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Implementation of the Montreal Protocol

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Montreal, 26-28 July 1995

PROJECT PROPOSALS: INDIA

This document includes the following project proposals which are grouped by sector. The agency responsible for the implementation of the project is also indicated. The project proposals are presented in the order indicated below.

Aerosol

• Accra Pak India Pvt. Ltd. Aerosol Conversion	World Bank
• Aerosols D'Asia Pvt. Ltd. Aerosol Conversion	World Bank
• Aero Industries Conversion, Vapi	World Bank
• Aeropres Conversion, Vapi	World Bank
• Asian Aerosols Pvt. Ltd. Aerosol Conversion	World Bank
• Aero Pack Products Conversion Project	World Bank
• Ultra Tech Specialty Chemicals Pvt Ltd.	World Bank
• Aerol Formulations Aerosol Conversion	World Bank
• Meenakshi aerosol and cosmetics conversion, Delhi	World Bank
• Stella Industries Aerosol Conversion	World Bank
• Texas Enterprises conversion, Bombay	World Bank
• A.A. Attarwala & Co. Pvt. Ltd. conversion, Bombay	World Bank
• My Fair Lady Ltd. conversion, Delhi	World Bank
• Conversion of 5 Aerosol Filling Installations to Manual Filling Equipment using HAP	World Bank

Foam

• Phase-out of CFCs in the manufacture of Extruded Polyethylene Foam at Real Polymers	World Bank
• Phase out of CFCs in the manufacture of Integral Skin PUF moldings at Pfeda Synthetics (P) Ltd.	World Bank
• Phase out of CFCs in the manufacture of Extruded Polyethylene Foam at Kunststoff Polymers Ltd.	World Bank
• Phase out of CFCs in the manufacture of PUF moldings at Vijayiyot Seats Ltd.	World Bank
• Phase out of CFCs in the manufacture of molded PUF automotive seats at Polyflex P. Ltd.	World Bank
• Phase out of CFCs in the manufacture of molded PUF at PUR Polyurethane Products P. Ltd.	World Bank

Solvent

• Phase out of CTC in the manufacture of Endosulphan at Excel Industries	World Bank

Project Cover Sheet

Country:	**India**
Project Title:	**Demonstration Project - Very Small Aerosol Fillers** Conversion of 5 Aerosol Filling Installations to Manual Filling Equipment using HAP
Sector Covered:	Aerosols
ODS Consumption in Sector:	1,100 mt. CFC-12 (Aerosol) in 1991
ODP Phased Out:	TBD
Project Impact:	N/A
Project Duration:	1 Year
Total Project Cost:	US$ 181,550
Proposed Grant:	US$ 181,550
Cost Effectiveness:	N/A
National Coordinating Agency:	Ministry of Environment and Forest, MOEF
Implementing Agency:	World Bank

This project will demonstrate the usefulness, appropriateness and usability of a new manual propellant filling machine that has yet to be made commercially available on the market. This technology promises to be particularly useful for Article 5 countries which have a large number of small aerosol fillers where substantial cost savings can be achieved.

In addition to demonstrating the feasibility of using this equipment in a developing country environment, this project will also accomplish the conversion to hydrocarbon aerosol propellant (HAPs) of 5 small enterprises.

The project will provide small manual filling equipment to replace manual filling equipment that is unsafe for use with flammable propellants such as HAP. Due to safety reasons *open air filling* rooms will be used. Permanent storage tanks and increased fire protection to improve overall operational safety will be required. Safety training and equipment monitoring and evaluation will be provided by foreign experts while the project will be implemented locally through am engineering consulting firm or industry association.

Project Objective:

The main objective of this project is to demonstrate the feasibility and appropriateness of widescale use of new manual propellant filling technology suitable for use with hydrocarbon aerosol propellant (HAP) under the manufacturing conditions prevalent in Article 5 countries.

The project will also support the actual phase out of the use of CFC-12 or CFC-11/CFC-12 (amount left to be determined) mixture by completing the conversion process from CFCs to HAPs in 5 small aerosol filling plants.

Sector Background:

A government task force estimated aerosol fillings at over 40,000,000 units per year, and the consumption of the sector over 1,400 mts. of CFC in 1993. Final country program estimates place CFC consumption at 1,100 mts. in 1991, and the market has grown substantially since then.

It is estimated that there are over 200 aerosols fillers in India. Competition is very keen and there is a general fear that switching to HAPs before the competition will result in lost of market share due to poor quality.

Those numerous small scale informal sector enterprises operate basically as fillers of unnamed aerosol brand. Their ability to deal with safety issues is low unless it is an inherent part of equipment design.

Project Description and Justification:

Typical facilities which are now being proposed (based on commercially available technology) for the conversion of aerosol fillers (albeit larger fillers than the ones considered here) to hydrocarbon cost a minimum of US$60,000. If the same installations were used for the very small fillers (which is the only option now), the resulting cost effectiveness would be fairly poor. The adoption of this new machine, which is intended solely for the aerosol fillers that uses only 1 manual machine, would make the cost much more reasonable, somewhere around US$20,000.

It is proposed to purchase five manual filling machines to be tested in the field. Five fillers plants has been identified for this demonstration projects. It will necessarily to monitor the implementation and ensure the suitability of the new technology in a medium scale production and under the production condition of small enterprises such as low financial capital and low labor qualifications.

Safety equipment will be purchased and participating entrepreneurs will be trained initially by a foreign expert, until a local India firm is trained to provide this service. Its expected that some "open air filling room" will be installed for the use of HAPs.

The demonstration project will essentially be a "train the trainers" type with associated introduction of low cost technology and the safety training.

Justification of Alternative Technology:

Hydrocarbon aerosol propellants have been the principal alternatives to CFC-12 in aerosol product applications worldwide. They are approved by the UNEP Technical Options Report on Aerosols, Sterilants, and Miscellaneous Uses and Carbon Tetrachloride.

Project Cost:

The total project incremental cost of $181,550 was calculated as the economic capital cost. (See Annex 1)

Implementation Schedule:

The project can be completed in about 1 year.

Task	Q1	Q2	Q3	Q4
Purchase Equipment	xxxx			
Build Open Air Filling Rooms		xxxx		
Install Equipment			xxxx	
Training/Visit/Start-up				xxxx

The project would be implemented through a local engineering firm that would handle all project management responsibilities including equipment purchasing, monitoring of implementation, etc...

Procurement:

Procurement will be in accordance with Bank guidelines. Provisions would be made for the trainer to be fully prepared concerning aerosol filling plants safety, and tank and piping installation. Experience with HAPs aerosol formulation will be a must.

Required Regulatory Actions:

Once all the aerosol fillers have had an opportunity to convert, and the technical expert contracted to do the training has certified that plant personnel are fully trained, the use of CFCs in aerosols should be prohibited.

Annex 1

Aerosol Demonstration Project
Manual Filling Equipment
India

	QTY	Unit Price US$	Specifications	**Total Cost US$**
Manual Aerosol Filling Equipment	5	9,500	Product Filler Crimper Propellant Filler	47,500
144,250Construct Open Air Filling Rooms	5	4,000		20,000
Rack for Propellant Tank	5	800		4,000
Propellant Tank	80	50		4,000
Additional Extinguishers	5	750	12 kg ABC extinguishers	3,750
Leak Test Tank	5	2,000		10,000
Portable Gas Detector	5	1,000		5,000
Set of Quality Control Gauges	5	3,200	Two set of gauges	16,000
Shipping and Handling		2,000		2,000
Sub Total				**112,250**
Project Management Services and Supervision (local firm)				30,000
Plant Safety Training (foreign expert) and Equipment Monitoring	2	9,000	Days (15) + DSA	18,000
Sub Total				**160,250**
Contingency	**10%**			**16,000**
Financial Agency Fee	**3%**			**5300**
Total				**181,550**

THE MONTREAL PROTOCOL ON
SUBSTANCES THAT DEPLETE THE OZONE LAYER

PROJECT COVER SHEET

COUNTRY	:	India	
PROJECT TITLE	:	Phase-out of CFCs in the manufacture of Extruded Polyethylene Foam at Real Polymers.	
SECTOR COVERED	:	Foam Blowing	
ODS USE IN SECTOR	:	1577 MT of CFCs (1991)	
PROJECT IMPACT	:	Phase out of 35 MT of CFC-12 (Base 1994-95)	
PROJECT DURATION	:	1.5 years	
PROJECT ECONOMIC LIFE	:	10 years	
TOTAL PROJECT COST	:	Incremental Capital Cost	US$ 247,000
		Contingency @ 10%	US$ 24,700
		Incremental Operating Savings	US$ 3,500
		Incremental Project Cost	US$ 268,200
		FA Fee @ 3%	US$ 5,000
		Total Project Cost	US$ 276,200
COST EFFECTIVENESS	:	**Grant Effectiveness**	US$ 7.66/kg/y
	:	**Unit Abatement Costs**	US$ 1.21/kg/y
PROPOSED OTF FINANCING	:	US$ 276,200 as grant	
IMPLEMENTING ENTERPRISE	:	Real Polymers.	
CO-ORDINATING NATIONAL BODY	:	Ministry of Environment and Forests (MOEF)	
IMPLEMENTING AGENCY	:	The World Bank	

PROJECT SUMMARY

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This project will phase out 35 MT of CFC-12 consumption in the production of extruded polyethylene foam products, at Real Polymers, by converting foam operations to LPG. The project will require the installation of LPG storage and handling system, modifications to the extruder, extensive fire safety and alarm systems, safety and process training etc. Marginal operating savings are expected on account of the favorable price of the substitute. The enterprise has already initiated the conversion, by installing LPG tanks and piping, for which it seeks retroactive finacing.

Technical Assessment: This proposal has been reviewed by OORG Technical reviewer, Dr. M. Jeffs, whose comments are attached.

The objective of this project is to phase out the use of CFCs in the manufacture of extruded polyethylene foam products at Real Polymers P.Ltd., at New Delhi, India.

SECTOR BACKGROUND

The Foam Sector in India consumed 1577 MT of CFCs in 1991. CFC-11 was the dominant substance followed by CFC-12. Some incidental use of CFC-113 and MCF (reported under the solvents sector) complete the consumption pattern.

The maximum consumption of CFCs was in the Rigid PUF insulating foams and refrigerants. Among the other foams (excluding rigid insulating foams for domestic refrigerators), the Flexible PUF has practically changed over to Methylene Chloride. The Molded foams are changing over to water blown technology. The higher Rigid foams, non insulating type are all water blown. The Rigid PUF for insulation applications consumes about 975 MT of CFCs and is expected to grow steadily.

The Ozone Cell, Ministry of Environment and Forests, is leading the efforts in the phase out of CFCs, in co-operation with the users/suppliers. Complete phaseout of CFCs in foams (except rigid foams) is targetted by 2000. Rigid PUF are expected to be CFC free by 2006.

This sector accounts for about 230 enterprises, of which about 20% are large/medium sized users, with relatively sophisticated equipment. The remaining are small scale and are technically unsophisticated. The support of chemical suppliers and associations will be crucial in reaching and educating these enterprises.

ENTERPRISE BACKGROUND

Real Polymers is a 100% indigenously owned partnership enterprise established in 1992. It manufactures a wide range of extruded polyethylene products, such as sheets, tubes etc., used extensively in packaging, anti-condensation insulation, etc. The enterprise has a large and growing market in India and also prospects of exports to the middle east countries. Due to the growing demand for CFC-free products in the export market and also for economic reasons the enterprise has already initiated phasing out of CFC-12 as a blowing agent from its manufacturing operations.

In 1994-95 the enterprise produced about 150 MT of extruded polyethylene foam and consumed about 35 MT of CFC-12.

PROJECT DESCRIPTION

In this project, Real Polymers will convert its manufacturing operations to butane. In India, a butane blend is available as LPG, which will require deoderizing. The enterprise has a Polyseal, Taiwan make single screw extruder that will require modifications/retrofitting for use with LPG. Storage and handling systems for LPG, extensive fire safety and alarm systems, ventilation, safety and process training will have to be provided.

The enterprise has already initiated the changeover by acquiring a new factory location, that has all the necessary licenses/approvals for handling inflammable/explosive substances, from the concerned authorities. Further, the enterprise has completed installation of LPG tanks and piping for which it seeks retrofinancing.

JUSTIFICATION FOR SELECTION OF ALTERNATIVE TECHNOLOGY

Unlike the blowing agents in PUF where CFCs are generally auxilliary blowing agents, in thermoplastic foams (polystyrene, polyethylene, polypropylene) CFCs are the sole physical blowing agents. They are required to satsfy the following criteria :

> Solubility in the resin
> Worker Safety
> Consumer Safety
> Environmental Safety
> Thermal and chemical stability
> Diffusivity

Of the wide range of options that have been proposed, such as atmospheric gases (carbondioxide, nitogen), hydrocarbons (butane, pentane, isobutane, isopentane, LPG), hydrochlorofluorocarbons (HCFC-22, HCFC142b), hydrofluorocarbons (HFC-134a, HFC-152a, etc.) hydrocarbons are proven replacements, with a cost effective technology, favorable price, good solubility, no ODP or GWP. However due to the flammability of hydrocarbons, **stringent safety precautions in manufacturing and handling are required.**

PROJECT COSTS

The total project cost (investment cost and incremental recurrent savings) is estimated at US$ 268,200.

The investment costs of US$271,700, including 10% contingency, include capital investment in LPG tank, pump & piping system, extruder modifications, fire safety systems, etc. The breakdown of these, is provided in Annexure 1.

The incremental operating savings of US$3,500 represent net present value of incremental operating savings for two years of operation and do not reflect growth. Details are provided in Annexure 2.

COST EFFECTIVENESS

Grant Effectiveness

The Grant Effectiveness (ratio of the total project costs to the total ODS phased out per year post-project)of this project works out to US$7.66/kg/y. This has been derived from the total project cost of US$268,200 and the total CFC-12 phased out in the first year of operation post project of 35 MT.

Unit Abatement Costs

The unit abatement cost calculated over a 10 year life span of the project is US$1.21 per kg of CFC-12 phased out. This has been derived from the incremental annualized capital costs of US$ 271,700 and net annualized recurrent savings of US$ 2,000 (first year), for the phase-out of about 35 MT of CFC-12.

The cost-effectiveness of this project is close to or better than other similar projects and is also within the recent guidelines from the Fund Secretariat for such projects.

REQUIRED REGULATORY ACTION

The Government of India has already waived import duties on the equipment to be used in ODS phase-out projects. Further legislations or regulations are expected. However this project does not require any specific regulatory action other than the above.

RESULTS

This project will eliminate the use of atleast 35 MT of CFC-12 in the first year of implementation.

