,300,000**

ANNEX B
Net Incremental Operating Costs

COST ITEM	1994	1995	1996	1997
Baseline	300,000	330,000	363,000	399,300
Post-Project	122,000	134,200	147,620	162,382
Net Incremental Operating Costs/(Savings)	(178,000)	(195,800)	(215,380)	(236,918)
NPV @ 10 percent (4 years)	**(647,223)**			

Assumptions:

-- 10 percent growth in demand
-- price of CFC-12 is US$2.50/kg (quote from local ICI sales representative)
-- price of HCFC-22 is US$3.20/kg (quote from local ICI sales representative)
-- price of food grade CO_2 is US$0.50/kg
-- for EPS, 15 percent more CO_2 is needed than CFC-12
-- for EPE, 20 percent more CO_2 is needed than CFC-12 but substitution ratio for HCFC-22 is 1:1
-- in 1993, consumption of CFC-12 equals 120 MT
-- in 1993, EPS output is twice as high as EPE output

ANNEX C
Unit Abatement Cost

A. ODS Savings

ODP of CFC-12	1.0
Annual growth in CFC-11 demand	10 percent
Use of CFC-12 in 1993	120 MT
ODP of HCFC-22	0.055
Economic Life of Project	10 years
Average Annual ODS Phased Out	208 ODP-weighted MT

B. Incremental Capital Costs

Total investment costs	1,300,000
Annualized incremental capital costs	211,569

C. Net Annualized Incremental Operating Savings 204,196

UAC ($/kg ODP phase out) 0.04

P.T. INITRI MULIATAMA

SCOPE

The project under review is concerned with the replacement of CFC 12 in the production of extruded polystyrene and polyethylene sheets.

RECOMMENDATION

The project is supported.

RELEVANCY AND ADEQUACY OF INFORMATION

Adequate

TECHNICAL SOUNDNESS

The technology choices are sound and technical support will be provided by suppliers and international experts. The HCFC 22 resin-based recovery system, mentioned in the preliminary project, appears to have been dropped. The enterprise should continue its pursuit of zero ODP replacements for the extruded polyethylene production.

LESSON FROM EXPERIENCE

None.

ENVIRONMENTAL ISSUES

The CO_2-based polystyrene process is benign to ozone. The use of HCFC 22 for a packaging application is only justified if safety issues preclude the use of hydrocarbon - as in this instance.

SAFETY ISSUES

None

COST EFFECTIVENESS

The UAC is very low, the reduced operating costs balancing the high licensing fee for the CO_2 technology. It is noted that the latter is still under negotiation.

OTHER

None

GMFJ/kd/20/9/93

COUNTRY:	Republic of Indonesia
PROJECT TITLE:	Elimination of CFC-11 in the manufacture of polyurethane foams
SECTOR COVERED:	Foam-Blowing
ODS USE IN SECTOR:	Approximately 1,250 MT of CFC-11 and CFC-12 in all foam-blowing applications in 1993 (1,250 ODP-weighted MT). Of this, about 200 MT of CFCs is consumed by small users in the non-insulating foam industry.
PROJECT IMPACT:	Phaseout of 125 MT of CFC-11 (125 ODP-weighted MT). Because HCFC-22 is proposed as the substitute for CFC-11 in some applications, the project results in a net phaseout of 122 ODP-weighted MT of ODS.
PROJECT DURATION:	18 months
PROJECT ECONOMIC LIFE:	10 years
TOTAL PROJECT COST:	ODS Reduction Investment Costs: US$ 620,000 Incremental Operating Cost : US$ 843,000 Total Project Costs: US$ 1,463,000
COST EFFECTIVENESS:	US$3.03/ODP-weighted kg of ODS phased out
PROPOSED OTF FINANCING:[1]	US$1,734,000 as grant
IMPLEMENTING ENTERPRISE:	P.T. DASA WINDU AGUNG
COORDINATING MINISTRY:	Indonesian Ministry of the Environment (LH)

PROJECT SUMMARY

This project will phaseout 125 MT of CFC-11 consumption in the production of polyurethane foams at P.T. Dasa Windu Agung. The enterprise will work with its chemical suppliers to this purpose. The project will start with replacement/modification of existing equipment where necessary to allow the introduction of new non-ODS technologies, followed by production trials. The project will result in a reduction of 122 ODP-weighted MT of ODS annually.

TECHNICAL ASSESSMENT

Comments made by the OORG technical reviewer (Dr. Michael Jeffs) during a preliminary review on September 13, 1993 on the choice of technology and schedule for implementation have been reflected in this document. The need for four new sets of high pressure dispensing machines have been provided and confirmed by the reviewer as necessary. The attached review from Dr. Jeffs supports the project,

[1] Includes 15 percent contingency and 3 percent financial agent fee.

PROJECT OBJECTIVE

The objective of this project is to phaseout the use of CFCs in the manufacture of rigid insulating foams, flexible molded foams, and integral skin foams at P.T. Dasa Windu Agung ("Dasa").

SECTOR BACKGROUND

The Indonesian non-insulating foam sector consists of approximately 15 large manufacturers, mainly concentrated on Java, and about one hundred small manufacturers, scattered over the other islands of the Republic. For the purposes of this project, large companies are defined as those using continuous foaming processes and having an ODS consumption of more than 50 MT. Among the large companies, 5 are producers of extruded polystyrene (EPS) and polyethylene (EPE) foam, 8 are flexible polyurethane foam (PUF) manufacturers (continuous process), and 2 are miscellaneous PUF manufacturers. In 1993, total consumption of CFC-11 and CFC-12 at these companies is estimated to be approximately 780 MT. Assuming that the smaller companies account for about 20 percent of the total consumption of ozone-depleting substances (ODS), total ODS consumption in all non-insulating end uses is estimated to be close to 1,000 MT. Insulating end uses such as appliance insulation are expected to account for approximately 250 MT of CFCs. Overall consumption in the foam-blowing sector is therefore estimated to be approximately 1,250 ODP MT.

ENTERPRISE BACKGROUND

PT Dasa Windu Agung is a fully Indonesian-owned company specialized in PUF products for the automotive, furniture and bedding industry. Products include:

- seats, spoilers, bumpers, dashboards, steering wheels, fasteners for OEM and aftermarket;
- Foams slabs and cushions for mattress and furniture; and
- Pipe, cold storage insulation.

The company employs almost 300 in a technically sophisticated facility in Cenkareng-Jakarta, that includes modern production equipment and state of the art safety features.

Dasa's engineers and mechanics are trained in Europe. Their skills match those working in about any similar facility in developed countries. The company designs most of its products in house and makes its own molds.

In 1993, Dasa will consume about 125 MT of CFC-11 in the manufacture of different types of polyurethane foams. Approximately 55 percent of CFC-11 usage is for molded foams, 30 percent for integral skin, 12 percent for rigid spray foam, and 3 percent for RIM foam. The company plans to cease its minor production of flexible slabstock foam. Management of the company is committed to the phaseout of CFCs and willing to function as a demonstration project for the Indonesian ODS phaseout program.

PROJECT DESCRIPTION

Dasa will adopt alternative technologies to eliminate CFC-11 in all of its foam-blowing applications that still use CFC-11. In all end uses, foam-blowing operations will be converted to high pressure equipment using either water or HCFC-22 blowing agent technology. At present, the company has 8 injection heads (4 high pressure and 4 low pressure) for integral skin and flexible molded applications). Four low pressure models (2 Maruka and 2 Canon will be replaced).

- For molded foams, a conversion to high resilient, all water blown foams will be carried out by replacing all low pressure equipment with high pressure mixing heads and storage tanks and by reformulating the blowing agent mixture.

- Integral skin foam (all automotive) will be converted to an alternative blowing agent (HCFC-22). Again, low pressure equipment will be replaced by high pressure units.

  The company is aware that HCFC-22 is an interim solution. Moreover, conversion to high pressure equipment will mean that the company will be ready for any of the emerging technologies that use high pressure blowing agents with the exception of butane. For safety reasons, butane is not a long-term option for the company.

- Rigid foam systems will be replaced by HCFC-22. Existing equipment will have to be adjusted and a blending unit installed.

- For RIM foam, a high pressure mixing head already exists for foam production. Because RIM foam output represents only 3 percent of total foam output, the high pressure used for RIM foam is used primarily for integral skin foam. Conversion will therefore simply involve switching to HCFC-22 because the low production volumes of RIM do not warrant a dedicated system.

Because of higher viscosities (all new systems) and low boiling point of the blowing agent (IS-PUF; R-PUF) 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 as future polyol systems will be, as a standard, delivered without pre-blended blowing agent.

The complexity of the product range of Dasa will require careful adjustment of formulations. Initial trials will be done at a chemical supplier that will supply the technology (e.g., Dow Chemical). This will be followed by on site trials under the assistance of the same supplier.

Production and safety training will be carried out by chemical and equipment suppliers to guarantee a smooth and safe operation. The company is very safety conscious and has the internal capabilities to provide for the necessary safety training.

JUSTIFICATION FOR SELECTION OF ALTERNATIVE TECHNOLOGY

There are numerous technologies to replace the use of CFCs in non-insulating foams by non-ODS or low-ODS options. Routes to replace CFCs in the production of integral skin PUF (IS-PUF) and rigid PUF (R-PUF) include:

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

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

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

The second solution--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 been recently introduced on several occasions, but its flammable character requires special safety conditions and limits its use.

Dasa has selected the second or "gas" solution using HCFC-22 as the blowing agent. For safety reasons, the company has ruled out the use of flammable hydrocarbons. The second solution is preferred to the first solution because the long-term strategy in both rigid and integral skin applications will require the use of a low boiling point blowing agent and because of the better process control associated with the use of such systems. In its rigid operations, the firm has considered the poorer thermal conductivity associated with aged HCFC-22 foams. Since its application is for spray foam where uneven foam thickness can be tolerated, this does not pose a problem. Recognizing that HCFC-22 is a short-term solution, the firm will convert to HFC-134a at its own expense. In its integral skin operations, the firm believes that it can effectively use HCFC-22 for its furniture applications. Because HCFC-22 has a low boiling point and because higher viscosities will result from use of the new formulations, high pressure manufacturing equipment are required to effectively convert from CFCs to non-ODS technology. The justification for HCFC-22 use for RIM is explained above in the section on project description.

PROJECT COSTS

As described below, and detailed in the relevant annexes, the total project cost over the first 4 years of the project (investment costs and net incremental operating costs) is US$1,483,000. This project will not provide Dasa with any incremental revenues.

Investment Costs of US$620,000 are detailed in Annex A. The bulk of this amount is to cover costs associated with high pressure foaming units.

Net Incremental Operating Costs of US$843,000 are equal to the net present value of the first four years of incremental operating costs. Operating costs reflect quoted prices of 5,000 rupiah (US$2.50) for CFC-11 and 6,500 rupiah (US$3.25) for HCFC-22. Given a ten percent discount rate, the net present value of the incremental operating costs minus the offsetting savings over the first four years of the project results in a net costs of US$862,996. A more detailed breakdown of the operating costs and the assumptions used for each year of the project are provided in Annex B.

Other Costs. A 15% contingency (US$225,000) was also included to ensure adequate funding of project costs following project appraisal. An additional US$52,000 (3%) was added to the grant request to cover the fee for services of the financial institution (FI) that will appraise the projects and oversee procurement, disbursement and audits.

Requested Funding. The proposed OTF grant for Dasa is US$1,780,000 and was calculated as follows: the total investment cost was added to the present value of the incremental operating cost over the first four years of the project. The resulting total project cost was multiplied by the percentage of Indonesian ownership (100 percent). This figure was increased by a 15 percent contingency to yield the grant amount. Finally, this figure was increased by 3 percent to account for the financial institution fee.

UNIT ABATEMENT COST (UAC)

As derived in Annex C, the UAC calculated over the ten year life of the project is US$3.03 per ODP-weighted kg of ODS phased out. This number is derived from the incremental annualized capital

costs of US$104,000, the net annual incremental operating costs of US$266,000, and average annual savings of approximately 122 ODP-weighted MT of ODS.

REQUIRED REGULATORY ACTIONS

At present, the Government of Indonesia levies varying duties on imported equipment. Because duties and taxes are considered transfer payments between organizations rather than true economic costs, the Multilateral Fund does not consider such costs as incremental. Hence, in order to reduce the total costs incurred by Dasa, it is recommended that the Indonesian government waive the import duty for all equipment supplied for this project.

RESULTS

This project will eliminate the use of at least 122 ODP-weighted tons of ODS in the first year of implementation.

SCHEDULE

TASK	Q1	Q2	Q3	Q4	Q5	Q6
Supplier and Vendor Selection	XXXX					
Equipment Installation and Modifications			XXXX			
Conversion to High Pressure Equipment				XX		
Training				XX		
Trials and testing				X	XXXX	XX

ANNEX A
Capital Costs (US$)

High Pressure Foaming Units (4) (see attached quote includes installation)	480,000
Value of old equipment (components)	(40,000)

The company currently has 8 foaming machines (4 high pressure and 4 low pressure) for integral skin and flexible molded applications). The four low pressure models (2 Maruka and 2 Canon will be replaced). A high pressure machine already exists for production of RIM foam.

Blending units (2) (verbal quote from Canon)	150,000

Blending tanks are needed because HCFC-22 has a higher volatility than CFC-11. The international trend is to move away from pre-blended mixtures to reduce the risks associated with contamination.

Modification of high pressure spray units (gear ratio adjustment)	10,000
Chemicals for trials ($5,000 per trial) (includes start-up and training with new chemicals)	20,000
TOTAL COSTS	**620,000**

ANNEX B
Net Incremental Operating Costs

COST ITEM	FOAM PRODUCED & % BLOWING AGENT	1994	1995	1996	1997
Baseline					
Molded	600 MT, (*)	1,500,000	1,500,000	1,500,000	1,500,000
Integral Skin	360 MT, 10% CFC-11	90,000	90,000	90,000	90,000
RIM	120 MT, 3% CFC-11	9,000	9,000	9,000	9,000
Rigid Spray	100 MT, 15% CFC-11	37,500	37,500	37,500	37,500
Post-Project					
Molded	600 MT, (*)	1,725,000	1,725,000	1,725,000	1,725,000
Integral Skin	360 MT, 10% HCFC-22	117,000	117,000	117,000	117,000
RIM	120 MT, 3% HCFC-22	11,700	11,700	11,700	11,700
Rigid Spray	100 MT, HCFC-22	48,750	48,750	48,750	48,750
Net Incremental Operating Costs		265,950	265,950	265,950	265,950
NPV @ 10% (4 years)	**843,026**				

Notes:

(*) for molded foam, the overall costs of the formulation is considered since the amounts of polyol, isocyanate, and blowing agent change when shifting from CFC-11 to HCFC-22. In this case, the formulation cost increases from $2.5/MT (pre-project) to $2.875/MT (post-project).