PROJECT IMPLEMENTATION SCHEDULE

TASK	Q1	Q2	Q3	Q4	Q5	Q6
1. a) MLF Approval b) ProcurementPreparation c) Vendor Selection	X X X	X				
2. a) Transportation, arrival and customs clearance b) Installation and plant modifications.			X	X X		
3. a) Machine Start-up b) Trials/Training c) Certification					X X	X X

ANNEXURES

Annexure 1 : Capital Costs
Annexure 2 : Incremental Operating Costs
Annexure 3 : Cost Effectiveness
Annexure 4 : Technical Review

ANNEXURE 1

Capital Costs in US$

1. LPG bulk tank and piping[1] (Inclusive of safety related civil works)	55,000
2. LPG pump with fireproof pump room	35,000
3. Deodorizer and buffer dosing unit	25,000
4. Extruder retrofitting	40,000
5. Equipment relocation	10,000
6. Fire safety & Alarm systems	72,000
Exhaust fans (12 Nos.)	6,000
Industrial blow down fans	12,000
Ventilation ducting	5,000
Gas sensing/detection system	10,000
Portable gas detector (1)	4,000
Fire extinguishers : Trolley Mounted(2)	4,000
Handheld(12)	3,000
Static eliminator (2)	6,000
Emergency lights (8)	2,000
Water Sprinkler System	20,000
7. Technology Transfer/Training	10,000
Incremental Capital Costs	**247,000**
Contingencies @ 10%	24,700
Total	271,700

Notes :

1. The enterprise has already implemented this part of the investment.
2. The price of LPG pump is based upon quotations received by the enterprise.

ANNEXURE 2

Incremental Operating Costs/Savings

Assumptions

1. CFC-12 Price : US$ 2.20/kg
2. LPG Price : US$ 0.80/kg
3. Cost of electricity : US$ 0.10/kwh
4. Operating Time : 5000 hrs/yr
5. Extra electrical load : 50 kw
6. Maintenance Costs : 5% of capital costs/yr
7. Insurance Costs : 2.5% of capital costs/yr
8. No growth considered.

Calculations

Baseline	1995	1996
Cost of 35 MT CFC-12(US$)	77,000	77,000
Total (US$)	77,000	77,000
Post-Project		
Cost of 35 MT LPG (US$):	28,000	28,000
Cost of extra electricity	25,000	25,000
Extra maintenance costs	13,000	13,000
Extra insurance	6,500	6,500
Continuing safety training	2,500	2,500
Total (US$)	75,000	75,000
Net Incremental Savings (US$)	(2,000)	(2,000)
Discount Factor	0.91	0.83
NPV @ 10% (US$)	(1,820)	**(1,660)**
For 2 years (US$)	(3,480)	

ANNEXURE 3

Cost Effectiveness

Grant Effectiveness

A. Incremental Capital Costs	:US$271,700
B. Incremental Operating Savings	:US$(3,500)
C. Total Project Costs (A+B)	:US$268,200
D. Total ODS phased out	:Kg 35,000
GRANT EFFECTIVENESS [C/D]	:US$7.66/kg/y

Unit Abatement Costs

A. Incremental Capital Costs	:US$271,700
B. Annualized Incremental Operating Savings:	:US$ (2,000)
C. Project Useful Life	:10 years
D. ODS reduction per year	:Kg 35,000
E. Capital Recovery Factor	:0.16275
UNIT ABATEMENT COST [(A X E) + B] / D	:**US$1.21/kg/y**

INDIA - REAL POLYMERS

TECHNOLOGY

The enterprise is in the course of converting its manufacturing operation for extruded polyethylene from CFC 12 to a butane blend.

This technology is well proven for this application but requires extensive modifications to ensure safety whilst using this highly flammable gas. The enterprise has acquired a new site for this operation.

ENVIRONMENTAL ISSUES

The main issue relates to safe operaiton with butane. The reviewer requires to see more details of the training which is proposed and assurance that the technology transfer includes safety knowledge from a proven source.

The enterprise should assure itself that it is complying with all relevant regulations relating to VOC emissions.

PROJECT COSTS

The project is cost effective and lies within EC guidelines. The capital and one-off items are justified.

The operating cost calculation is already set out but details of extra-electricity or maintenance estimates should be given.

IMPLEMENTATION TIMEFRAME

Acceptable.

RECOMMENDATION

Approval.

GMFJ/kd/7/6/95

SUBPROJECT PROPOSAL

PROJECT COVER SHEET

COUNTRY	: India		
PROJECT TITLE	: Phase-out of CFCs in the manufacture of Integral Skin : PUF moldings at Pfeda Synthetics (P) Ltd.		
SECTOR COVERED	: Foam Blowing		
ODS USE IN SECTOR	: 1577 MT of CFCs (1991)		
PROJECT IMPACT	: Phase out of 30 MT of CFC-11 (Base 1994-95)		
PROJECT DURATION	: 1.5 years		
PROJECT ECONOMIC LIFE	: 10 years		
TOTAL PROJECT COST	Incremental Capital Cost	US$	310,000
	Contingency @ 10%	US$	31,000
	Incremental Operating Costs	US$	65,300
	Total Incremental Cost	US$	406,300
	85% local ownership	US$	345,400
	FA fee @ 3%	US$	10,400
	Total Project Cost @85%	US$	355,800
COST EFFECTIVENESS	: **Grant Effectiveness:**	US$	13.51/kg/y
	Unit Abatement Costs:	US$	3.10/kg/y
PROPOSED OTF FINANCING	: US$ 355,800 as grant (= 85% local ownership)		
IMPLEMENTING ENTERPRISE	: Pfeda Synthetics (P) Ltd.		
CO-ORDINATING NATIONAL BODY	: Ministry of Environment and Forests (MOEF)		
IMPLEMENTING AGENCY	: The World Bank		

PROJECT SUMMARY

This project will phase-out 30 MT of CFC-11 consumption in the production of PUF integral skin moldings, at Pfeda Synthetics (P) Ltd., by converting foam operations to HCFC-141b. The project will require the replacement of two of the existing low pressure foaming units with a high pressure unit with four mixing heads, a blender, trials, technical assistance and training. Incremental operating costs, owing to the higher costs of the HCFC-141b based formulation are foreseen.

TECHNICAL ASSESSMENT: This proposal has been reviewed by OORG Technical reviewer Dr. M. Jeffs, whose comments are attached.

PROJECT OBJECTIVE

The objective of this project is to phase out the use of CFCs in the manufacture of PUF integral skin moldings at Pfeda Synthetics (P) Ltd., located at Noida, near New Delhi, India.

SECTOR BACKGROUND

The Foam Sector in India consumed 1577 MT of CFCs in 1991. CFC-11 was the dominant substance followed by CFC-12. Some incidental use of CFC-113 and MCF (reported under the solvents sector) complete the consumption pattern.

The maximum consumption of CFCs was in the Rigid PUF insulating foams and refrigerants. Among the other foams (excluding rigid insulating foams for domestic refrigerators), the Flexible PUF has practically changed over to Methylene Chloride. The Molded foams are changing over to water blown technology. The higher Rigid foams, non insulating type are all water blown. The Rigid PUF for insulation applications consumes about 975 MT of CFCs and is expected to grow steadily.

The Ozone Cell, Ministry of Environment and Forests, is leading the efforts in the phase out of CFCs, in co-operation with the users/suppliers. Complete phaseout of CFCs in foams (except rigid foams) is targetted by 2000. Rigid PUF are expected to be CFC free by 2006.

This sector accounts for about 230 enterprises, of which about 20% are large/medium sized users, with relatively sophisticated equipment. The remaining are small scale and are technically unsophisticated. The support of chemical suppliers and associations will be crucial in reaching and educating these enterprises.

ENTERPRISE BACKGROUND

Pfeda Synthetics (P) Ltd., is one of the leading manufacturers of PUF integral skin moldings for automotive and furniture applications, such as steering wheels, gear lever knobs, arm rests, grab handles, back rests for motorcycles, etc. The company also manufactures PU elastomers, semi-rigid PUF parts such as fenders, dashboards, facia panels. Thermoformed components with back filled PUF is another product line.

The enterprise was established in 1983 as a joint venture with a German partner company. It commenced commercial production in 1985. The enterprise employs 200 persons of which 20 are technically qualified. During 1994-95 the company produced about 250-300 MT of moldings, as OEM supplies to reputed automotive manufacturers such as Tata, Premier, Leyland, Eicher, etc. and also to the replacement market. The annual sales during this period were about U$ 3 million and consumed 30 MT of CFC-11.

The enterprise has already begun trials on CFC-free technologies in some products and is keen to phase out CFCs in all its production.

PROJECT DESCRIPTION

Pfeda Synthetics (P) Ltd. has a total of six foam dispensers installed and in production. The makes and models for these machines are as under:

One Desma High Pressure Dispenser (Model HYA48/2017)
One Battenfeld High Pressure Dispenser (Model SH 75-75)
One Battenfeld High Pressure Dispenser (Model SH40-40)
One Admiral Low Pressure Dispenser (Model V15 24)
One Admiral Low Pressure Dispenser (Model MIH 2H)
One Admiral Low Pressure Dispenser (Model V15 2HH)

Of these machines, the products (mainly elastomers) manufactured by the three high pressure machines consume insignificant quantities of CFCs. Of the three low pressure machines, bulk of the production (and therefore the CFC consumption) of the integral skin products, is handled by two machines. The third low pressure machine is mainly employed for new product trials, testing new formulations (including CFC-free formulations), etc.

The enterprise proposes to convert foaming operations to HCFC-141b based formulation, however will retain its options to implement HCFC-22 based systems. This will involve replacing two of the three low pressure machines with one high presure machine with four mixing heads. The company will retain the third low pressure machine for trials and other development activities related to environment-friendly technologies. A closed system blender for closer control over formulations is also proposed, alongwith provision for trials, technical assistance for formulation development, training etc. Due to the higher cost of HCFC-141b based formulation, incremental operating costs are foreseen.

The company is aware that HCFCs are interim substitutes. The proposed machinery replacement will enable the enterprise to implement newer and environmentally safer alternatives with little or no further investments.

JUSTIFICATION FOR SELECTION OF ALTERNATIVE TECHNOLOGY

Integral Skin polyurethane foams are characterised by a high density outer skin and a low density core. In addition to blowing the foam, blowing agents are required to perform auxilliary functions such as skin formation and decrease of viscosity.

HCFCs satisfy the market rquirements on aesthetics and performance and are considered the most acceptable interim replacements. HCFCs such as -22,-141b and -123 have all been tested mostly with positive results. However HCFC-22 has been seen to cause frothing in some applications. HCFC-141b appears to be the most viable interim substitute, though price and availability questions need to be more satisfactorily addressed.

Possible replacement scenarios for the future comprise of Hydrocarbons (Pentanes), HFCs (152a, 134a, 125, 245, 356) either independently or as a supplement to water based formulations and fully water blown systems.

In this project, the proposed investments will allow the enterprise to implement all the above alternatives with minimal or no further investments.

PROJECT COSTS

The total project cost (investment cost and incremental recurrent cost) is estimated at US$345,400.

The investment costs of US$341,000 including 10% contingency, include capital investment in one high pressure foaming unit with four mixing heads, trials etc. The cost breakdown of these, is provided in Annexure 1.

The incremental operating costs of US$65,300 represent net present value of incremental operating costs for two years of operation and do not reflect growth. Details are provided in Annexure 2.

COST EFFECTIVENESS

Grant Effectiveness

The Grant Effectiveness (Ratio of the total project costs to the total ODS phased out per year post-project)of this project works out to US$ 13.51/kg. This has been derived from the total project costs of US$406,300 and the total ODS phased out in the first year of operation post project of 30 MT.

Unit Abatement Costs

The unit abatement cost calculated over a 10 year life span of the project is US$ 3.10 per ODP weighted kg of CFC-11 phased out. This has been derived from the incremental annualized capital costs of US$341,000 and net annualized recurrent costs of US$37,500 (first year), for the phase-out of about 30 ODP weighted MT of CFC-11.

The cost-effectiveness of this project is close to or better than similar other projects, and is also within the recent guidelines from the Fund Secretariat for such projects.

REQUIRED REGULATORY ACTION

The Government of India has already waived import duties on the equipment to be used in ODS phase-out projects. Further legislations or regulations are expected. However this project does not require any specific regulatory action other than the above.

RESULTS

This project will eliminate the use of atleast 30 MT of CFC-11 in the first year of implementation.

PROJECT IMPLEMENTATION SCHEDULE

TASK	Q1	Q2	Q3	Q4	Q5	Q6
1. a) MLF Approval b) ProcurementPreparation c) Vendor Selection	X X X	X				
2. a) Transportation, arrival and customs clearance b) Installation and plant modifications.			 X	X X		
3. a) Machine Start-up b) Trials/Training c) Certification					X X	X X

ANNEXURES

Annexure 1 : Capital Costs
Annexure 2 : Incremental Operating Costs
Annexure 3 : Cost Effectiveness
Annexure 4 : Technical Review

ANNEXURE 1

Capital Costs in US$

1. One High Pressure Foam Dispenser with four mixing heads (Including freight, installation, etc.)	230,000
2. Closed system pre-mix station	60,000
3. Trials	5,000
4. Training	5,000
5. Technical assistance for formulation development	10,000
Incremental Capital Costs	**310,000**
Contingencies @ 10%	31,000
Total	**341,000**

Notes :

1. The prices for the items of machinery are based on standardised price-lists of reputed suppliers, and are corrected for rebates applicable for bulk purchases.

2. It is understood that the machines proposed to be replaced will either be scrapped or surrendered to an agency approved by the National Co-ordinating body for such projects.

ANNEXURE 2

Incremental Operating Costs

Assumptions

1. CFC-11 Price : US$ 2.00/kg
2. MDI Price : US$ 2.00/kg
3. HCFC-141b Price : US$ 3.50/kg
4. No growth considered.

Calculations

Baseline	1995	1996
Cost of 30 MT CFC-11(US$)	60,000	60,000
Total (US$)	60,000	60,000
Post-Project		
Cost of 25 MT HCFC-141b	87,500	87,500
Cost of 5 MT MDI (US$)	10,000	10,000
Total (US$)	97,500	97,500
Net Incremental Costs (US$)	37,500	37,500
Discount Factor	0.91	0.83
NPV @ 10% (US$)	**34,125**	**31,125**
For 2 years (US$)	65,300	

ANNEXURE 3

Cost Effectiveness

Grant Effectiveness

A. Incremental Capital Costs	US$ 341,000
B. Incremental Operating Costs (NPV)	US$ 65,300
C. Total Project Costs (A+B)	US$ 406,300
D. Total ODS phased out	Kg 30,000
GRANT EFFECTIVENESS [C/D]	US$13.51/kg/y

Unit Abatement Costs

A.	Incremental Capital Costs	US$341,000
B.	Annualized Incremental Operating Costs	US$ 37,500
C.	Project Useful Life	10 years
D.	ODS reduction per year	Kg 30,000
E.	Capital Recovery Factor	0.16275
UNIT ABATEMENT COST [(A X E) + B] / D		**US$ 3.1/kg/y**

INDIA - PFEDA SYNTHETICS (P) LTD

TECHNOLOGY

The enterprise is proposing to replace the use of CFC 11 for the production of polyurethane integral skin mouldings by converting to the use of HCFC 141b.