Assumptions:

-- no growth in production
-- price of CFC-11 is US$2.50/kg
-- price of HCFC-22 is US$3.25/kg
-- consumption of CFC-11 in 1993 equals 125 MT

ANNEX C
Unit Abatement Cost

A. ODS Savings

ODP of CFC-11	1.0
Use of CFC-11 in 1993	125 MT
ODP of HCFC-22	0.055
Economic Life of Project	10 years
Average Annual ODS Phased Out	122 ODP-weighted MT

B. Incremental Capital Costs

Total investment costs	640,000
Annualized incremental capital costs	104,157

C. Net Annualized Incremental Operating Costs 265,950

UAC ($/kg ODP phase out) 3.034

P.T. DASA WINDU AGUNG

SCOPE

The project under review covers the elimination of the use of CFC 11 in flexible, integral skin, RIM and rigid polyurethane foams for a range of applications. RIM is included in this section because it is mentioned in the operating cost section (Annex C) but not elsewhere.

RECOMMENDATION

The reviewer believes that the project is basically sound but the points noted in this review should be addressed before formal support is given. This would provide consistency with other recently approved projects.

RELEVANCE AND ADEQUACY OF INFORMATION

Annex A is missing. The level of information in the area of equipment is inadequate and no quotations are included. Information in Annex B is sparse. There is no mention or provision for training. There is no timetable giving the phases of the project.

TECHNICAL SOUNDNESS

This topic is discussed by sector.

The replacement of CFC 11 moulded foams by water blown high resilience foams is sound and in line with the contemporary trend.

For integral skin foams, CFC 11 is to be replaced in two phases - first by reducing the CFC 11 used and then full replacement by HCFC 22. The project should be optimised to minimise the operating time of the reduced CFC 11 phase. It should also be noted that HCFC 22 should be only used for automotive safety applications - this may well be the case - and not used for furniture applications.

For RIM foams I note, from Annex C, that HCFC 22 is proposed. The enterprise should be aware that air nucleation technology exists and there should be no need to use HCFC 22. An alternative is methylene chloride. For rigid foams for panels (cold stores) and spray foam the use of HCFC 22 is supported.

P.T. DASA WINDU AGUNG

These comments are intended to complement the OORG review dated 13/9/93.

- I have examined the project timetable and find it to be satisfactory.
- I note that the quotation from Cannon is now included.
- Training is now included in the project.
- I note that the reduced CFC 11 stage for integral skin foams has now been eliminated.
- RIM is now included in the project - although it only represents 3% of the enterprise's output.
- The remarks under "Environmental Issues" in the OORG review should be followed by The Bank during project implementation.
- The UAC is comparatively high - a major reason for this is the broad spread of activities which are being undertaken by the enterprise.

RECOMMENDATION

The project is supported.

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The enterprise is aware of the aged thermal conductivity limitations of this option. A range of zero ODP options are considered and the enterprise should follow the development of experience with those to make the appropriate choice at the earliest opportunity.

Technology support is to be provided by the enterprise's raw material suppliers.

LESSONS FROM EXPERIENCE

As noted, the project as seen by the reviewer does not contain a comprehensive review of all relevant aspects, for example, in comparison with Indian projects recently reviewed.

ENVIRONMENTAL ISSUES

It is becoming international policy to limit HCFCs in these applications to insulating foams and to automotive safety applications. This should be followed in all projects unless there are over-riding safety issues which prevent the use of, for example, flammable alternatives.

SAFETY ISSUES

None are apparent.

COST EFFECTIVENESS

The UAC is comparatively high at 3.085 $/kg ODP. The calculation does not take into account the use of reduced CFC 11 technology for (an unknown) time period for integral skin foams but is based on immediate implementation of HCFC 22 technology. This inconsistency should be removed. It should also be noted that the ODP of HCFC 22 is 0.055.

Further information should be provided on chemical requirements.

There is a major contribution to the UAC from the four high pressure units - this is justified.

OTHERS

None.

GMFJ/kd/13/9/93

COUNTRY:	Republic of Indonesia
PROJECT TITLE:	Elimination of CFC-11 in the manufacture of flexible polyurethane foam (slabstock and molded)
SECTOR COVERED:	Foam-Blowing
ODS USE IN SECTOR:	Approximately 1,250 MT of CFC-11 and CFC-12 in all foam-blowing applications in 1993 (1,250 ODP-weighted MT). Of this, about 200 MT of CFCs is consumed by small users in the non-insulating foam industry.
PROJECT IMPACT:	Phaseout of 80 MT of CFC-11 (80 ODP-weighted MT)
PROJECT DURATION:	1 year
PROJECT ECONOMIC LIFE:	10 years
TOTAL PROJECT COST:	ODS Reduction Investment Costs: US$307,000 Incremental Operating Cost/(Savings): US$(15,000) Total Project Costs: US$292,000
COST EFFECTIVENESS:	US$0.28/ODP-weighted kg of ODS phased out
PROPOSED OTF FINANCING:[1]	US$175,000 as grant
IMPLEMENTING ENTERPRISE:	P.T. FOAMINDO Industri Uretan
COORDINATING MINISTRY:	Indonesian Ministry of the Environment (LH)

PROJECT SUMMARY

This project will phaseout 80 MT of CFC-11 consumption in the production of flexible polyurethane foam (both slabstock and molded) at PT Foamindo by converting foam-blowing operations to methylene chloride (slabstock) and water blown systems (molded). The enterprise will use support from an international foam process specialist to convert the foam formulations and to train personnel in the safe handling of methylene chloride. The requested grant takes into account the local content of the enterprise (51%).

TECHNICAL ASSESSMENT

Comments made by the OORG technical reviewer (Dr. Michael Jeffs) during a preliminary review on August 19, 1993 on the handling of methylene chloride and assumptions for operating costs have been reflected in this document. The attached review of September 13 from Dr. Jeffs supports the project. Annexes A and B have been examined by the reviewer and have been determined to indicate acceptable costs.

[1] Includes 15 percent contingency and 3 percent financial agent fee.

PROJECT OBJECTIVE

The objective of this project is to phaseout the use of CFCs in the manufacture of flexible polyurethane foam (slabstock and molded) at PT Foamindo Industri Uretan ("Foamindo").

SECTOR BACKGROUND

The Indonesian non-insulating foam sector consists of approximately 15 large manufacturers, mainly concentrated on Java, and about one hundred small manufacturers, scattered over the other islands of the Republic. For the purposes of this project, large companies are defined as those using continuous foaming processes and having an ODS consumption of more than 50 MT. Among the large companies, 5 are producers of extruded polystyrene (EPS) and polyethylene (EPE) foam, 8 are flexible polyurethane foam (PUF) manufacturers (continuous process), and 2 are miscellaneous PUF manufacturers. In 1993, total consumption of CFC-11 and CFC-12 at these companies is estimated to be approximately 780 MT. Assuming that the smaller companies account for about 20 percent of the total consumption of ozone-depleting substances (ODS), total ODS consumption in all non-insulating end uses is estimated to be close to 1,000 MT. Insulating end uses such as appliance insulation are expected to account for approximately 250 MT of CFCs. Overall consumption in the foam-blowing sector is therefore estimated to be approximately 1,250 ODP MT.

ENTERPRISE BACKGROUND

P.T. Foamindo Industri Uretan was founded in 1974 as a joint venture between an Indonesian company (51%) and a Hong Kong entity (49%). The principal owner and president of the company is Mr. Antonio M. Go. Mr. Go is also Chairman of the Association of Polyurethane Foam Industry (APFI) in Indonesia. The company operates two continuous production lines for flexible foam; one for square blocks (Maxfoam process) and one for round blocks. In addition the company operates a low pressure molding machine for the production of molded flexible PUF. The company's main products are rollstock for the shoe industry, mattress slabs and cushions for the furniture industry. The production volume for 1992 was 2500 MT of slabstock foam and 150 MT of molded foam. The company maintains two facilities in Tangerang and Cengkareng. It employs about 150 people.

PROJECT DESCRIPTION

In 1992, Foamindo utilized about 80 tons of CFC-11 in the manufacture of slabstock and molded flexible polyurethane foam. The management of the company is committed to the phaseout of CFCs in both its slabstock and molded operations and is willing to function as a demonstration project for the Indonesian ODS phaseout program.

Methylene chloride has been identified as the preferred replacement for CFC-11 in slabstock foam-blowing operations. The technology is commonly available. Its use will require some modifications on existing equipment in conjunction with safety related modifications in the production environment. Also, production and safety training is needed to guarantee a smooth and safe operation. Modifications needed to implement the use of methylene chloride as a blowing agent include:

- Extra metering system(s)
- Encapsulation, ventilation
- Fall plate modification, and
- Reformulation.

Safety and process training for production staff and personnel will also be needed.

The company will also convert a molding line to water blown foams. However, the low pressure molding system is not capable of handling the related higher viscosities resulting in the need to convert to high pressure equipment. The current low pressure machine (Cannon C-30) will therefore be replaced by a high pressure unit.

The company is under strong pressure from the Indonesian shoe industry which exports mainly to Europe and the USA, and wants to phase out CFCs immediately. For this reason it has already started preparations for a conversion and would like to begin implementation of the project as soon as possible.

The project budget includes an international foams process expert to assist Foamindo in making the necessary formulation adjustments and to provide the necessary safety training. The technology selected for this project is not licensed and the process specialist will ensure that effective transfer of the technology to Foamindo occurs. Because Foamindo's quality requirements for its foam products are high, it will experience an increase in scrappage costs after converting to methylene chloride during the first two years. The estimated project budget accounts for the incremental costs associated with increased scrappage during this period.

JUSTIFICATION FOR SELECTION OF ALTERNATIVE TECHNOLOGY

There are numerous technologies to replace the use of CFCs in flexible foam by non-ODS or low-ODS options. The management of Foamindo decided, after attending seminars in Singapore and Jakarta, to opt for the use of an alternative blowing agent (i.e., methylene chloride) for the slabstock production and for modified chemistry, resulting in water blown foams for the molding production.

The combination of these technologies will allow replacement of CFCs in a cost effective way, without unacceptable losses in performance and processing. A 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, work place concentrations of methylene chloride have to be limited to acceptable industrial hygienic standards. Methylene chloride is a highly volatile chlorinated substance with a relatively low acute toxicity. The volatility can trigger high concentrations in the air. The substance is classified by both the U.S. Environmental Protection Agency (USEPA) and the International Agency for Research on Cancer (IARC) as a probable human carcinogen. The U.S. Occupational Safety and Health Administration has set an 8 hour time weighted average (TWA) level of 500 ppm for methylene chloride. Careful handling is therefore required to avoid over exposure. Examples of safety measures typically needed include: proper encapsulation of the production units that use methylene chloride, ventilation of production and storage areas, training of personnel in handling of the substance, and industrial hygienic monitoring.

PROJECT COSTS

As described below, and detailed in the relevant annexes, the total project cost (investment costs and recurring operating costs) over the first 4 years of the project is US$292,000. This project will not provide FOAMINDO with any incremental revenues.

Investment Costs of US$307,000 are detailed in Annex A.

Net Incremental Operating Savings of US$15,000 are equal to the net present value of the first four years of incremental operating costs minus offsetting benefits. Operating costs reflect expected growth in demand for CFCs of 10 percent per year, a CFC-11 price of 5,000 rupiah (US$2.50), a methylene chloride price of 1,500 rupiah (US$0.75), increased costs for the new slabstock formulation, and increased scrappage of foam over the first two years of the project. Given a ten percent discount rate, the net present value of the incremental operating costs minus the offsetting savings over the first four years of the project results in a net savings of US$15,000. A more detailed breakdown of the operating costs and the assumptions used for each year of the project are provided in Annex B.

Local Ownership Fraction of 51% was considered to determine the amount of eligible OTF grant financing. The total project cost was multiplied by the fraction of local ownership to determine the proposed grant amount.

Other Costs. A 15% contingency (US$21,000) was also included to ensure adequate funding of project costs following project appraisal. An additional US$5,000 (3%) was added to the grant request to cover the fee for services of the financial institution (FI) that will appraise the projects and oversee procurement, disbursement and audits.

Requested Funding. The proposed OTF grant for FOAMINDO is US$175,000 and was calculated as follows: the present value of the net incremental operating savings over the first four years of the project were subtracted from the total investment costs. The resulting total project cost was multiplied by the percentage of Indonesian ownership (51 percent). This figure was increased by a 15 percent contingency to yield the grant amount. Finally, this figure was increased by 3 percent to account for the financial institution fee.

UNIT ABATEMENT COST (UAC)

As derived in Annex C, the UAC calculated over the ten year life of the project is US$0.28 per ODP-weighted kg of CFC-11 phased out. This number is derived from the incremental annualized capital costs of US$307,000 the net annual incremental operating savings of US$15,000 and average annual savings of approximately 127.5 ODP-weighted MT of CFC-11 assuming a ten percent annual growth rate in demand for CFC-11. The project is therefore extremely cost effective.

REQUIRED REGULATORY ACTIONS

At present, the Government of Indonesia levies varying duties on imported equipment. Because duties and taxes are considered transfer payments between organizations rather than true economic costs, the Multilateral Fund does not consider such costs as incremental. Hence, in order to reduce the total costs incurred by FOAMINDO, it is recommended that the Indonesian government waive the import duty for all equipment supplied for this project.

RESULTS

This project will eliminate the use of at least 80 tons of CFC-11 in the first year of implementation. Market and company growth indicates that this may increase by 10% annually in subsequent years.

SCHEDULE

TASK	Q1	Q2	Q3	Q4
Trials with Methylene Chloride for Slabstock Foam	XXXX			
Investments in Safety Equipment		XXXX		
Follow Up Visit and Safety Training from International Foams Expert		X		
Conversion of Molded Foam Manufacturing to High Pressure Equipment			XX	
Trials with High Pressure Equipment			XX	
Follow Up Visit from International Foams Expert				X

ANNEX A
Capital Costs (US$)

Molded

High pressure production Unit (see quote from Canon)	120,000
Freight, Installation	20,000
Value of existing l.p. equipment (e.g., tanks etc.)	(10,000)
Trial Materials	5,000

Slabstock

MC Metering System	
Pumps, Flow-control	10,000
Tank, Piping	20,000
Maxfoam machine	15,000
Round Block Machine	40,000
Fall Plate	10,000
Miscellaneous Adjustments	10,000
International process specialist (2 trips)	20,000
Trial Material (7 minutes*30 foam types*$450/minute)	94,500
50% cost recovery	(47,250)
TOTAL CAPITAL COSTS (US$)	307,000

ANNEX B
Net Incremental Operating Costs/Savings

COST ITEM	1994	1995	1996	1997
Baseline				
CFC-11 costs	200,000	220,000	242,000	266,200
Molded Formulation	425,000	467,500	514,250	565,675
Scrappage costs	192,500	211,570	232,925	256,218
Post-Project				
Methylene chloride	60,000	66,000	72,600	79,860
New molded formulation	488,750	537,625	591,388	650,526
Scrappage costs	385,000	317,625	232,925	232,925
Net Incremental Operating Costs/(Savings)	116,250	22,180	(92,260)	(101,549)
NPV @ 10 percent (4 years)	**(14,773)**			

Assumptions:

-- 10 percent growth in demand
-- 1993 scrappage = 2500 tons * $3.5/kg * 2 percent scrappage per year
-- new molded formulation is 15 percent more expensive than old one
-- price of CFC-11 is US$2.50/kg
-- price of methylene chloride is US$0.75/kg

ANNEX C
Unit Abatement Cost

A. ODS Savings

ODP of CFC-11	1.0
Annual growth in CFC-11 demand	10 percent
Use of CFC-11 in 1993	80 MT
Economic Life of Project	10 years
Average Annual ODS Phased Out	127.5 MT

B. Incremental Capital Costs

Total investment costs	307,250
Annualized incremental capital costs	50,004

C. Net Annualized Incremental Operating Savings 14,773

UAC ($/kg ODP phase out) **0.276**

FOAMINDO

SCOPE

The project under review concerns the phaseout of CFC 11 in the manufacture of slabstock and moulded flexible polyurethane.