The use of HCFC 141b is technically proven for this application and is used in different parts of the world. However, the use of HCFC 22 should be seriously considered. The enterprise expresses its retention of the option to implement HCFC 22 technology and has evaluated its use. Its experienced some frothing but there are several chemical suppliers operating in the market who have viable HCFC 22 technology and market these systems widely in W. Europe and elsewhere. HCFC 22 has an ODP(see below) 50% of that of HCFC 141b. The enterprise proposes closed premixing equipment which enables HCFC 22 to be used - the reviewer questions whether the trials were carried out with such equipment and, if not, suggests that the equipment should ameliorate any such problems. The equipment proposed would handle fully water-blown, gaseous HFCs or future liquid HFCs as future zero ODP options but would require safety modifications for the use of pentane.

ENVIRONMENTAL ISSUES

HCFC 141b (and HCFC 22) have residual ODPs of 0.11 (and 0.055 respectively) and should be replaced by zero ODP options as soon as the enterprise is satisfied that such a technology meets the specifications set by its customers.

PROJECT COSTS

The capital items proposed are justified. Presumably the exact costs will be ascertained from the vendors (eg. the Cannon quotation). The trials and training costs are reasonable.

Incremental costs could be affected by the use of HCFC 22.

HCFC 22 is also manufactured locally - a safeguard for its availability.

The project is relatively cost effective and within the EC guidelines.

IMPLEMENTATION TIMEFRAME

This is acceptable and in line with Cannon's (five months) delivery timescale.

RECOMMENDATION

Approval on the basis of further consideration of HCFC 22 technology.
This latter point should not delay project implementation.

GMFJ/kd/7/6/95

THE MONTREAL PROTOCOL ON
SUBSTANCES THAT DEPLETE THE OZONE LAYER

PROJECT COVER SHEET

COUNTRY	: India	
PROJECT TITLE	: Phase-out of CFCs in the manufacture of Extruded Polyethylene Foam at Kunststoff Polymers Ltd.	
SECTOR COVERED	: Foam Blowing	
ODS USE IN SECTOR	: 1577 MT of CFCs (1991)	
PROJECT IMPACT	: Phase out of 30 MT of CFC-12 (Base 1994-95)	
PROJECT DURATION	: 1.5 years	
PROJECT ECONOMIC LIFE	: 10 years	
OTAL PROJECT COST	: Incremental Capital Cost	US$ 277,000
	: Contingency @ 10%	US$ 22,700
	: Incremental Operating Savings	US$ 10,400
	: Incremental Project Cost	US$ 239,300
	: FA Fee @ 3%	US$ 7,200
	Total Project Cost	US$ 246,500
COST EFFECTIVENESS	: **Grant Effectiveness** US$ 7.98/kg/y **Unit Abatement Costs** US$ 1.15/kg/y	
PROPOSED OTF FINANCING	: US$ 246,500	
IMPLEMENTING ENTERPRISE	: Kunststoff Polymers Ltd.	
CO-ORDINATING NATIONAL BODY	: Ministry of Environment and Forests (MOEF)	
IMPLEMENTING AGENCY	: The World Bank	

PROJECT SUMMARY

This project will phase out 30 MT of CFC-12 consumption in the production of extruded polyethylene foam products, at Kunststoff Polymers Ltd., by converting foam operations to LPG. The project will require the installation of LPG storage and handling system, modifications to the extruder, extensive fire safety and alarm systems, safety and process training etc. Marginal operating savings are expected on account of the favorable price of the substitute.

Technical Assessment: This proposal has been reviewed by OORG Technical reviewer, Dr. M. Jeffs, whose comments are attached.

PROJECT OBJECTIVE

The objective of this project is to phase out the use of CFCs in the manufacture of extruded polyethylene foam products at Kunststoff Polymers Ltd., at Mandideep, near Bhopal, India.

SECTOR BACKGROUND

The Foam Sector in India consumed 1577 MT of CFCs in 1991. CFC-11 was the dominant substance followed by CFC-12. Some incidental use of CFC-113 and MCF (reported under the solvents sector) complete the consumption pattern.

The maximum consumption of CFCs was in the Rigid PUF insulating foams and refrigerants. Among the other foams (excluding rigid insulating foams for domestic refrigerators), the Flexible PUF has practically changed over to Methylene Chloride. The Molded foams are changing over to water blown technology. The higher Rigid foams, non insulating type are all water blown. The Rigid PUF for insulation applications consumes about 975 MT of CFCs and is expected to grow steadily.

The Ozone Cell, Ministry of Environment and Forests, is leading the efforts in the phase out of CFCs, in co-operation with the users/suppliers. Complete phaseout of CFCs in foams (except rigid foams) is targetted by 2000. Rigid PUF are expected to be CFC free by 2006.

This sector accounts for about 230 enterprises, of which about 20% are large/medium sized users, with relatively sophisticated equipment. The remaining are small scale and are technically unsophisticated. The support of chemical suppliers and associations will be crucial in reaching and educating these enterprises.

ENTERPRISE BACKGROUND

Kunststoff Polymers Ltd., is a 100% indigenously owned enterprise established in 1989. It manufactures a wide range of extruded polyethylene products, such as sheets, tubes etc., used extensively in packaging, anti-condensation insulation, etc. The enterprise has a large and growing market in India and also prospects of exports. Due to the growing demand for CFC-free products in the export market and also for economic reasons the enterprise has already initiated phasing out of CFC-12 as a blowing agent from its manufacturing operations.

In 1994-95 the enterprise produced about 120 MT of extruded polyethylene foam and consumed about 30 MT of CFC-12.

PROJECT DESCRIPTION

In this project, Kunststoff Polymers Ltd. will convert its manufacturing operations to butane. In India, a butane blend is available as LPG, which will require deoderizing. The enterprise has a Contiblow, Germany, make single screw horizontal 70 mm extruder that will require modifications/retrofitting for use with LPG. Storage and handling systems for LPG, extensive fire safety and alarm systems, ventilation, safety and process training will have to be provided.

JUSTIFICATION FOR SELECTION OF ALTERNATIVE TECHNOLOGY

Unlike the blowing agents in PUF where CFCs are generally auxilliary blowing agents, in thermoplastic foams (polystyrene, polyethylene, polypropylene) CFCs are the sole physical blowing agents. They are required to satisfy the following criteria :

> Solubility in the resin
> Worker Safety
> Consumer Safety
> Environmental Safety
> Thermal and chemical stability
> Diffusivity

Of the wide range of options that have been proposed, such as atmospheric gases (carbondioxide, nitogen), hydrocarbons (butane, pentane, isobutane, isopentane, LPG), hydrochlorofluorocarbons (HCFC-22, HCFC142b), hydrofluorocarbons (HFC-134a, HFC-152a, etc.) hydrocarbons are proven replacements, with a cost effective technology, favorable price, good solubility, no ODP or GWP. However due to the flammability of hydrocarbons, **stringent safety precautions in manufacturing and handling are required.**

PROJECT COSTS

The total project cost (investment cost and incremental recurrent savings) is estimated at US$ 239,300.

The investment costs of US$ 249,700 include capital investment in LPG tank, pump & piping system, extruder modifications, fire safety systems, etc. The breakdown of these, is provided in Annexure 1.

The incremental operating savings of US$ 10,400 represent the net present value of incremental operating savings for two years of operation and do not reflect growth. Details are provided in Annexure 2.

COST EFFECTIVENESS

Grant Effectiveness

The Grant Effectiveness (ratio of the total project costs to the total ODS phased out per year post-project)of this project works out to US$ 7.98/kg/y. This has been derived from the total project cost of US$ 239,300 and the total CFC-12 phased out in the first year of operation post project of 30 MT.

Unit Abatement Costs

The unit abatement cost calculated over a 10 year life span of the project is US$ 1.15 per kg of CFC-12 phased out. This has been derived from the incremental annualized capital costs of US$ 249,700 and net annualized recurrent savings of US$ 6,000 (first year), for the phase-out of about 30 MT of CFC-12.

The cost-effectiveness of this project is close to or better than other similar projects and is also within the recent guidelines from the Fund Secretariat for such projects.

REQUIRED REGULATORY ACTION

The Government of India has already waived import duties on the equipment to be used in ODS phase-out projects. Further legislations or regulations are expected. However this project does not require any specific regulatory action other than the above.

RESULTS

This project will eliminate the use of atleast 30 MT of CFC-12 in the first year of implementation.

PROJECT IMPLEMENTATION SCHEDULE

TASK	Q1	Q2	Q3	Q4	Q5	Q6
1. a) MLF Approval	X					
b) ProcurementPreparation	X	X				
c) Vendor Selection	X					
2. a) Transportation, arrival and customs clearance				X		
b) Installation and plant modifications.			X	X		
3. a) Machine Start-up					X	
b) Trials/Training					X	X
c) Certification						X

ANNEXURES

Annexure 1 : Capital Costs
Annexure 2 : Incremental Operating Costs
Annexure 3 : Cost Effectiveness
Annexure 4 : Technical Review

ANNEXURE 1

Capital Costs in US$

1. LPG bulk tank, pump and piping (Inclusive of safety related civil works)	US$ 60,000
2. Civil works connected with tanks and construction of fireproof pump room	US$ 20,000
3. Deodorizer and buffer dosing unit	US$ 25,000
4. Extruder retrofitting	US$ 40,000
5. Fire safety & Alarm systems	US$ 72,000
Exhaust fans (12 Nos.)	6,000
Industrial blow down fans(12)	12,000
Ventilation ducting	5,000
Gas sensing/detection system	10,000
Portable gas detector (1)	4,000
Fire extinguishers : Trolley Mounted (2)4,000 Handheld(12)	3,000
Static eliminator (2)	6,000
Emergency lights (8)	2,000
Water Sprinkler System	20,000
7. Technology Transfer	US$ 10,000
Incremental Capital Costs	US$ 227,000
Contingencies @ 10%	US$ 22,700
Total	**US$ 249,700**

ANNEXURE 2

Incremental Operating Costs/Savings

Assumptions

1. CFC-12 Price : US$ 2.20/kg
2. LPG Price : US$ 0.80/kg
3. Cost of electricity : US$ 0.10/kwh
4. Operating Time : 5000 hrs/yr
5. Extra electrical load : 50 kw
6. Maintenance Costs : 5% of capital costs/yr
7. Insurance Costs : 2.5% of capital costs/yr
8. No growth considered.

Calculations

Baseline	1995	1996
Cost of 30 MT CFC-12(US$)	66,000	66,000
Total (US$)	77,000	77,000
Post-Project		
Cost of 30 MT LPG (US$)	24,000	24,000
Cost of extra electricity	25,000	25,000
Extra maintenance costs	13,000	13,000
Extra insurance	6,500	6,500
Continuing safety training	2,500	2,500
Total (US$)	71,000	71,000
Net Incremental Savings (US$)	(6,000)	(6,000)
Discount Factor	0.91	0.83
NPV @ 10% (US$)	**(5,460)**	**(4,980)**
For 2 years (US$)	**(10,440)**	

ANNEXURE 3

Cost Effectiveness

Grant Effectiveness

A. Incremental Capital Costs	US$249,700
B. Incremental Operating Savings	US$(10,400)
C. Total Project Costs (A+B)	US$239,300
D. Total ODS phased out	Kg 30,000
GRANT EFFECTIVENESS [C/D]	**:US$7.98/kg/y**

Unit Abatement Costs

A. Incremental Capital Costs	US$ 249,700
B. Annualized Incremental Operating Savings	US$ (6,000)
C. Project Useful Life	10 years
D. ODS reduction per year	Kg 30,000
E. Capital Recovery Factor	0.16275
UNIT ABATEMENT COST [(A X E) + B] / D	**US$ 1.15/kg/y**

INDIA - KUNSTSTOFF POLYMERS LTD.

TECHNOLOGY

The enterprise is proposing to replace the use of CFC 12 in the manufacture of extruded polyethylene by butane.

Hydrocarbons are a proven technology for this application. The use of butane requires extensive safety equipment and operating procedures (see below).

ENVIRONMENTAL ISSUES

The main issue is the safety of the operation with highly flammable hydrocarbon technology. The equipment proposed would appear to be adequate. There should be a statement on the advice given to the enterprise in this respect - is this what the item "technology transfer" in the one-off costs refer to ?

The enterprise should also ascertain that it is complying with all relevant regulations concerning VOCs.

PROJECT COSTS

The project cost effectiveness exactly matches the limit set by the EC ! The capital items are justified.

The incremental cost calculation indicates a slight saving - these should be reviewed in the light of actual electricity and maintenance costs.

IMPLEMENTATION TIMEFRAME

Acceptable.

RECOMMENDATION

Approval.

GMFJ/kd/7/6/95

SUBPROJECT PROPOSAL

PROJECT COVER SHEET

COUNTRY	:	India
PROJECT TITLE automotive	:	Phase-out of CFCs in the manufacture of PUF moldings at Vijayjyot Seats Ltd.
SECTOR COVERED	:	Foam Blowing
ODS USE IN SECTOR	:	1577 MT of CFCs (1991)
PROJECT IMPACT	:	Phase out of 49 MT of CFC-11 (Base 1994-95)
PROJECT DURATION	:	1.5 years
PROJECT ECONOMIC LIFE	:	10 years
TOTAL PROJECT COST	:	Incremental Capital Cost US$ 222,000 Contingency @ 10% US$ 22,200 Incremental Operating Costs US$ 103,500 Total Incremental Cost : US$ 347,700 FA fee @ 3% US$ 10,400 Total Project Cost US$ 358,100
COST EFFECTIVENESS	:	**Grant Effectiveness** : US$ 7.10/kg/y **Unit Abatement Costs** : US$ 2.03/kg/y
PROPOSED OTF FINANCING	:	US$ 358,100 as grant
IMPLEMENTING ENTERPRISE	:	Vijayjyot Seats Ltd.
CO-ORDINATING NATIONAL BODY	:	Ministry of Environment and Forests (MOEF)
IMPLEMENTING AGENCY	:	The World Bank

PROJECT SUMMARY

This project will phase out 49 MT of CFC-11 consumption in the production of molded PUF automotive components, at Vijayjyot Seats Ltd., by converting foam operations to all water-blown system for cold-cure moldings and HCFC-141b for integral skin moldings. The project will require the replacement of one existing low pressure foaming unit by a high pressure unit, a blender, trials, technical assistance for formulation development and training. Due to the increased cost of the HCFC-141b formulation, some incremental operating costs are also foreseen.