RECOMMENDATION

The project is supported.

RELEVANCY AND ADEQUACY OF INFORMATION

Generally good. It is noted that Annexes A and B are missing. A project timetable should be developed.

TECHNOLOGY SOUNDNESS

The technology choices are sound.

For the slabstock production methylene chloride is a standard approach. Likewise, the choice of waterblown moulding foams is in line with the international trend.

LESSON FROM EXPERIENCE

Issues raised by the reviewer at an earlier stage have been addressed.

ENVIRONMENTAL ISSUES

The main issue relating to the use of methylene chloride is in the safety category.

SAFETY ISSUES

This is a key issue and the project document address it in an appropriate fashion. The use of an experienced consultant is noted.

COST EFFECTIVENESS

The UAC is very low - the only question related to costs which is not adequately explained is the higher scrappage cost with the CFC free technologies.

OTHER

None.

GMFJ/kd/13/9/93

COUNTRY:	Republic of Indonesia	
PROJECT TITLE:	Technical Assistance Program for Small CFC Users in the Flexible Polyurethane Foam Sector	
SECTOR COVERED:	Foam-Blowing	
ODS USE IN SECTOR:	Approximately 1,250 MT of CFC-11 and CFC-12 in all foam-blowing applications in 1993 (1,250 ODP-weighted MT). Of this, about 200 MT of CFCs is consumed by small users in the non-insulating foam industry.	
PROJECT IMPACT:	Approximately 100 MT of CFC-11 will be phased out.	
PROJECT DURATION:	2 years	
PROJECT ECONOMIC LIFE:	10 years	
TOTAL PROJECT COST:	ODS Reduction Investment Costs: Incremental Operating Cost : Total Project Costs:	US$1,351,000 US$0 US$1,351,000
COST EFFECTIVENESS:	US$2.20/ODP-weighted kg of ODS phased out	
PROPOSED OTF FINANCING:[1]	US$1,600,000 as grant	
IMPLEMENTING ENTERPRISE:	Association of Polyurethane Foams Indonesia (APFI)	
COORDINATING MINISTRY:	Indonesian Ministry of the Environment (LH)	

PROJECT SUMMARY

This project will phase out consumption of about 100 MT of CFC-11 at approximately 50 small companies in the flexible polyurethane foam sector in Indonesia. The first part of this two-part project will set up a technical assistance program to identify the assistance required by the small enterprises need and to develop a program to meet those needs. The second part will convert about 50 small users of CFCs to methylene chloride. In so doing, it will eliminate about 100 MT of CFCs once all conversions have been implemented including implementation of necessary measures to ensure the safe and effective use of methylene chloride at each of the participating enterprises. The program will be jointly coordinated by the Association of Polyurethane Foam Indonesia (APFI) and the Indonesian Ministry of the Environment (LH). The lessons learned from this project will be used to prepare a follow up project that will eliminate the residual ODS consumption in the non-insulating foam sector.

TECHNICAL ASSESSMENT

Comments made by the OORG technical reviewer (Dr. Michael Jeffs) during a preliminary review on September 13, 1993 on the exclusion of certain costs have been reflected in this document. Further documentation was provided to indicate that additional costs would not be required. The attached review from Dr. Jeffs supports the project.

[1] Includes 15 percent contingency and 3 percent financial agent fee.

PROJECT OBJECTIVE

The objective of this project is to establish a mechanism for providing assistance to small manufacturers of flexible polyurethane foam and then to facilitate the phase out of CFC-11 at these companies. A further objective is to develop a model technology transfer program that could be replicated in other Article 5 countries with many small users of ODS in a particular sector.

SECTOR BACKGROUND

The Indonesian non-insulating foam sector consists of approximately 15 large manufacturers, mainly concentrated on Java, and about one hundred small manufacturers, scattered over the other islands of the Republic. For the purposes of this project, large companies are defined as those using continuous foaming processes and having an ODS consumption of more than 50 MT. Among the large companies, 5 are producers of extruded polystyrene (EPS) and polyethylene (EPE) foam, 8 are flexible polyurethane foam (PUF) manufacturers (continuous process), and 2 are miscellaneous PUF manufacturers. In 1993, total consumption of CFC-11 and CFC-12 at these companies is estimated to be approximately 780 MT. Assuming that the smaller companies account for about 20 percent of the total consumption of ozone-depleting substances (ODS), total ODS consumption in all non-insulating end uses is estimated to be close to 1,000 MT. Insulating end uses such as appliance insulation are expected to account for approximately 250 MT of CFCs. Overall consumption in the foam-blowing sector is therefore estimated to be approximately 1,250 ODP MT.

ENTERPRISE BACKGROUND

The Association of Polyurethane Foam Indonesia (APFI) was established on February 6, 1993. Its stated objectives are: (1) to actively participate in the development of Indonesia, (2) to bring together foam producers from across Indonesia, and (3) to serve a liaison role for its members to communicate with Indonesian government agencies. All companies producing polyurethane foam in Indonesia are eligible to become members. The work of the organization is directed by an elected managing board consisting of four individuals. The organization appears to be well suited to a role of organizing and overseeing a project to provide technical assistance to small producers of polyurethane foam.

The smaller PUF manufacturers are scattered across Indonesia. A significant portion of these companies are also located in Metro Jakarta. In general, the enterprises are fully Indonesian-owned and have limited in-company technical expertise. Because the quality of manufactured foam is not an important production variable, they use batch rather than continuous process to make their foam (i.e., formulations are mixed manually in drums without using metering equipment). The foam is blown, allowed to rise, and then cut off into blocks. They have little in the way of manufacturing safety provisions.

PROJECT DESCRIPTION

The project will comprise two main parts. The first part will set up a technical assistance program to identify the kind of assistance required by small users of CFCs in the flexible polyurethane industry throughout Indonesia and the second part of the project will be to carry out the assistance and phase out about 100 MT of CFC-11 at approximately 50 small foam producers.To ensure the program's long-term sustainability, the program will be jointly coordinated by the Association of Polyurethane Foam Indonesia (APFI) and the Indonesian Ministry of the Environment (LH).

Activities to be undertaken in the first part include: (1) a survey to develop a better CFC consumption profile of the small users, (2) 4 regional technology transfer workshops to discuss the

non-ODS technology available to such enterprises, and (3) plant visits to enable plant managers from smaller enterprises to visit larger foam manufacturing plants that will already have converted from CFCs to non-ODS alternatives.

The results of the survey will be used to cluster the small enterprises by region. Based on the preliminary profile of the foam manufacturing industry provided by APFI and LH, it is anticipated that the following cluster groups will be set up:

- Metro Jakarta
- Other Java
- Sumatra
- Other regions

The four regional technology transfer workshops to be held after survey results have been analyzed by APFI and LH will enable enterprises in each of the four cluster groups to obtain detailed information on the technology appropriate for their own specific flexible foam manufacturing operations. Representatives from large companies such as P.T. FOAMINDO that will already have converted from CFC-11 to methylene chloride will be invited to the workshops to present the lessons learned from their experiences. Further technical information will be made available through proposed plant visits to large foam manufacturers that have phased out use of CFCs. With the assistance of an international foams production process specialist and a local foams expert who will visit each of the interested plants, each of the smaller enterprises will then prepare brief proposals outlining the types of technical and financial assistance they need to convert from CFCs to methylene chloride. APFI and LH will review these proposals and, with the help of the international and local experts, will develop the program for phasing out CFC-11 to be undertaken in the second part of the project. Methylene chloride technology is well understood and fairly standard for flexible PUF applications. As discussed above, small foam manufacturers employ a manual production process and so conversion will only require trial production runs with new formulations, provisions for safety equipment, and technical assistance in start-up. The specific process requirements for each company may, however, cause slight variations in the type of technical assistance provided to each such company.

Based on the program developed through a review of the submitted proposals, the second part of the project will then involve a series of conversions at the smaller enterprises. Working closely with the local foams expert(s), the international foams expert will provide all of the technical support necessary (including a plant visit to help administer tests on modified foam formulations and a follow up site visit once conversion from CFC-11 to methylene chloride has taken place) in assisting about fifteen of the fifty companies that are converting from CFC-11 to methylene chloride. An important emphasis throughout the duration of this project is to transfer expertise from the international foams expert to the local foams expert(s). As a result, the local expert(s) will have responsibility for the remaining 35 companies. The international foams expert may also be called upon should technical problems be encountered at some of these remaining companies.

JUSTIFICATION FOR SELECTION OF ALTERNATIVE TECHNOLOGY

Internationally, the polyurethane slabstock industry has already substantially converted from CFC-11 to methylene chloride. For the most part, this conversion has been driven by the economics rather than the environmental reasons for doing so. In Indonesia, economics also favors this conversion however lack of technical know-how and safety concerns are preventing widespread adoption. Methylene chloride is currently priced at approximately 1,450 rupiah per kilogram (US$0.75/kg) compared with 5,000 rupiah per kilogram (US$2.50/kg) for CFC-11. Investments in safety upgrades are, however, also necessary to ensure that methylene chloride is used safely and effectively.

Methylene chloride is a highly volatile chlorinated substance with a relatively low acute toxicity. The volatility can trigger high concentrations in the air. The substance is classified by both the U.S. Environmental Protection Agency (USEPA) and the International Agency for Research on Cancer (IARC) as a probable human carcinogen. The U.S. Occupational Safety and Health Administration has set an 8 hour time weighted average (TWA) level of 500 ppm for methylene chloride. Careful handling is therefore required to avoid over exposure. Examples of safety measures typically needed include: proper encapsulation of the production units that use methylene chloride, ventilation of production and storage areas, training of personnel in handling of the substance, and industrial hygienic monitoring.

PROJECT COSTS

The total project cost of US$1,351,300 are all for technical assistance, production trials, and provisions of safety measures. This project will not provide any of the participating companies with incremental revenues.

Other Costs. A 15% contingency (US$200,000) was also included to ensure adequate funding of project costs following project appraisal. An additional US$48,700 (3%) was added to the grant request to cover the fee for services of the financial institution (FI) that will appraise the projects and oversee procurement, disbursement and audits.

Requested Funding. The proposed OTF grant for this project is US$1,600,000 and was calculated as follows: the total project cost (all one-time technical assistance costs) was increased by a 15 percent contingency to yield the grant amount. Finally, this figure was increased by 3 percent to account for the financial institution fee.

UNIT ABATEMENT COST (UAC)

The UAC is US$2.20 per ODP-weighted kilogram phased out based on total project costs of US$1.35 million and 100 MT of CFC-11 being phased out. Project costs are annualized over the ten years of the project life.

RESULTS

Implementing this proposed project will result in a phaseout of 100 ODP-weighted MT of CFC-11 from about 50 small CFC-using flexible polyurethane foam manufacturing enterprises. The project will also serve as a model for other Article 5 countries.

PROJECT IMPLEMENTATION

Management

LH and APFI will jointly coordinate this project. LH will be responsible for overall oversight of the project, for helping to assess the survey results, and for organizing the regional workshops. APFI will be responsible for soliciting and providing information about candidate enterprises and for communicating with each of the companies.

Schedule

All project activities will be completed over the following schedule during the time period 1994-1995. The schedule takes into account that conversions at small companies will occur after conversions have been implemented at larger companies like P.T. FOAMINDO.

TASK	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
Survey of small users	XXXX							
Regional technology transfer workshops		XXXX						
Visits to larger facilities that have already converted to methylene chloride			XX					
Initial plant visits to small companies				XXXX				
Preparation of proposals					XXXX			
Review proposals						XX		
Trials using new foam formulations and safety training							XXXX	
Follow up visits to ensure effective technology transfer and use of safety equipment								XXXX

ANNEX A
PROJECT COSTS

Survey and analysis	US$ 10,000
Workshops (4)	
-- organization and logistics	US$ 5,000
-- travel for local participants	US$ 10,000
International Foam Expert (US$500/day)	
-- preparation for workshops	US$ 1,000
-- international travel (2 trips)	US$ 10,000
-- local travel and expenses	US$ 15,000
-- initial plant visits (30-50)	US$ 50,000
-- follow-up visits (15)	US$ 7,500
Local Foams Expert (US$150/day)	
-- preparation for workshops	US$ 300
-- local travel and expenses	US$ 20,000
-- initial plant visits (50)	US$ 15,000
-- follow-up visits (50)	US$ 7,500
Investments	
-- Foam formulation trials (50)	US$ 200,000
-- Safety measures for methylene chloride (50)	US$1,000,000
TOTAL BUDGET	**US$1,351,300**

ASSOCIATION OF POLYURETHANE FOAMS, INDONESIA

These comments are intended to complement the OORG review dated 13/9/93.

- I have now examined the project timetable. I note the important follow up visits to check that safety measures are being adhered to.
- I note the proposed involvement of Foamindo in the project.
- Cost effectiveness - I now understand that there will be no further equipment costs and, because of the nature of the product produced by the small manufacturers, there are no scrappage costs. The recalculated Unit Abatement Cost is acceptable.

RECOMMENDATION

The project is supported.

GMFJ/kd/20/9/93

ASSOCIATION OF POLYURETHANE FOAM INDONESIA

SCOPE

The project under review is concerned with the replacement of CFC 11 in the manufacture of flexible polyurethane slabstock foam in a number of small producers.

RECOMMENDATION

The reviewer is not certain that all costs have been addressed - see below. This aspect should be reviewed before a recommendation is made.

RELEVANCY AND ADEQUACY OF INFORMATION

Good. A project timetable should be included.

TECHNICAL SOUNDNESS

The choice of methylene chloride is sound - it is the normal replacement route in the industry. It is noted that Foamindo (in their project) are prepared to act as a pilot - but this is not mentioned in this project.

LESSON FROM EXPERIENCE

This is the first project of this nature that the reviewer has seen.

ENVIRONMENTAL ISSUES

The main issue relating to the use of methylene chloride is in the safety category.

SAFETY ISSUES

This is a key issue and the project document addresses it appropriately. The use of an experienced consultant is noted.

COST EFFECTIVENESS

The UAC is very high. The main factor in this is intrinsic in the very nature of the project - that is, there is a large number of units with a low individual output to be converted.