Technical Assessment: This proposal has been reviewed and supported by OORG technical reviewer, Mr. M. Jeffs, whose comments are attached.

PROJECT OBJECTIVE

The objective of this project is to phase out the use of CFCs in the manufacture of cold cured and integral skin molded PUF automotive components, at Vijayjyot Seats Ltd., at Halol, near Baroda, India.

SECTOR BACKGROUND

The Foam Sector in India consumed 1577 MT of CFCs in 1991. CFC-11 was the dominant substance followed by CFC-12. Some incidental use of CFC-113 and MCF (reported under the solvents sector) complete the consumption pattern.

The maximum consumption of CFCs was in the Rigid PUF insulating foams and refrigerants. Among the other foams (excluding rigid insulating foams for domestic refrigerators), the Flexible PUF has practically changed over to Methylene Chloride. The Molded foams are changing over to water blown technology. The higher Rigid foams, non insulating type are all water blown. The Rigid PUF for insulation applications consumes about 975 MT of CFCs and is expected to grow steadily.

The Ozone Cell, Ministry of Environment and Forests, is leading the efforts in the phase out of CFCs, in co-operation with the users/suppliers. Complete phaseout of CFCs in foams (except rigid foams) is targetted by 2000. Rigid PUF are expected to be CFC free by 2006.

This sector accounts for about 230 enterprises, of which about 20% are large/medium sized users, with relatively sophisticated equipment. The remaining are small scale and are technically unsophisticated. The support of chemical suppliers and associations will be crucial in reaching and educating these enterprises.

ENTERPRISE BACKGROUND

This enterprise was established in 1987 as Premier Auto Electric Ltd. (Polymer Division) and began commercial production in 1989. The enterprise was taken over by the Shah & Motasha group of companies in 1994, and now operates as Vijajyot Seats Ltd. The product range (having a brand name 'Royal Comfort') includes complete seating systems for automobiles and also vehicle interior items such as door pads, steering wheels, arm-rests, RIM fenders, etc. The customers include reputed automobile manufacturers like Tata, PAL-Peugeot, GM, etc.

The enterprise employs about 234 persons of which about 30 are technically qualified. The company produced about 350 MT of moldings in 1994-95 and expects to double this production in the forthcoming year. The total CFC-11 consumption during 1994-95 was 49 MT.

PROJECT DESCRIPTION

In this project, Vijayjyot Seats Ltd. will phase out CFC-11usage from its production of cold cured and integral skin molded PUF automotive components such as seat cushions, steering wheels, etc. The manufacturing facilities include the following foaming equipment :

One Cannon High Pressure Foam Dispenser (Model H40)

One Cannon High Pressure Foam Dispenser (Model H100)
One Cannon Low Pressure Foam Dispenser (Model C60)

The low pressure machine is used for making PUF integral skin moldings. It is provided with a mold heating tunnel mounted on a 12-mold carousel. The high pressure machines produce cold-cured moldings.

The enterprise will switch to all-water blown system for its cold-cured molding operation. This new formulation can be handled by the existing machines. Provision for a mold heating oven, a set of 12 new metallic molds, trials, technical assistance for formulation development and training will need to be made.

For its integral skin molding operation, the enterprise will convert to HCFC-141b-based formulation, however the enterprise will retain its option to try out HCFC-22 based systems. This will involve replacing the low pressure machine with a high pressure machine. In addition, a closed system pre-mix station for closer control over formulations (and for future gaseous alternatives if required) will be required. Provision for trials, technical assistance for formulation development and training will also be made.

JUSTIFICATION FOR SELECTION OF ALTERNATIVE TECHNOLOGY

There are numerous technologies to replace the use of CFCs in cold-cured molded PUF. Available replacements fall into the following categories :

- Alternative blowing agents
- Alternative chemistry
- Alternative manufacturing technologies

The enterprise has selected alternative chemistry option, comprising of all-water blown high resilience foam. This requires lower investments than for alternative manufacturing, avoids potential quality discrepancies (as in alternative blowing agents) and allows maintaining of the foam properties.

Integral skin foams are characterised by a high density outer skin and low density soft inner core. In addition to the blowing of foam, the blowing agent is required to perform auxilliary functions such as skin formation and decrease of viscosity. HCFCs satisfy the market requirements for aesthetics and performance and are considered the most acceptable interim substitutes. HCFCs such as -22, -141b, -123 have all been tested with mostly positive results. However HCFC-22 in certain formulations has been seen to cause frothing. HCFC-141b appears to be the most viable interim substitute, though price and availability questions need to be addressed more satisfactorily.

Possible replacement scenarios for the future comprise of Hydrocarbons (Pentanes), HFCs (152a, 134a, 125, 245, 356) either independently or as a supplement to water-based formulations, and fully water blown foams.

In this project the proposed investments will allow the enterprise to implement any of the above alternatives with little or no new investments

PROJECT COSTS

The total project cost (investment cost and incremental recurrent cost) is estimated at US$ 347,700.

The investment costs of US$ 244,200, including 10% contingency, include capital investment in one high pressure foaming unit, trials etc. The cost breakdown is provided in Annexure 1.

The incremental operating costs of US$ 103,500 represent net present value of incremental operating costs for two years of operation and do not reflect growth. Details are provided in Annexure 2.

COST EFFECTIVENESS

Grant Effectiveness
The Grant Effectiveness (ratio of the total project costs to the total ODS phased out per year post-project) of this project works out to US$ 7.10/kg. This has been derived from the total project cost of US$ 347,700 and the total ODS phased out in the first year of operation post project of 49 MT.

Unit Abatement Costs
The unit abatement cost calculated over a 10 year life span of the project is US$ 2.03 per ODP weighted kg of CFC-11 phased out. This has been derived from the incremental annualized capital costs of US$ 244,200 and net annualized recurrent costs of US$ 59,500(first year), for the phase-out of about 49 ODP weighted MT of CFC-11.

The cost-effectiveness of this project is close to or better than other similar projects and is also within the recent guidelines from the Fund Secretariat for such projects.

REQUIRED REGULATORY ACTION

The Government of India has already waived import duties on the equipment to be used in ODS phase-out projects. Further legislations or regulations are expected. However this project does not require any specific regulatory action other than the above.

RESULTS

This project will eliminate the use of at least 49 MT of CFC-11 in the first year of implementation.

PROJECT IMPLEMENTATION SCHEDULE

TASK	Q1	Q2	Q3	Q4	Q5	Q6
1. a) MLF Approval b) ProcurementPreparation c) Vendor Selection	X X X	X				
2. a) Transportation, arrival and customs clearance b) Installation and plant modifications.			X	X X		
3. a) Machine Start-up b) Trials/Training c) Certification					X X	X X

ANNEXURES

Annexure 1 : Capital Costs
Annexure 2 : Incremental Operating Costs
Annexure 3 : Cost Effectiveness
Annexure 4 : Technical Review

ANEXURE 1

Capital Costs in US$

1. One High Pressure Foam Dispenser (Including freight, installation, etc.)	115,000
2. Closed-system Premix Station	60,000
3. Mold heating Oven	10,000
4. Metallic Molds (12 Nos.)	12,000
5. Trials	10,000
6. Technical Assistance for Formulation Development	10,000
7. Training	5,000
Incremental Capital Costs	**222,000**
Contingencies @ 10%	22,200
Total	**244,200**

ANNEXURE 2

Incremental Operating Costs

Assumptions

1. CFC-11 Price : US$ 2.00/kg
2. MDI Price : US$ 2.00/kg
3. HCFC-141b Price : US$ 3.50/kg
4. No growth considered.

Calculations

Baseline		1995	1996
Cost of 49 MT CFC-11(US$)	:	98,000	98,000
Total (US$)		98,000	98,000
Post-Project			
Cost of 21MT HCFC-141b	:	73,500	73,500
Cost of 42 MT MDI (US$)	:	84,000	84,000
Total (US$)	:	157,500	157,500
Net Incremental Costs (US$)	:	59,500	59,500
Discount Factor	:	0.91	0.83
NPV @ 10% (US$)	:	**54,145**	**49,385**
For 2 years (US$) , rounded	:	**103,500**	

ANNEXURE 3

Cost Effectiveness

Grant Effectiveness

A. Incremental Capital Costs	:	US$	244,200
B. Incremental Operating Costs	:	US$	103,500
C. Total Project Costs (A+B)	:	US$	347,700
D. Total ODS phased out	:	Kg	49,000
GRANT EFFECTIVENESS [C/D]	:	**US$**	**7.1/kg/y**

Unit Abatement Costs

A. Incremental Capital Costs	:	US$	244,200
B. Annualized Incremental Operating Costs	:	US$	59,500
C. Project Useful Life	:	10 years	
D. ODS reduction per year	:	Kg	49,000
E. Capital Recovery Factor	:	0.16275	
UNIT ABATEMENT COST [(A X E) + B] / D	:	**US$**	**2.03/kg/y**

INDIA - VJAYJYOT SEATS LTD.

TECHNOLOGY

The enterprise manufactures moulded flexible polyurethane foam seat cushions and automotive integral skin articles and proposes to convert from CFC 11 to all water blown (CO_2) and HCFC 141b-based technologies respectively.

For moulded seats water blown technology is the world-wide norm and no other option needs to be considered.

For polyurethane integral skin mouldings HCFC 141b represents a viable and widely used technology. However, HCFC 22 is even more widely used, satisfies stringent specifications set by automotive manufacturers and has 50% of the ODP of HCFC 141b. It is also locally produced. Hence, it is recommended that HCFC 22 be further considered. The equipment proposed is compatible with HCFC 22 and with the zero ODP blowing agents which listed - with the exception of pentane.

ENVIRONMENTAL ISSUES

The main issue relates to the ODP of HCFC 141b (or HCFC 22). The enterprise should continue to evaluate zero ODP technologies.

PROJECT COSTS

The cost effectiveness, measured by UAC, is comparatively reasonable. The grant effectiveness lies above the EC guideline for flexible foam but well below that for integral skin foams.

The hardware capital items are justified - the new moulds on the basis that (some of) the current moulds are made of epoxy.

The incremental cost calculation is clear and justified.

IMPLEMENTATION TIMEFRAME

Acceptable.

RECOMMENDATION

Approval.

The enterprise should pursue HCFC 22 integral skin technology in place of HCFC 141b but this should not hold up the project.

GMFJ/kd/7/6/95

JUSTIFICATION FOR SELECTION OF ALTERNATIVE TECHNOLOGY

There are numerous technologies to replace the use of CFCs in flexible molded PUF. Available replacements fall into the following categories :

- Alternative blowing agents
- Alternative chemistry
- Alternative manufacturing technologies

The enterprise has selected alternative chemistry option, comprising of all-water blown high resilience foam. This requires lower investments than for alternative manufacturing, avoids potential quality discrepancies (as in alternative blowing agents) and allows maintaining of the foam properties.

The water-based formulations can be developed under the guidance of an external process expert with or in co-operation with the system suppliers.

PROJECT COSTS

The project cost (investment cost and incremental recurrent cost) is estimated at US$226,900.

The investment costs of US$157,300 (including 10% contingency) include capital investment in mixing heads, mold oven, molds, trials etc. The cost breakdown is provided in Annexure 1.

The incremental operating costs of US$69,600 represent net present value of incremental operating costs for two years of operation and do not reflect growth. Details are provided in Annexure 2.

COST EFFECTIVENESS

Grant Effectiveness
The Grant Effectiveness (ratio of the total project costs to the total ODS phased out per year post-project)of this project works out to US$ 5.67/kg. This has been derived from the total project cost of US$226,900 and the total ODS phased out in the first year of operation post project of 40 MT.

Unit Abatement Costs
The unit abatement cost calculated over a 10 year life span of the project is US$1.64 per ODP weighted kg of CFC-11 phased out. This has been derived from the incremental annualized capital costs of US$157,300 (excluding the contingency) and net annualized recurrent costs of US$40,000 (first year), for the phase-out of about 40 ODP weighted MT of CFC-11.

The cost-effectiveness of this project is close to or better than other similar projects and is also within the recent guidelines from the Fund Secretariat for such projects.

REQUIRED REGULATORY ACTION

The Government of India has already waived import duties on the equipment to be used in ODS phase-out projects. Further legislations or regulations are expected. However this project does not require any specific regulatory action other than the above.

RESULTS

This project will eliminate the use of atleast 40 MT of CFC-11 in the first year of implementation.

PROJECT IMPLEMENTATION SCHEDULE

TASK	Q1	Q2	Q3	Q4	Q5	Q6
1. a) MLF Approval b) ProcurementPreparation c) Vendor Selection	X X X	X				
2. a) Transportation, arrival and customs clearance b) Installation and plant modifications.			 X	X X		
3. a) Machine Start-up b) Trials/Training c) Certification					X X	 X X

ANNEXURES

Annexure 1 : Capital Costs
Annexure 2 : Incremental Operating Costs
Annexure 3 : Cost Effectiveness
Annexure 4 : Technical Review

SUBPROJECT PROPOSAL

PROJECT COVER SHEET

COUNTRY	:	India
PROJECT TITLE	:	Phase-out of CFCs in the manufacture of molded PUF automotive seats at Polyflex (India) P.Ltd.
SECTOR COVERED	:	Foam Blowing
ODS USE IN SECTOR	:	1577 MT of CFCs (1991)
PROJECT IMPACT	:	Phase out of 40 MT of CFC-11 (Base 1994-95)
PROJECT DURATION	:	1.5 years
PROJECT ECONOMIC LIFE	:	10 years
TOTAL PROJECT COST	:	Incremental Capital Cost: US$ 143,000 Contingency @ 10%: US$ 14,300 Incremental Operating Costs: US$ 69,600 Incremental Project Cost: US$ 226,900 FA fee @ 3%: US$ 6,800 Total Project Cost: US$ 233,700
COST EFFECTIVENESS	:	**Grant Effectiveness**: US$ 5.67/kg/y **Unit Abatement Costs:** US$ 1.64/kg/y
PROPOSED OTF FINANCING	:	US$ 233,700
IMPLEMENTING ENTERPRISE	:	Polyflex (India) P.Ltd.
CO-ORDINATING NATIONAL BODY	:	Ministry of Environment and Forests (MOEF)
IMPLEMENTING AGENCY	:	The World Bank

PROJECT SUMMARY

This project will phase out 40 MT of CFC-11 consumption in the production of molded PUF automotive seats, at Polyflex (India) P.Ltd., by converting foam operations to all water-blown system. The enterprise has already high pressure machines that can handle the new formulations. The project envisages upgrading of the mixing heads, mold oven, mold upgrading, trials, technical assistance for formulation development and training. Increased operating costs are expected due to the higher cost of the water-based formulation.