In the Foamindo project provision is made for higher formulation costs and higher scrappage rates with methylene chloride technology. Why has this been omitted in this case ? Why are they unnecessary here but necessary for Foamindo ? Are there any hidden machinery requirements ?

OTHER

None.

GMFJ/kd/13/9/93

COUNTRY:	Republic of Indonesia
PROJECT TITLE:	Safety and Technical Program to Assist Manufacturers of Hydrocarbon Propelled Aerosol Products
SECTOR COVERED:	Aerosols
ODS USE IN SECTOR:	In 1991, the total ODS consumption was approximately 1,500 MT of CFCs. Approximately 300-400 MT of CFCs is still being used. Companies that recently converted from CFCs to hydrocarbons (i.e., the target segment for this project) consumed approximately 1,400 MT of CFCs in 1991.
PROJECT IMPACT:	The project will not directly phase out any ODS. It will indirectly, however, ensure the sustained phase out of 1,000 MT of ODS and the long-term safe and effective use of non-ODS alternatives such as hydrocarbon aerosol propellants.
PROJECT DURATION:	2 years
PROJECT ECONOMIC LIFE:	N/A
COST EFFECTIVENESS:	N/A
TOTAL PROJECT COST:	Total Project Costs: US$201,000
PROPOSED OTF FINANCING: [1]	US$ 240,000 as grant
IMPLEMENTING ENTERPRISE:	Indonesian Ministry of Industry and Ministry of Environment
COORDINATING MINISTRY:	Indonesian Ministry of the Environment (LH)

[1] Includes 15 percent contingency and 3 percent financial agent fee.

PROJECT SUMMARY

This project will ensure the safe and effective use of hydrocarbon aerosol propellants (HAPs) at eighteen large and medium-sized aerosol product manufacturing plants in Indonesia. These companies have already begun to shift from CFCs to HAPs. However, because high quality hydrocarbon aerosol propellants (HAPs) are not yet widely available in Indonesia, CFCs are still being used in some product applications.

These enterprises are suffering from the poor quality of the available hydrocarbons (a somewhat purified grade of liquified petroleum gas or "LPG") and are losing market share to these smaller producers that still use CFCs. A complementary project proposal is being prepared to ensure that aerosols companies have access to an adequate supply of high quality HAPs.

While the project will not directly phase out the use of CFCs at the larger companies, it will ensure the sustained phase out of approximately 1,000 MT of CFCs and that the companies use LPG and HAPs in a safe and effective manner. At present, plants that have converted to hydrocarbons have inadequate flammability safeguards in place to prevent a major accident involving HAPs. In the long-run, improvements in manufacturing safety is key to minimizing the possible dislocation to the Indonesian aerosol industry resulting from the potential impacts of a major accident involving HAPs. The proposal will set up a safety and technical assistance program that will include plant safety audits, a training program, investments in safety equipment, and information awareness directed at smaller companies and consumers of aerosols products.

TECHNICAL ASSESSMENT

Comments made by the OORG technical reviewer (Dr. Harry McCain) during his review on September 8, 1993 on the importance of training fire fighting personnel have been reflected in this document. The project is supported by the OORG reviewer.

PROJECT OBJECTIVE

The objective of this project is to ensure the safe and effective use of hydrocarbon aerosol propellants (HAPs) at aerosol product manufacturing plants in Indonesia.

SECTOR BACKGROUND

The use of CFCs in aerosol production for cosmetics and personal care products (PCP) was banned by an Indonesian Ministry of Health decree in 1991. Initially, the effective date of the ban was August, 1992. It was, however, subsequently delayed by a year until August, 1993. Because high quality hydrocarbon aerosol propellants (HAPs) are not yet widely available in Indonesia, CFCs are still being used in some cosmetic, PCP, and other aerosol applications. Furthermore, enterprises that have converted to alternative propellants, such as HAPs, are suffering from the poor quality of available hydrocarbons and are losing market share to those that still use CFCs. Because companies that use HAPs have to undertake a number of purification steps, the economics do not provide a sufficient incentive for companies to use HAPs. There is some risk that companies which have begun to switch from CFCs to HAPs could switch back. A complementary project proposal is therefore being prepared to ensure that aerosols companies have access to an adequate supply of high quality HAPs.

At the time of the ban, approximately 1,500 MT of CFCs was being used by the approximately 50 to 100 companies that make up the Indonesian aerosol industry. In response to the ban, most of the larger companies have recently partially or completely shifted from CFCs to the use of HAPs. About 300-400 MT of CFCs is still being used by 25 mostly smaller companies. In total, the Indonesian aerosol industry produces approximately 45 million cans per year, primarily for consumption in the domestic market.

ENTERPRISE BACKGROUND

The eighteen companies that have partially or totally shifted away from CFCs will receive assistance through this proposed project. All will receive safety training, safety audits, and some investments in safety equipment.

Some of the following companies will be included in this program. Preference will be given to companies that are 100 percent Indonesia-owned: PT Cedefindo, PT Candi Swadaya Sentosa, PT, Scan Chemie, PT Bayer Indonesia, PT Nipsea Paints/Chemicals, Evian Paint, PT Crisna Kosmetica, PT Estrella Laboratories, PT Prima Cosmetics Industry, PT Tancho Indonesia, PT Unilever Indonesia, PT Tensia Mfg. Indonesia, PT Norel Renee Parfum M. Ind., PT Primestar, PT Dahlia Cosmetic Indonesia, PT Kiwi Indonesia, PT Mirabela, PT SC Johnson and Son Indonesia, Pacific Paint Factory, PT Murni Chemicals, PT Mawar Sejati, Mayon Cosmetics Industry, Romos Inti Cosmetics Industry, PT Triple Ace Corporation, PT Universal Lion, PT Yasular Indonesia, Java Perfumerie, CV. Rita Chemical Industry.

PROJECT DESCRIPTION

The focus of this project is to provide the necessary safety and technical assistance to aerosol manufacturers in Indonesia that have already begun to shift their production from CFCs to HAPs.

While HAPs provide a cost effective propellant alternative, these gases are, unfortunately, hydrocarbon gases are very flammable. Because their flash points are extremely low, any fire or spark can ignite hydrocarbons at ambient temperatures. In order to prevent fire or explosion, the concentration of hydrocarbons in the air must be below the lower explosive limit and all possible sources of ignition must be eliminated.

Their intrinsic flammability requires special care and safety design in the following areas: (1) propellant receiving and storage, (2) propellant filling of containers, (3) in-plant storage of filled aerosol products, (4) disposal of defective or test units, and (5) laboratory operations.

To raise awareness of safety hazards and mitigation strategies, the safety and technical assistance program will consist of six main components: (1) plant safety audit, (2) training program and implementation, (3) provisions of safety equipment, (4) follow up, (5) information awareness program, and (6) transfer of project experience to other Article 5 countries.

Plant Safety Audit

Approximately eighteen companies have already partially or completely shifted from CFCs to HAPs. Each of these plants would receive the benefits of a consultant's safety audit. A consultant team consisting of an international expert on alternatives to CFCs in the aerosols industry and a local aerosols expert will visit each of the plants and prepare a report with recommendations on ways to enhance safety measures. An interpreter (Bahasa Indonesian/English) will be made available for the consultants on the visits. The report will include estimates of the costs and the benefits (e.g.,

prevention of accidents) associated with the recommended changes in equipment and facilities and an explanation of the risks likely to be eliminated with such changes.