Technical Assessment: This proposal has been reviewed and supported by OORG technical reviewer, Mr. M. Jeffs, whose comments are attached.

PROJECT OBJECTIVE

The objective of this project is to phase out the use of CFCs in the manufacture of molded PUF automotive seats at Polyflex (India) P.Ltd., near Bangalore, India.

SECTOR BACKGROUND

The Foam Sector in India consumed 1577 MT of CFCs in 1991. CFC-11 was the dominant substance followed by CFC-12. Some incidental use of CFC-113 and MCF (reported under the solvents sector) complete the consumption pattern.

The maximum consumption of CFCs was in the Rigid PUF insulating foams and refrigerants. Among the other foams (excluding rigid insulating foams for domestic refrigerators), the Flexible PUF has practically changed over to Methylene Chloride. The Molded foams are changing over to water blown technology. The higher Rigid foams, non insulating type are all water blown. The Rigid PUF for insulation applications consumes about 975 MT of CFCs and is expected to grow steadily.

The Ozone Cell, Ministry of Environment and Forests, is leading the efforts in the phase out of CFCs, in co-operation with the users/suppliers. Complete phaseout of CFCs in foams (except rigid foams) is targetted by 2000. Rigid PUF are expected to be CFC free by 2006.

This sector accounts for about 230 enterprises, of which about 20% are large/medium sized users, with relatively sophisticated equipment. The remaining are small scale and are technically unsophisticated. The support of chemical suppliers and associations will be crucial in reaching and educating these enterprises.

ENTERPRISE BACKGROUND

Polyflex (India) P.Ltd. was established in 1984. The enterprise manufactures cold-cured molded PUF seat cushions for automotive applications, as an OEM supplier to most two-wheeler scooter/motorcycle manufacturers such as Bajaj Auto, Kinetic Honda, Escorts Yamaha, etc. The enterprise claims 80% of the share of the two-wheeler seats market in India, producing about one million seats per year. The enterprise has about 100 employees, mostly technically qualified/trained.

The enterprise is very keen to convert its operations to CFC-free technologies. In 1994-95, it produced about 750 MT of moldings, consuming 40 MT of CFC-11 and has already begun trials in this direction.

PROJECT DESCRIPTION

Polyflex (India) P.Ltd. has two high pressure foam dispensers. (Hennecke Models HK 270 & HK 650). There are a total of 95 metallic and epoxy molds in use, for various sizes of seats/products. The molds are mounted on rotary tables as well as on trolleys. The enterprise will convert its foaming operations to water-based formulations. This can be implemented with the existing high pressure machines. The old mixing heads will have to be replaced to handle the new formulations. Some of the old epoxy molds will also need to be replaced with metallic molds to withstand higher reaction temperatures. A mold heating oven will be needed. Due to the large volume of production, some provision for validation testing shall be made. Provision for trials, technical assistance for formulation development, and training will also be made. Due to the higher cost of the new formulation, increased operating costs are expected.

ANNEXURE 1

Capital Costs in US$

1. Mixing Heads for two high pressure machines	50,000
2. Mold heating Oven	10,000
3. Metallic Molds (48 Nos)	48,000
4. Validation Testing	5,000
4. Trials (for 3 formulations at US$ 5,000 each)	15,000
5. Technical assistance for formulation development	10,000
5. Training	5,000
Incremental Capital Costs	**143,000**
Contingencies @ 10%	14,300
Total	**157,300**

ANNEXURE 2

Incremental Operating Costs

Assumptions

1. CFC-11 Price : US$ 2.0/kg
2. MDI Price : US$ 2.0/kg
3. No growth considered.

Calculations

Baseline	1995	1996
Cost of 40 MT CFC-11(US$)	80,000	80,000
Cost of 140 MT MDI (US$)	280,000	280,000
Total (US$)	360,000	360,000
Post-Project		
Cost of 200 MT MDI (US$)	400,000	400,000
Total (US$)	400,000	400,000
Net Incremental Costs (US$)	40,000	40,000
Discount Factor	0.91	0.83
NPV @ 10% (US$)	**36,400**	**33,200**
For 2 years (US$)	**69,600**	

ANNEXURE 3

Cost Effectiveness

Grant Effectiveness

A. Incremental Capital Costs	US$	157,300
B. Incremental Operating Costs	US$	69,600
C. Total Project Costs (A+B)	US$	226,900
D. Total ODS phased out	Kg	40,000
GRANT EFFECTIVENESS [C/D]	**US$**	**5.67/kg/y**

Unit Abatement Costs

A. Incremental Capital Costs	US$	157,300
B. Annualized Incremental Operating Costs	US$	40,000
C. Project Useful Life	10 years	
D. ODS reduction per year	Kg	40,000
E. Capital Recovery Factor	0.16275	
UNIT ABATEMENT COST [(A X E) + B] / D	**US$**	**1.64/kg/y**

INDIA - POLYFLEX (INDIA) P LTD.

TECHNOLOGY

The enterprise proposes to convert from CFC 11-based to all water (CO_2) blown technology for the manufacture of a wide range of flexible polyurethane moulded foam seats for two-wheeled vehicles.

The enterprise has considered other technologies but finalised on water-blown. This is the widely used industry norm.

ENVIRONMENTAL ISSUES

There are no significant environmental or safety issues associated with this zero ODP technology.

PROJECT COSTS

The cost effectiveness is within EC guidelines.

The capital items listed are justified. The current high pressure equipment is modified by the proposed new mixing heads. The change-over of 48 moulds from epoxy to metal is also justified.

The operating costs are clearly set out and are justified.

IMPLEMENTATION TIMEFRAME

Acceptable.

RECOMMENDATION

Approval.

GMFJ/kd/7/6/95

SUBPROJECT PROPOSAL

PROJECT COVER SHEET

COUNTRY	: India	
PROJECT TITLE	: Phase-out of CFCs in the manufacture of molded PUF at PUR Polyurethane Products P.Ltd.	
SECTOR COVERED	: Foam Blowing	
ODS USE IN SECTOR	: 1577 MT of CFCs (1991)	
PROJECT IMPACT	: Phase out of 17 MT of CFC-11 (Base 1994-95)	
PROJECT DURATION	: 1.5 years	
PROJECT ECONOMIC LIFE	: 10 years	
TOTAL PROJECT COST	: Incremental Capital Cost:	US$ 161,000
	Contingency @ 10%:	US$ 16,100
	Incremental Operating Costs:	US$ 17,400
	Incremental Project Cost:	US$ 194,500
	FA fee @ 3%:	US$ 5,800
	Total Project Cost:	US$ 200,300
COST EFFECTIVENESS	: **Grant Effectiveness:**	US$ 11.44/kg/y
	Unit Abatement Costs:	US$ 2.28/kg/y
PROPOSED OTF FINANCING	: US$ 200,300	
IMPLEMENTING ENTERPRISE	: PUR Polyurethane Products P.Ltd.	
CO-ORDINATING NATIONAL BODY	: Ministry of Environment and Forests (MOEF)	
IMPLEMENTING AGENCY	: The World Bank	

PROJECT SUMMARY

This project will phase out 17 MT of CFC-11 consumption in the production of PUF molded automotive seats, at PUR Polyurethane Products P.Ltd., by converting foam operations to all water blown system. The project will require the replacement of the existing two low pressure foaming units by one high pressure unit, a mold oven, trials, technical assistance for new formulations and training. Provision has also been made for increased operating costs due to the higher costs of the new formulation that are foreseen.

TECHNICAL ASSESSMENT: This proposal has been reviewed by OORG Technical reviewer Dr. M. Jeffs, whose comments are attached.

PROJECT OBJECTIVE

The objective of this project is to phase out the use of CFCs in the manufacture of molded PUF seat cushions at PUR Polyurethane Products P. Ltd., New Delhi, India.

SECTOR BACKGROUND

The Foam Sector in India consumed 1577 MT of CFCs in 1991. CFC-11 was the dominant substance followed by CFC-12. Some incidental use of CFC-113 and MCF (reported under the solvents sector) complete the consumption pattern.

The maximum consumption of CFCs was in the Rigid PUF insulating foams and refrigerants. Among the other foams (excluding rigid insulating foams for domestic refrigerators), the Flexible PUF has practically changed over to Methylene Chloride. The Molded foams are changing over to water blown technology. The higher Rigid foams, non insulating type are all water blown. The Rigid PUF for insulation applications consumes about 975 MT of CFCs and is expected to grow steadily.

The Ozone Cell, Ministry of Environment and Forests, is leading the efforts in the phase out of CFCs, in co-operation with the users/suppliers. Complete phaseout of CFCs in foams (except rigid foams) is targetted by 2000. Rigid PUF are expected to be CFC free by 2006.

This sector accounts for about 230 enterprises, of which about 20% are large/medium sized users, with relatively sophisticated equipment. The remaining are small scale and are technically unsophisticated. The support of chemical suppliers and associations will be crucial in reaching and educating these enterprises.

ENTERPRISE BACKGROUND

PUR Polyurethane Products P.Ltd., was established in 1983, as a 100% indigenously owned private limited enterprise. The enterprise manufactures molded PUF automotive seats, as an OEM supplier to automobile manufacturers like DCM-Toyota, Swaraj-Mazda, Rajdoot-Yamaha, Hero Mopeds etc. It also supplies molded PUF seats for buses/coaches and furniture applications.

The enterprise has about 20 employees. It produced about 120 MT of PUF moldings and consumed 17 MT of CFC-11 in 1994-95.

PROJECT DESCRIPTION

PUR Polyurethane Products P. Ltd. has the following foaming machines in production :

One OMS make High Pressure Dispenser (Model NHP-2)
One OMS make Low Pressure Dispenser (Model C-12)
One Cannon make Low pressure Dispenser (Model C-60)

In this project PUR will switch to all-water blown system, in place of CFC-11 formulation. To cater to the increased viscosity of the new formulation, one high pressure foam dispenser will be required to replace the existing two low pressure units. In addition, provision for a mold oven, trials, and technical assistance for formulation development will be made. Marginally increased operating costs are expected.

JUSTIFICATION FOR SELECTION OF ALTERNATIVE TECHNOLOGY

There are numerous technologies to replace the use of CFCs in molded PUF. Available replacements fall into the following categories :

- Alternative blowing agents
- Alternative chemistry
- Alternative manufacturing technologies

The enterprise has selected alternative chemistry option, comprising of all-water blown high resilience foam. This requires lower investments than for alternative manufacturing, avoids potential quality discrepancies (as in alternative blowing agents) and allows maintaining of the foam properties to a large extent.

PROJECT COSTS

The total project cost (investment cost and incremental recurrent cost) is estimated at US$194,500.

The investment costs of US$177,100 including 10% contingency, include capital investment in one high pressure foaming unit, trials etc. The cost breakdown is provided in Annexure 1.

The incremental operating costs of US$17,400 represent net present value of incremental operating costs for two years of operation and do not reflect growth. Details are provided in Annexure 2.

COST EFFECTIVENESS

Grant Effectiveness

The Grant Effectiveness (ratio of the total project costs to the total ODS phased out per year post-project)of this project works out to US$11.44/kg/y. This has been derived from the total project costs of US$194,500 and the total ODS phased out in the first year of operation post project of 17 MT.

Unit Abatement Costs

The unit abatement cost calculated over a 10 year life span of the project is US$2.28 per ODP weighted kg of CFC-11 phased out. This has been derived from the incremental annualized capital costs of US$177,100 and net annualized recurrent costs of US$10,000 (first year), for the phase-out of about 17 ODP weighted MT of CFC-11.

The cost-effectiveness of this project is close to or better than other similar projects and is also within the recent guidelines from the Fund Secretariat for such projects.

REQUIRED REGULATORY ACTION

The Government of India has already waived import duties on the equipment to be used in ODS phase-out projects. Further legislations or regulations are expected. However this project does not require any specific regulatory action other than the above.

RESULTS

This project will eliminate the use of atleast 17 MT of CFC-11 in the first year of implementation.

PROJECT IMPLEMENTATION SCHEDULE

TASK	Q1	Q2	Q3	Q4	Q5	Q6
1. a) MLF Approval b) ProcurementPreparation c) Vendor Selection	X X X	X				
2. a) Transportation, arrival and customs clearance b) Installation and plant modifications.			 X	X X		
3. a) Machine Start-up b) Trials/Training c) Certification					X X	 X X

ANNEXURES

Annexure 1 : Capital Costs
Annexure 2 : Incremental Operating Costs
Annexure 3 : Cost Effectiveness
Annexure 4 : Technical Review

ANNEXURE 1

Capital Costs in US$

1. High Pressure Foam Dispenser with two mixheads (Including freight, installation, etc.)	:	140,000
2. Mold heating Oven	:	10,000
3. Trials	:	3,000
4. Technical assistance for formulation development	:	5,000
5. Training	:	3,000
Incremental Capital Costs	**:**	**161,000**
Contingencies @ 10%	:	16,100
Total	**:**	**177,100**

ANNEXURE 2

Incremental Operating Costs

Assumptions

1. CFC-11 Price : US$ 2.0/kg
2. MDI Price : US$ 2.0/kg
3. No growth considered.

Calculations

Baseline	1995	1996
Cost of 17 MT CFC-11(US$)	34,000	34,000
Cost of 60 MT MDI (US$)	120,000	120,000
Total (US$)	154,000	154,000
Post-Project		
Cost of 82 MT MDI (US$)	164,000	164,000
Total (US$)	164,000	164,000
Net Incremental Costs (US$)	10,000	10,000
Discount Factor	0.91	0.83
NPV @ 10% (US$)	9,100	**8,300**
For 2 years (US$)	**17,400**	

ANNEXURE 3

Cost Effectiveness

Grant Effectiveness

A. Incremental Capital Costs	US$	177,100
B. Incremental Operating Costs	US$	17,400
C. Total Project Costs (A+B)	US$	194,500
D. Total ODS phased out	Kg	17,000
GRANT EFFECTIVENESS [C/D]	**US$**	**11.44/kg/y**

Unit Abatement Costs

A. Incremental Capital Costs	US$	177,100
B. Annualized Incremental Operating Costs	US$	10,000
C. Project Useful Life	10 years	
D. ODS reduction per year	Kg	17,000
E. Capital Recovery Factor	0.16275	
UNIT ABATEMENT COST [(A X E) + B] / D	**US$**	**2.28/kg/y**

INDIA - PUR POLYURETHANE PRODUCTS P LTD.

TECHNOLOGY

The enterprise manufactures flexible moulded polyurethane foam seats for vehicles and furniture and proposes to convert from using CFC 11 to an all water blown technology.

This is the industry norm, is relatively cost effective and no other technologies need to be seriously considered.

ENVIRONMENTAL ISSUES

There are no significant environmental or safety issues with this zero ODP technology.

PROJECT COSTS

The project cost effectiveness at 10.49 $/kg is outside the EC recommended limit (of 6.23$/kg). Nevertheless, the low UAC indicates a cost effective project considering the low level of ODS phased out.

The incremental operating cost calculation is transparent and accepted.

IMPLEMENTATION TIMEFRAME

Acceptable.

RECOMMENDATION

Approval.

GMFJ/kd/7/6/95

BACKGROUND NOTE ON AEROSOL PROJECTS SUBMITTED TO 17TH EC MEETING

Introduction

1. This background note provides information on the aerosol-sector projects which are being presented for consideration at the 17th Meeting of the Executive Committee (EC) of the Multilateral Fund for the Implementation of the [illegible]l (MFMP). This note presents information which is specific to the [illegible]ia but which is also relevant to other aerosol sectors in developing c[illegible]world.

2. To date, there have been very [illegible]hich have been funded by the Multilateral Fund. The reasons for t[illegible] given tha mature state of the substitute technologies, but it would [illegible] strong belief that conversion projects are inherently profitable and t[illegible] are no enterprise-level incremental cost. If this was the case, then conversions would have been completed on a global basis in developing countries except in countries where shortage of capital was accute. The results of the first phase of the Global Aerosol Project under Bank-lead execution clearly indicates that there remains significant CFC usage globally in the aerosol sector. It may also be said that a clear case has never been made to demonstrate that in a certain economies and under certain conditions of dual markets (both CFC and hydrocarbon-based products) there are no incremental savings from the conversion from CFC to a lower-cost propellant such as hydrocarbon aerosol propellant (HAP).

3. Recently, the World Bank, on behalf of the Government of India, presented aerosol-sector ODS phaseout projects for consideration under the Small Project Approval Procedure (SPAP). Although the projects met all the eligibility criteria, the presentation of the calculation of the incremental costs of the project was not sufficiently detailed to clearly demonstrate without the shadow of a doubt that no incremental savings accrue to the enterprise considering phasing out the use of ozone depleting substances (ODS).

4. Therefore, in order to promote the phaseout of ODS in the aerosol sector in India, an in-depth study was undertaken to determine, based on the prevailing local cost and market structures, the typical cost-benefit which would be faced by an enterprise considering the phaseout of CFCs. To this end, four detailed case studies were prepared. These are presented in Attachment 2. These case studies were prepared for three enterprises that are representative of the Indian enterprises active in the aerosol industry. These case studies address the cases of a silicon mold release aerosol filler, a room freshener aerosol filler and a perfume aerosol filler.

The Context of Aerosol-Sector Enterprises in India and Related Policy Matters

5. India has made significant progress in developing a policy-based action program for ODS phaseout in the aerosol sector which must now be supported by active development and implementation of investment projects. Key aspects of the action program are summarized below:

6. India's strategy paper for the aerosol sector has been prepared with support from India's Ministry of Environment and Forests (MOEF) and the Bank. The paper highlights the high growth rate in the sector. It appears that the aerosol industry grew at a 20% annual rate until 1993. This impressive growth rate has stabilized at about 10% per year and is expected to be maintained at this level for the foreseeable future. The strategy paper has also further highlighted the scattered and diverse ownership pattern for the industry and the need for a well coordinated sector approach to phase out ODS. A number of policy actions have already been taken, i.e.:

a) The Government has waived import duties on ODS related phaseout equipment. Most Indian aerosol enterprises are in the small scale and unorganized sector with limited financial resources and would not have been able to pay duties on the type of equipment that must be imported and needed for the safe transition to ODS-free technology;

b) The projects proposed to the 17th EC meeting will establish safety standards on an industry-wide basis that will facilitate the development of an ODS-free industry on a safe and sustainable basis, including the many small scale enterprises; and

c) The Government has also agreed that public-owned refineries will undertake to supply HAP. These three actions - HAP supply, waiving import duties and safety - are the most critical actions deterring phaseout in this sector.

d) The Government of India has already issued a draft Notification for providing ECO-MARK label for aerosol products under the Government scheme on Labeling of Environmentaly Friendly Products. This Notification is in the process of being finalized

7. MOEF has designated the Bank and UNIDO to develop work programs and investment projects in the aerosol sector. The Bank will concentrate on the larger projects working through IDBI (Industrial Development Bank of India) while UNIDO will focus on the smaller projects working through SIDBI (Small–Industries Development Bank of India). The Bank is also considering establishing a national execution mechanism through SIDBI for small scale projects in other ODS-consuming sectors.

Funding Level and Project Design Considerations

8. The design of each aerosol-sector project presented to the 17th EC Meeting has been critically assessed with regard to competitive supply of commercially proven and safe equipment including fire protection. Many enterprises use manual filling equipment with multiple systems to accommodate increasing production volume. Currently, manual systems are not commercially available that permit safe operation with HAP. The design philosophy adopted in this set of projects is as follows: a) replace three or more manual filling machines with one semi-automatic filling machine ; b) replace two semi-automatic filling machines with one automatic machine; c) defer to the demonstration project described below any enterprise that currently has only one manual machine and; d) substitute two or more semi-automatic machines with one automatic machines and e) substitute 1 semi-automatic machine with the same. In this manner, safety is fully taken into consideration without giving an enterprise an undue technology and/or capacity

upgrade. This replacement strategy results in cost effective projects which meet the threshold established by the EC.

9. Filling machines and other key equipment are standard sizes and prices have been set at the lowest price for competitively available machines. Since the mechanism for national execution is now in place in India, the subprojects would be implemented quickly once funding is approved and contingency allowance could be reduced to 10 percent for all projects. Safety and fire protection costs have been set at international levels for other similar projects that the EC has approved.

10. The project grant requests are based on 100 percent funding of capital costs given that there are no operating savings. The details supporting these proposals are presented in the following attachments to this note:

(a) Attachment 1 — Profitability Analysis of Typical Contract Filling;

(b) Attachment 2 — Profitability Analysis for Conversion from CFC to HAP - Three Case studies

11. As explained, under conditions prevailing in the Indian aerosol sector, reduction in aerosol product costs result in lower selling prices with the end result that there are no operational savings.

Implementation Arrangements

12. The critical assessment of capital costs for the projects has resulted in funding request for a number of projects to fall below US$100,000.

13. For these projects, the financial agent fee of 3 percent is well below IDBI costs for implementation supervision and is below the minimum threshold that IDBI has agreed for managing project implementation. MOEF has agreed to the transfer of these project to the implementation responsibility of UNIDO. Therefore, funds approved for aerosol-sector projects under US$100,000 should be transfered to UNIDO for their implementation.

Demonstration Project for Manual Filling Equipment

14. Through the Global Aerosol Project, the existence of a manual filling machine which can be utlized with HAP has been identified. This machine has never been commercialized and is not presently being manufactured on an on-going basis. It is being proposed that a small number of these machines be purchased and be tested in the field. Should this new machine prove to be suitable, it will significantly reduce the cost of phaseout of the very small aerosol fillers which utilize only one manual filling machine while significantly enhancing the safety of these operations. The demonstration project is also presented for the consideration of the Executive Committee.

Attachment I

Profitability Analysis of Typical Contract Filling

1. There are basically two types of enterprises that fill aerosol cans. The first fills only its own brands and products while the second fills only other companies brands and products. These "contract fillers" package various brands of aerosol products (different uses and sizes) and charge a "filling charge" for this service. The contract filler may also provide a market-ready product, but usually they only supply the filling service and a few packaging components (can, valve, top, etc.). Because propellants require storage in large tanks, and inventory control is difficult, the contract filler usually supplies the gas, buying in bulk and selling to his clients at a cost per gram. In today's market, contract fillers typically charge US$0.05-0.15 per can plus the cost of CFC 12. When they convert to hydrocarbon aerosol propellants (HAPs) or any other propellant, fillers will also charge US$0.05-0.15 plus the cost of the propellant. No savings accrue to the contract filler.

2. Because of the difference in densities between the two propellants (CFC-12 and HAP), the marketer or brand owner is, of course, always aware which propellant is being used in the product. ***No marketer will pay CFC prices for products filled with hydrocarbons i.e. there is a clear difference between the products.***

3. Furthermore, contract fillers have argued successfully that they serve as the storage depot for the CFC manufacturers, and they have achieved discounts through bulk purchases of CFCs. In India, they cannot obtain these discounts in HAPs which are sold at a standard price. They may be able to recover part of their cost of purification but that is all. Thus, *a contract filling company which is converting from CFCs to HAP could lose money in the loss of extra discounts.* No developing country aerosol contract filler (including those in India) has presented an investment project proposal claiming these "lost discounts" as a loss of profits. Contract filling can adapt many different forms but the filling service is invariably charged as a fixed fee per can as demonstrated below for perfume.

4. The tables that follow illustrate a typical contract filling calculation. There are a number of charges/costs (administrative, warehousing, shipping, etc.) which are independent of the propellant used. There are of course variations on this typical project. Some clients will buy their own bottles, others their own valves. Many will supply the cardboard boxes. Some companies will ask their contract filler to supply the solvent, in this case isopropyl alcohol (IPA).

5. Contract fillers have always played an important part in the aerosol sector. They offer a valuable service that allows many companies to market aerosols that would otherwise not be available to consumers, provide formulations, buy components at large volumes and low prices, and with the coming of HAPs, do so safely, so that smaller and less technologically sophisticated firms do not have to take risks themselves.

Perfume Contract Filler - Typical Data

With CFC				With HAPs		
Raw Material.	***Kg per 1000 units***	***US$. per kg.***	***US$.per 1000 units***	***Kg.per 1000 units***	***US$ per kg.***	***US$.per 1000 units***
Aroma	3.00	20.00	60.00	3.00	20.00	60.00
IPA	24.00	1.30	31.20	22.00	1.30	28.60

With CFC				With HAPs		
Raw Material.	***Kg per 1000 units***	***US$ per kg.***	***US$ per 1000 units***	***Kg.per 1000 units***	***US$ per kg.***	***US$.per 1000 units***
CFC	18.00	3.30	59.40			
HAP				10.00	1.30	13.00
Sub Total Propellant				59.40		13.00
Glass bottle			200.00			200.00
Valve			70.00			70.00
Top			30.00			30.00
Cardboard Box			15.00			15.00
+Filling charge			50.00			50.00
+Other charges			30.00			30.00
TOTAL			**424.40**			**378.00**

6. Therefore, as indicated earlier, there are no incremental savings since the concentrate is supplied by the brand owner. The contract filler adds his filling charge and sells the gas, valves, etc., as shown below:

7. Typically, the contract fillers charge all they can for their services. The filling charge is as high as possible, except for one factor - competition. In Mexico, where there are four contract fillers, prices are as low as they can be, and there is no difference in filling charges between filling CFC, HAPs, CO_2 or any other propellant. In Thailand, there are three major contract fillers and the same occurs. In India, almost every company that fills aerosols offers contract packaging, and there are more than 10 firms that have no brands at all, but do only contract filling. Filling service prices are on a per can basis, and are unaffected by the type of gas used.

8. From the filling charge, the enterprise must pay all expenses: direct labor, quality control and maintenance, administrative costs, etc. What remains is the net profit obtained. Because quality control costs, maintenance costs, and insurance costs are higher with HAPs (and direct labor may be also), net profits are lower with HAPs than with CFCs. These costs may be quantified on a case-by-case basis, but it is not necessary to do so for contract fillers. The salient point is that the filling charge is the same for either CFC or HAPs because it is a *fixed charge per can* and negotiated on a competitive basis

9. Contract fillers convert to HAPs not because of profits or savings, but because their clients request a change in propellant. The contract fillers, subject to market competition, maintain the same filling charge with HAPs as with CFCs.

Small scale informal sector enterprises

10. There are also many small scale informal sector enterprises in India.. These enterprises typically operate as contract fillers and produce a wide range of unbranded products in a very price-conscious market niche. They also often use second-hand cans that enable them to offer even lower prices, a practice that the larger enterprises do not follow and would not be safe in the switch to HAPs. These informal enterprises dominate the market particularly in products that require less quality control such as perfumes and some industrial products and together with the contract fillers dominate the pricing system in the Indian aerosol sector.

Attachment 2

India Aerosols Projects :

Profitability analysis for conversion from CFCs to HAPs.

Three Case Studies

1. A detailed analysis of three specific sectors (representing close to 100 percent of the aerosol-sector usage of CFCs in India) was conducted in order to determine the level of incremental operational costs or savings which accrue to the aerosol fillers. Three formulations were analyzed based on typical **actual** prevailing costs and prices in the Indian market. The three products are silicon mold release, room fresheners and perfumes. Detailed cost breakdown for the three formulations are shown in the following three boxes:

A. Case Study : Industrial Aerosols

Formulation Analysis - Silicon Mold Release

(Costing in Rs; Rs 30.00 = US$1.00)

	With CFC			With HAPs		
Raw Matrl.	***Kg per 1000 units***	***Rs. per kg.***	***Rs.per 1000 units***	***Kg.per 1000 units***	***Rs. per kg.***	***Rs.per 1000 units***
Silicon	25.00	272.00	6,800	25.00	272.00	6,800
Solvent	25.00	96.00	2,400	25.00	96.00	6,800
CFC	500.00	100.20	50,100			
HAP				275.00	40.000	11,000
Totals	550.00		59,300	325.00		20,20
Can	18 ox.		15,000	22 oz.		16,000
Valve			4,000			4,000
Packing Material.			1,800			1,800
TOTAL			**80,100**			**42,000**
Sale price per thousand cans (before VAT)			90,000			50,500
Profit - Sales price less cost (per thousand cans)			9,900			8,500

B. Case Study: Room Freshener

Basis: A room freshener product manufactured by a leading aerosol company in India.