Training Program and Implementation

Representatives from the eighteen companies will be invited to participate in a training program. The training program will be conducted to address the special circumstances of each company and focusing on the recommendations of the safety audit. Where LPG storage tanks and cylinders are to be used by aerosol product manufacturers, local fire fighting personnel will also be invited to receive additional training in handling LPG fires. The consultants will help companies develop a schedule for implementing the recommendations and will schedule plant visits to ensure that such recommendations are being implemented. All training materials will be translated into Bahasa Indonesian.

Provisions of Safety Equipment

As part of the technical assistance program, each company may be eligible to receive immediate provisions of safety equipment. This package of safety equipment will consist of fire extinguishers (carbon dioxide and ABC dry powder), aerosol crimp gauges, portable gas detectors, and manual gassing adapters.

Gassing adapters are often sources of leakage. Changing to new adapters will therefore almost always improve safety. Warehouse fires may be caused by poor crimping. Installation of proper crimp gauges will greatly lessen this risk. Portable gas detectors contribute directly to plant safety. They are not very robust and should be replaced about every year if they are used continuously. They provide plant managers with an excellent means of identifying problem areas within the facility.

Follow Up

Two follow up visits will be made to each facility. In each case, the international and local consultant will spend a full day at each of the eighteen facilities, reviewing programs and correcting problem areas.

Information Awareness

Representatives from the smaller companies that still use CFCs will be invited to participate in a safety and technical information workshop. The focus of the workshop will be to inform participants about the ozone depletion issue, the phaseout of CFCs, the need to switch to alternatives such as HAPs, the safety considerations when using HAPs, and the various options available to them for continuing to produce aerosol products (i.e., including contracting out aerosol filling).

In addition, an information awareness campaign will be developed for consumers to educate them about the changes in aerosols products resulting from a switch in propellants.

Transfer of Project Experience to other Article 5 Countries

Expertise, educational materials, and products from the training program can be used in the global aerosols project to transfer from Indonesia to other Article 5 countries. The lessons learned in Indonesia could be used to adapt the project to other countries. This would result in savings in project preparation and effective use of developing country expertise.

JUSTIFICATION FOR SELECTION OF ALTERNATIVE TECHNOLOGY

Hydrocarbons are the most commonly used substitutes for CFCs in aerosol propellants. They account for 80 percent of worldwide conversions from CFCs and 90 percent of current aerosol propellant uses in the United States. Advantages of hydrocarbons include their widespread availability, low cost, nontoxicity, and good dispersion characteristics. The main drawback of hydrocarbons is their high flammability. This project provides assistance to companies that have converted from CFCs to hydrocarbons to help them minimize the safety risks associated with using flammable propellants.

A major accident involving HAPs in Indonesia would have the following negative effects:

- damages/losses in human life and property
- cancellation of the conversion plans of those plants currently using nonflammable CFCs
- switch from HAPs to CFCs at some plants, and
- press coverage detrimental to the process of eliminating CFCs in aerosol applications in other Article 5 countries.

In the long-run, improvements in manufacturing safety minimize the possible dislocation to the aerosols industry and the rest of the economy resulting from the above effects.

PROJECT COSTS

As detailed in Annex A, the total project cost is US$201,000. Because there are no operating costs, ODS savings, or non-ODS investment costs associated with this project, the total cost is also the incremental cost. This project will not provide any of the companies with any incremental revenues.

Other Costs. A 15% contingency (US$30,000) was also included to ensure adequate funding of project costs following project appraisal. An additional US$9,000 (3%) was added to the grant request to cover the fee for services of the financial institution (FI) that will appraise the projects and oversee procurement, disbursement and audits.

Requested Funding. The proposed OTF grant for this project is US$240,000 and was calculated as follows: the total project cost was increased by a 15 percent contingency to yield the grant amount. Finally, this figure was increased by 3 percent to account for the financial institution's fee.

PROJECT IMPLEMENTATION

Management

LH will oversee the implementation of this project in conjunction with the Ministry of Industry.

Schedule

As shown in the following table, this project can be implemented over four quarters.

TASK	Q1	Q2	Q3	Q4
Safety Audit	XXXX			
Safety Training Seminar		XXXX		
Safety Investments		XXXX		
Follow Up Visit 1			XXXX	
Follow Up Visit 2				XXXX

RESULTS

Project Impacts

This project will not directly eliminate any ODS. It will, however, ensure the sustained elimination of 1,000 MT of CFCs. Moreover, it will ensure the long-term safe and effective use of hydrocarbons instead of CFCs in the Indonesian aerosol sector. Aerosol filling plants in Indonesia will receive significant improvements in manufacturing safety. Worker safety will be improved through implementation of this project. A global training and technology transfer program such as this will eliminate the need to provide training on a company-by-company basis. As such, it will save money and ensure that the conversion from CFCs to hydrocarbons is rapid and permanent.

ANNEX A
Investment Costs (US$)

The project costs are follows:

Safety Audits, Training Seminar, and Follow Up Visits

1.	Plant Safety Audit (18 plants - 1 day each)	$14,400
2.	Plant Training Program and Seminar (18 plants - 1 day each subsequent to analyzing the audit data plus 3 days for the safety seminar	$16,800
3.	2 Follow Up Visits (18 days each trip)	$28,800
4.	Air Travel for International Aerosols Consultant	$16,000
5.	72 days for interpreter, translation of training materials, and printing of materials in Bahasa Indonesian	$5,000
6.	Miscellaneous expenses (secretarial, courier, telephone etc.)	$5,000
Sub-total		$86,000

Information awareness

1.	Information awareness campaign for small companies and consumers	$25,000

Safety Investments

1.	2 each 6 kg CO_2 fire extinguishers	$ 200
2.	2 each 12 kg ABC fire extinguishers	$ 200
3.	1 set of aerosol crimp gauges	$ 1,200
4.	1 each portable gas detector	$ 1,200
5.	2 each manual gassing adapters	$ 2,200

Sub total per plant = $5,000
Number of plants = 18

Sub-total		$90,000
TOTAL COSTS		**$201,000**

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September 8, 1993

TO : Jessica Poppele FAX: 202-477-5752
ENVGC
The World Bank

FROM : Harry B. McCain HBMC

SUBJECT : **SAFETY AND TECHNICAL PROGRAM TO ASSIST MANUFACTURERS OF HYDROCARBON PROPELLED AEROSOL PRODUCTS**

- **SCOPE**

The project under review ensures the safe and effective use of hydrocarbon aerosol propellants (HAPs) at 18 large and medium-sized aerosol product manufacturing plants in Indonesia. The project will place safeguards which will help prevent accidents involving HAPs.

- **RECOMMENDATION**

The project is supported. The project is totally necessary but its placement will require diligence. The importance of this training and assistance cannot be underestimated.

- **RELEVANCE AND ADEQUACY OF INFORMATION PROVIDED**

The information provided is comprehensive, well set out and should accomplish the stated objectives. One additional objective should be added to those already listed under "Project Description." That is, "The Nature and Handling of LPG Fires." Fire fighting personnel may need to receive additional training in handling LPG fires. This is especially true if LPG storage tanks and cylinders are to be used by the manufacturers of aerosol products.

- **TECHNICAL SOUNDNESS**

The technical aspects of this project require technically qualified individuals who are capable of training personnel in a meaningful way. One should be asked to have a training manual in hand before approaching this project.

- **LESSONS FROM EXPERIENCE**

Adequate training can only be accomplished if adequate preparation has been made. In this project, the work done before the training begins will determine the success of the project.

- **ENVIRONMENTAL ISSUES**

(Not applicable)

- **SAFETY ISSUES**

The project's sole aim is adequate safety training.

- **COST EFFECTIVENESS**

If 18 aerosol manufacturers understand and adopt the training proposed, the project is cost effective at $250,000.00 U.S.

- **OTHER**

None