160 gms with HAP

200 gms with CFC

Cost per can calculation		
Material	CFC Product	HAPs Product
	Cost per can (Rs.)	Cost per can (Rs.)
Fragrance	2.72	3.50
Can	15.50	15.50
Valve	4.50	4.50
Cap	1.50	1.50
Solvent	0.40	0.40
Sleeve	0.35	0.35
Carton	0.75	0.75
Sticker	0.18	0.18
Incremental Maintenance/Quality control/Labor costs		1.5
Insurance		0.5
CFC	32.00	
HAP		6.0
		6.00
TOTAL	**57.9**	**34.7**
20% excise	11.5	6.9
Cost price	69.4	41.6
Sale price	110.0	80.0
Net profit	40.6	38.4

Basis: CFC : Rs. 115/kg and HAP : Rs. 40/kg

C. Case study : Perfume

Basis: 50 gms Perfume product manufactured by a leading aerosol company in India.

Cost per can calculation		
Material	CFC Product	HAPs Product
	Cost per can (Rs.)	Cost per can (Rs.)
Fragrance	4.00	5.00
Can	5.50	6.50
Valve	4.50	4.50
Cap	0.70	0.70
Solvent	-	1.05
Sleeve	0.27	0.27
Carton	0.70	0.75
Sticker	-	0.18
Incremental Maintenance/Quality control/Labor costs	-	1.5
Insurance	-	0.5
CFC	6.00	
HAP		1.0
TOTAL	**21.6**	**21.95**
Excise duty (ED)	4.3 (20%ED)	21.95 (100%ED with ethyl alcohol as a solvent)
Cost price	25.9	43.9
Sale price	125.0	125.0
Net profit	99.1	81.1

Basis - CFC : Rs.115/kg and HAP : Rs.40/kg

2. There is less profit per can sold with HAPs compared with CFCs as shown above for each of the formulations. Market prices are dominated by the contract fillers and small scale informal sector enterprises as discussed in Attachment 1, as well as by the market recognition that HAP cans weigh less than CFC cans and are thus less desirable from the consumer's point of view.

3. Cost of other items for all formulations, besides formulation costs, generally go up with the introduction of HAP. Maintenance and labor cost go up with use of the open air filling room and with the additional product and safety standards that must be maintained. Second-hand cans cannot be used for safety reasons. Insurance costs also increase primarily from use of HAPs.

4. Thus, although there is a reduction in overall production cost of products based on HAPs; there is an equivalent (and sometimes greater) reduction in the selling price due to the factors discussed above and in Attachment 1. Competition is so strong from contract fillers and informal sector enterprises that generally fillers cannot even recoup the increase in other operating cost items, so generally there is a reduction in net margin per can. In a country like India, enterprises will count on an expanding market to first recover their lost profits and then further increase revenues, and eventually profits.

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SUB PROJECT PROPOSAL REPORT

COUNTRY	India	
SECTOR COVERED	Aerosols	
ODS USE IN SECTOR (1991)	1100 tons CFC (1100 ton ODP)	
PROJECT TITLE	**Accra Pak India Pvt. Ltd. Aerosol Conversion**	
PROJECT IMPACT	Phaseout 52 tons per year of CFC 12 and CFC-11/12 Mixture (52 tons ODP).	
PROJECT ECONOMIC LIFE	10 Years	
PROJECT DURATION	12 months	
TOTAL PROJECT COST	Incremental Capital Cost	US$ 118,000
	Contingencies @ 10%	11,800
	Project Capital Cost	129,800
	FA Fee @ 3%	3,900
	Total Project Cost	US$ 133,700
PROPOSED OTF FINANCING	US $ 133,700	
UNIT ABATEMENT COST	US$ 0.42/Kg	
GRANT EFFECTIVENESS	US$ 2.49/kg	
IMPLEMENTING ENTERPRISE	Accra Pak India Pvt. Ltd	
COORDINATING NATIONAL BODY	Ozone Cell of MOEF	
IMPLEMENTING AGENCY	The World Bank /IDBI	

PROJECT SUMMARY

This project will accomplish the conversion to hydrocarbon aerosol propellant (HAP) at Accra Pak India. This company converted early, using technology from Accra Pak in the United States. One of their filling machines is not safe for filling HAPs, the enterprise would require a storage tank for high pressure HAPs, and some construction items and sprinklers.

Technical Assessment: This proposal has been reviewed and supported by OORG technical reviewer, Mr. H. McCain, whose comments are attached.

PROJECT OBJECTIVES:

The project objective is to phase out the use of 52 tons of CFC 12 or CFC 11/CFC 12 annually by completing the conversion process from CFCs to HAPs.

SECTOR BACKGROUND:

In India, two tiered market exists in aerosols, with light weight, flammable HAPs aerosols selling at much lower prices than heavy, CFC aerosols, so there is little incentive to change. Also it is estimated that there are over 200 fillers of aerosols in India, so that competition is very keen, and there is a general fear of switching to HC before the competition, and losing market share due to poor quality.

A government task force has estimated aerosol fillings at over 40,000,000 units per year, and a consumption of over 1,400 metric tons of CFC (1993). Final country programme estimates place CFC consumption at 1100 m.t. in 1991, and the market has grown substantially since then.

ENTERPRISE BACKGROUND:

Accra Pak is one of the largest contract packagers of aerosols in India, filling various brands for a multitude of customers. The enterprise would convert entirely to HAPs. Most of their installations are already explosion proof, which would result on small additional investment for a large company to complete the conversion. Actual consumption of CFC is 52 Mt. per year. Accra Pak Pvt. Ltd. is family owned and 100% Indian capital.

Unit sales are as follows:

Year	Cans Filled	CFC used kg.	HAPs used
1992-93	765,000	46,837	-
1993-94	711,000	43,018	-
1994-95	849,000	51,958	-

Breakdown by product in 1994-95:

Product	Weight gm	Percent total	CFC used Kg.
"A" Silicone	550	13%	7,000
"B" Household	100	71%	37,000
"C" Industrial	250	12%	6,000
"D" Pharma	30	4%	2,000
TOTAL:		100%	52,000

Production machinery is as follows:

Line	Type	CPM[1]	CPY[1]
1	2 head Product Filling, Crimping & Charging Machine	20	2,000,000
Capacity	same	same	same

Capacity of the new recommended machine is 1,500,000 CPY (15 CPM), less than the actual installed capacity. The company will destroy the old machine when the new one is operating.

PROJECT DESCRIPTION:

Accra Pak India requires very little to be completely converted. One existing filling machine currently in use is unsafe for HAPs, they need storage and mixing tanks for propellant, etc. Their basic installation is already explosion proof. Accra Pak has well designed molecular sieve towers, which they will continue to use with LPG until proper HAPs propellant is available.

Some installations are needed, including pumps, piping, fittings etc. construction items are needed, including painting, paltform and ladders for storage tanks, and the installation of sprinklers.

JUSTIFICATION FOR ALTERNATE TECHNOLOGY SELECTION:

Hydrocarbon aerosol propellants (HAPs) have been the principal alternatives to CFC 12 employed worldwide. They are approved by the 1993 UNEP Technical Options Report on Aerosols, Sterilants, and Miscellaneous Uses and Carbon Tetrachloride.

Aerosol grade hydrocarbon propellant is not currently available in India, but the government of India has agreed to provide this material from one or more of the government owned refineries.

[1] CPM is cans per minute of actual production. This is multiplied by 100,000 minutes (400 effective production minutes per day for 250 days per year) to give cans per year (CPY). Capacity is the sum of the cans per year of the various filling lines.

PROJECT COSTS:

The total project incremental cost of $ 133,700 was calculated as the economic capital cost. The Breakdown is provided in Annexure A.

RECURRING COSTS/SAVINGS:

Accra Pak is contract filler. There is no operating savings for this project as explained in the cover memo.

UNIT ABATEMENT COST AND GRANT EFFECTIVENESS:

UAC 0.42 per kilogram. Grant Effectiveness = $2.49 (Annexure B)

PROJECT IMPLEMENTATION SCHEDULE:

The project can be implemented within 12 months of the grant being made available:

Task	Q1	Q2	Q3	Q4
Purchase of Equipment	XXX			
Site Preparation		XXX		
Install Equipment			XXX	
Start up/Testing				XXX

REQUIRED REGULATORY ACTIONS:

Once all aerosol manufacturers have had an opportunity to convert, and once the technical expert contracted to do the training has audited safety and certified that plant personnel are fully trained, the use of CFCs in aerosols in India should be prohibited.

RESULTS:

This project will result in the immediate reduction of 52,000 kilograms of CFC usage in the first year. If the company's volume continues to grow as expected, it is estimated that the actual reduction will be considerably higher in 2 or 3 years time.

ENVIRONMENTAL IMPACT:

The substitute propellant, a mixture of butane and propane, does not damage the ozone layer. It does not contribute to acid rain, not is it carcinogenic, mutagenic, or toxic. The butane/ propane mix does not pollute the soil or ground water. This mixture is a volatile organic compound (VOC) that contributes somewhat to ground level contamination. This mixture does have a global warming potential, albeit very low, but safety requirements are such that leakage is kept to an absolute minimum, and thus GWP considerations are negligible.

Hdrocarbons as substitute are extremely flammable, and explosive. The storage of the hydrocarbon propellants must be accomplished by strict adherence to all applicable Indsian and local codes and regulations.

Annexure A

Capital Costs in US$

No.	Quant.	Description	Local	Foreign or Import
1	1	Rotary aerosol filling machine		69,000.0
2	1	10 m.t. high pressure gas storage tank	13,000.0	
3	1	Small tank (5,000 m.t.) for blending	7,500.0	
4	3	Propellant pumps		2,450.0
5	lot	Connections and fittings	1,030.0	
6	lot	Piping, connections, and instruments	7,150.0	
7	lot	Installation expense	8,400.0	
8	lot	Painting pipework	2,400.0	
9	lot	Platform and ladders for tankfarm	3,500.0	
10	1	Sprinkler system	3,500.0	
		Sub-totals	46,480.0	71,450.0

Summary	Cost
Capital Cost	118,000.0
+ 10% Contingency	11,800.0
+ 3% Financial Agents Fee	3,900.0
Total Project Cost	133,700.0

Annexure B

UNIT ABATEMENT COST AND GRANT EFFECTIVENESS:

The **unit abatement cost** of the Accra Pak India's aerosol conversion project is calculated as follows:

Using the formula $A = \frac{C(F) + (OC-OS)}{W}$

Where C = $ 118,000.0 + 11,800.0 OC = 0

(C)F = $ 21,113.7 OS = 0

W = 52,000

Doing the calculation, unit abatement cost = $ 0.42/kg.

The **grant effectiveness** of this project is $129,800.0 divided by 52,000 = $ 2.49

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May 25, 1995

TO : Naimeh Hadjitarkhani FAX: 202-477-7352
Operations Officer
SA2CI, South Asia Country Dept. II

COPY TO : Tom Waltz FAX: 202-522-3258
ENVGC

FROM : Harry B. McCain

1. **Country of origin:** India

2. **Project title:** Accra Pak India Pvt. Ltd. Aerosol Conversion

3. **Sector/sub-sector:** Aerosols

4. **Relationship to country programme**

5. **Technology**

(a) Hydrocarbon propellants have long been the preferred substitute for CFCs when used as an aerosol propellant. Hydrocarbon propellants are selected because of their zero ozone depleting potentials. The only environmental shortcoming of the hydrocarbon aerosol propellants (HAPs) is their flammability which can be correctly handled with the appropriate and now well established HAP technology. The U.S.A. has been using HAPs in aerosols instead of CFCs since 1978. In 1994 approximately 3 billion aerosol cans were filled with HAPs.

(b) The technology for the use of HAPs as a substitute for CFCs in aerosol products is well established, permanent, and not transitional. There are no transitional technologies that could be used in the aerosol sector that would be appropriate.

(c) It is totally feasible that the HAP technology required for this project can be transferred from Western Europe and the U.S.A. using the free market system.

(i) No technology transfer agreement is required.
(ii) There is no licensing agreement required.

(iii) The reviewer agrees with the determination to use HAPs as a replacement technology for CFCs used as propellants in aerosol products.
(iv) HAP is the most cost effective technology for this conversion.

6. Environmental Impact

(a) This project will result in the phaseout of 52 tons/year of CFC-12 and CFC-11/12 (ODS). Global warming potential is negligible. Unit Abatement Cost is $0.40/Kg U.S.
(b) Costs are appropriate to minimize health and safety and other environmental impacts.

7. Project costs

(a) All cost components identified in the project are essential for the conversion from CFCs to hydrocarbon aerosol propellants.
(b) Many cost components are present that will facilitate the conversion to hydrocarbon aerosol propellants.
(c) Cost of equipment
  (i) The cost of existing equipment is addressed in a manner that is consistent with the reviewer's experience.
  (ii) The reviewer agrees with the finding that all of the base line equipment in the report should be acquired.
  (iii) No additional equipment requests are essential for the conversion.
  (iv) All of the base line equipment will necessarily have to be replaced.
  (v) The fate of scrapped equipment has not been addressed in this report.
  (vi) Salvage value of scrapped equipment was not addressed.
  (vii) Capacity of the new recommended machine is 1.5 million cans/year. Present production capacity is two million cans/year.
(d) Training costs are appropriate, although the number of persons to be trained per the $4,000.00 U.S. was not given.
(e) Operating costs
  (i) The operating costs are appropriate.
  (ii) Net recurring costs and recurring savings are equal ($0.00) because Accra Pak India will absorb any additional maintenance costs.
  (iii) N/A

8. Implementation time frame

The time frame of four quarters is appropriate.

9. **Recommendations**

(a) This project is approved as proposed.

OORG/UNDP Technical Reviewer: Harry B. McCain

Date Review Completed: May 25, 1995

SUB PROJECT PROPOSAL REPORT

COUNTRY	India		
SECTOR COVERED	Aerosols		
ODS USE IN SECTOR (1991)	1100 tons CFC (1100 ton ODP)		
PROJECT TITLE	**Aerosols d'Asia Pvt. Ltd Aerosol Conversion**		
PROJECT IMPACT	Phaseout 18 tons per year of CFC 12 and CFC-11/12 Mixture (18 tons ODP).		
PROJECT ECONOMIC LIFE	10 Years		
PROJECT DURATION	12 months		
TOTAL PROJECT COST	Incremental Capital Cost	US$	63,200
	Contingencies @ 10%		6,300
	Project Capital Cost		69,500
	FA Fee @ 3%		2,100
	Total Project Cost	US$	71,600
PROPOSED OTF FINANCING	US $ 71,600		
UNIT ABATEMENT COST	US$ 0.62/kg		
GRANT EFFECTIVENESS	US$ 3.86/kg		
IMPLEMENTING ENTERPRISE	Aerosols d'Asia Pvt. Ltd.		
COORDINATING NATIONAL BODY	Ozone Cell of MOEF		
IMPLEMENTING AGENCY	The World Bank /IDBI		

PROJECT SUMMARY

The project will complete the conversion to hydrocarbon aerosol propellant (HAP) at Aerosols d'Asia. The company is part of the "Asian Aerosols group" that mostly contract packages industrial aerosols. They are filling CFCs because their filling machine is not safe for filling HAPs, and the enterprise has enough space to install the open air filling room on its current lot. A leak test tank, quality control instruments, racks for propellant cylinders and other small items are also required.

Technical Assessment: This proposal has been reviewed and supported by OORG technical reviewer, Mr. H. McCain, whose comments are attached.

PROJECT OBJECTIVES:

The project objective is to phase out the use of 18 tons of CFC 12 or CFC 11/CFC 12 annually by completing the conversion process from CFCs to HAPs.

SECTOR BACKGROUND:

In India, two tiered market exists in aerosols, with light weight, flammable HAPs aerosols selling at much lower prices than heavy, CFC aerosols, so there is little incentive to change. Also it is estimated that there are over 200 fillers of aerosols in India, so that competition is very keen, and there is a general fear of switching to HAP before the competition, and losing market share due to poor quality.

A government task force has estimated aerosol fillings at over 40,000,000 units per year, and a consumption of over 1,400 metric tons of CFC (1993). Final country programme estimates place CFC consumption at 1100 m.t. in 1991, and the market has grown substantially since then.

ENTERPRISE BACKGROUND:

Aerosols d'Asia is a member of the Asian Aerosols group, one of the largest contract filling companies in the aerosol industry in India. They fill various brands for many customers, with this company dedicated mostly to industrial aerosols. The Asian Aerosols group has chosen to operate several small facilities rather than one large one, such that they do not need to package for two or more competitors at the same facility, but rather can separate competing interests at different contract filling plants. They wish to convert entirely to HAPs. Actual consumption of CFC is 18 tons per year. Aerosols d'Asia has their own CFC consumption that is not claimed by any other enterprise in the group. The Asian Aerosols group is family owned and 100% Indian capital.

Unit sales are as follows:

Year	Cans Filled	CFC used mt	HAPs used
1992-93	35,000	18	-
1993-94	35,000	18	-
1994-95	35,000	18	-

Breakdown by product in 1994-95

Product	Weight gm	Percent total	CFC used mT
Silicon Spray	550	100%	18

Production machinery is as follows:

Line	Type	CPM[1]	CPY[1]
1	Semi-automatic	25	2,500,000
Capacity	same	same	same

The capacity of the new recommended machine is 1,000,000 CPY (10 CPM) which is less than installed capacity. The company will destroy the old machine when the new one is operating.

PROJECT DESCRIPTION:

Aerosols d'Asia has sufficient space to use an open air filling room (OAFR) at the current volume of production at the present lot. The filling machine that they have is unsafe for filling HAPs. The project is proposing to obtain a new filling machine and provision for construction of the filling room is provided. They have small molecular sieve towers, which will continue to be used with LPG until proper HAPs propellant is available.

Some installations are needed, including a water bath (required for safe filling of aerosols with HAPs propellant), racks for propellant cylinders, piping, and site preparation. A set of quality control gauges, a portable gas detector, and additional fire extinguishers are also needed. Total conversion cost includes shipping and handling of the filling machine and safety training to be provided initially by foreign expert until capacity is built and trainers can provide such services.

JUSTIFICATION FOR ALTERNATE TECHNOLOGY SELECTION:

Hydrocarbon aerosol propellants (HAPs) have been the principal alternatives to CFC 12 employed worldwide. They are approved by the 1993 UNEP Technical Options Report on Aerosols, Sterilants, and Miscellaneous Uses and Carbon Tetrachloride.

Aerosol grade hydrocarbon propellant is not currently available in India, but the government of India has agreed to provide this material from one or more of the government owned refineries shortly.

PROJECT COSTS:

The total project incremental cost of $71,600 was calculated as the economic capital cost. The breakdown is provided in Annexure A.

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[1] CPM is cans per minute of actual production. This is multiplied by 100,000 minutes (400 effective production minutes per day for 250 days per year) to give cans per year (CPY). Capacity is the sum of the cans per year of the various filling lines.

RECURRING COSTS/SAVINGS:

Aerosol d'Asia is contract filler and its principal product is Silicon Mold Release. There are no recurring savings for this project as explained in the cover memo.

UNIT ABATEMENT COST AND GRANT EFFECTIVENESS:

UAC = $ 0.62 per kilogram. Grant Effectiveness = $3.86 (Annexure B).

PROJECT IMPLEMENTATION SCHEDULE:

The project can be implemented within 12 months of the grant being made available.

Task	Q1	Q2	Q3	Q4
Purchase of Equipment	XXX			
Build Open Air Filling Room		XXX		
Install Equipment			XXX	
Start up/Testing				XXX

REQUIRED REGULATORY ACTIONS:

Once all aerosol manufacturers have had an opportunity to convert, and the technical expert contracted to do the training has audited safety and certified that plant personnel are fully trained, the use of CFCs in aerosols in India should be prohibited.

RESULTS:

The project would result in the immediate reduction of 18,000 kilograms of CFC usage in the first year. If the company's volume continues to grow as expected, it is estimated that the actual reduction will be considerably higher in 2 or 3 years time.

ENVIRONMENTAL IMPACT:

The substitute propellant, a mixture of butane and propane, does not damage the ozone layer. It does not contribute to acid rain, not is it carcinogenic, mutagenic, or toxic. The butane/ propane mix does not pollute the soil or ground water. This mixture is a volatile organic

compound (VOC) that contributes somewhat to ground level contamination. This mixture does have a global warming potential, albeit very low, but safety requirements are such that leakage is kept to an absolute minimum, and thus GWP considerations are negligible.

Hydrocarbons are extremely flammable and explosive. The storage of the hydrocarbon propellants must be accomplished by strict adherence to all applicable Indian and local codes and regulations.

Annexure A

Capital Costs in US$

No.	Quant.	Description	Local	Foreign or Import
1	1	Semi automatic aerosol filling machine		37,000.0
2	lot	Site Preparation/Wall in Lot	3,000.0	
3	lot	Construct Open Air Filling Room	4,000.0	
4	lot	Piping	1,200.0	
5	1	Racks for Propellant Cylinders	800.0	
6	16	Cylinders (50 kgs)	800.0	
7	lot	Additional Fire Extinguishers	700.0	
8	1	Manual Leak Test Tank w/heater (water bath)	4,000.0	
9	1	Set of Quality Control Gauges (crimp height, crimp diameter, pressure, vacuum, etc.		3,200.0
10	1	Portable Gas Detector		1,000.0
11	lot	Shipping and Handling		3,500.0
12	lot	Plant Safety Training		4,000.0
		Sub-totals	14,500.0	48,700.0

Summary	Cost
Capital Cost	63,200.0
+ 10% Contingency	6,300.0
+ 3% Financial Agents Fee	2,100.0
Total Project Cost	71,600.0

Annexure B

UNIT ABATEMENT COST AND GRANT EFFECTIVENESS:

The **unit abatement cost** of the Aerosol d'Asia Product's aerosol conversion project is calculated as follows:

Using the formula $A = \frac{C(F) + (OC-OS)}{W}$

Where C	=	$ 63,200 + 6,320	OC = 0
(C)F	=	$ 11,315	OS = 0
W	=	18,000	

Doing the calculation, unit abatement cost = $ 0.62/kg.

The **grant effectiveness** of this project is $69,500.0 divided by 18,000 = $ 3.86

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May 25, 1995

TO : Nalmeh Hadjitarkhani FAX: 202-477-7352
Oporations Officer
SA2CI, South Asia Country Dept. II

COPY TO : Tom Waltz FAX: 202-522-3258
ENVGC

FROM : Harry B. McCain

1. **Country of origin:** India

2. **Project title:** Aerosols d'Asia Pvt. Ltd. Aerosol Conversion

3. **Sector/sub-sector:** Aerosols

4. **Relationship to country programme**

5. **Technology**

(a) Hydrocarbon propellants have long been the preferred substitute for CFCs when used as an aerosol propellant. Hydrocarbon propellants are selected because of their zero ozone depleting potentials. The only environmental shortcoming of the hydrocarbon aerosol propellants (HAPs) is their flammability which can be correctly handled with the appropriate and now well established HAP technology. The U.S.A. has been using HAPs in aerosols instead of CFCs since 1978. In 1994 approximately 3 billion aerosol cans were filled with HAPs.

(b) The technology for the use of HAPs as a substitute for CFCs in aerosol products is well established, permanent, and not transitional. There are no transitional technologies that could be used in the aerosol sector that would be appropriate.

(c) It is totally feasible that the HAP technology required for this project can be transferred from Western Europe and the U.S.A. using the free market system.

(i) No technology transfer agreement is required.
(ii) There is no licensing agreement required.

(iii) The reviewer agrees with the determination to use HAPs as a replacement technology for CFCs used as propellants in aerosol products.
(iv) HAP is the most cost effective technology for this conversion.

6. **Environmental Impact**

(a) This project will result in the phaseout of 18 tons/year of CFC-12 and CFC-11/12 (ODS). Global warming potential is negligible. Unit Abatement Cost is $0.62/Kg U.S.
(b) Costs are appropriate to minimize health and safety and other environmental impacts.

7. **Project costs**

(a) All cost components identified in the project are essential for the conversion from CFCs to hydrocarbon aerosol propellants.
(b) Many cost components are present that will facilitate the conversion to hydrocarbon aerosol propellants.
(c) Cost of equipment
  (i) The cost of existing equipment is addressed in a manner that is consistent with the reviewer's experience.
  (ii) The reviewer agrees with the finding that all of the base line equipment in the report should be acquired.
  (iii) No additional equipment requests are essential for the conversion.
  (iv) All of the base line equipment will necessarily have to be replaced.
  (v) The old equipment will be destroyed once the new equipment is installed.
  (vi) There will be no salvage value with the destroyed equipment.
  (vii) With the installation of the new filling machines, production capacity will drop from 2.5 million cans/year to one million cans/year.
(d) Training costs are appropriate, although the number of persons to be trained per the $4,000.00 U.S. was not given.
(e) Operating costs
  (i) The operating costs are appropriate.
  (ii) Net recurring costs and recurring savings are equal ($0.00) because Aerosols d'Asia will absorb any additional maintenance costs.
  (iii) N/A

8. **Implementation time frame**

The time frame of four quarters is appropriate.

9. **Recommendations**

(a) This project is approved as proposed.
(b) It would be much better if all of these projects that use cylinders could be consolidated in a lessor number of industries using bulk storage. Since they cannot, special precautions must be taken for handling cylinders.

OORG/UNDP Technical Reviewer: Harry B. McCain

Date Review Completed: May 25, 1995

SUB PROJECT PROPOSAL REPORT

COUNTRY	INDIA	
PROJECT TITLE	Aero Industries Conversion, Vapi	
SECTOR COVERED	Aerosols	
ODS USE IN SECTOR	1100 tons CFCs (= ODP) IN 1991	
PROJECT IMPACT	27.7 tons CFC-12 and CFC 11/12 mixture/Y =ODP ; Base 1994	
PROJECT DURATION	1 Year	
PROJECT ECONOMIC LIFE	10 Years	
TOTAL PROJECT COSTS	Incremental Capital Costs:	US$110,700
	Contingencies @ 10%:	US$11,100
	Project Capital Cost:	US$121,800
	FA Fee @ 3%:	US$3,700
	Total Project Cost:	US$ 125,500
PROPOSED OTF FINANCING	US$ 125,500	
UNIT ABATEMENT COST	US$ 0.72/kg/y	
COST EFFECTIVENESS	US$ 4.4 /kg/y	
IMPLEMENTING ENTERPRISE	Aero Industries, Vapi	
COORDINATING MINISTRY	Ministry of Environment and Forests	
IMPLEMENTING AGENCY	The World Bank	

PROJECT SUMMARY

The company has already started implementation of the phase out and is using non-ODS substitutes. The changes proposed include replacement of the existing filling lines which are old and not considered suitable for handling flammable propellants. Further, LPG detection system and additional fire fighting equipment are required. Presently Aero Industries has two semi-automatic lines with a capacity upto 30 cans per minute. These two lines are proposed to be replaced with an imported automatic filling line which would be more cost effective than 2 semi-automatic lines. Considering the HAP requirement a stationery tank is advisable as it is safer than filling from cylinders.

Technical Assessment: This proposal has been reviewed and endorsed by OORG reviewer, Mr. Harry McCain whose comments are attached.

PROJECT OBJECTIVE:

The project objective is to phase-out the use of 27.7 tons of CFC 11/12 annually after completion of the conversion process which already has been initiated.

SECTOR BACKGROUND:

In India, two tiered market exists in aerosols, with light weight, flammable HAPs aerosols selling at much lower prices than heavy, CFC aerosols, so there is little incentive to change. Also it is estimated that there are over 200 fillers of aerosols in India, so that competition is very keen, and there is a general fear of switching to HAP before the competition, and losing market share due to poor quality.

A government task force has estimated aerosol fillings at over 40,000,000 units per year, and a consumption of over 1,400 metric tons of CFC (1993). Final country program estimates place CFC consumption at 1100 m.t. in 1991, and the market has grown substantially since then.

ENTERPRISE BACKGROUND:

Aero Industries is part of the Asian Aerosol Group, an industrial consortium consisting of several companies. Aero Industries is the largest filler (in terms of unit sales) of household insecticide. Aero Industries, a proprietary firm of Joitabhai Trust, is 100% Indian owned. The group had a sales of almost US$ 2 million in 1994-95.

Unit sales are as follows:

Year	Cans Filled	CFC used mt	LPG used mt
1992-93	NA	NA	NA
1993-94	NA	NA	NA
1994-95	610,000	27.7	55

Details for 92-93 and 93-94 are not available as the factory was leased to another filler and all inputs were purchased by the lessee.

Break down by product in 1994-95:

Product	Weight gm	Percent Total	CFC used mt
CFC Products	550	10	27.7
LPG Products	200	90	nil
Total		100	27.7

All products are completely packed on contract filling basis.

Production machinery is as follows:

Line	Type	CPM[1]	CPY[1]
1	Semi-Automatic	25	2,500,000
2	Semi-Automatic	25	2,500,000
Total		50	5,000,000

The capacity of the automatic line proposed is lesser than the present installed capacity. This is acceptable to the enterprise as the most cost effective change.

PROJECT DESCRIPTION:

The project is proposing to purchase an automatic filling line to replace the existing two semi-automatic filling lines. Moreover, LPG detection system; non-absorbant spark-proof flooring and fire protection system have to be incorporated.

A storage tank for HAP is also required and a compound wall would have to be erected. A set of quality control gauges will have to be procured and safety training provided.

The capacity of the automatic line proposed would be lesser than the currently installed two semi-automatic lines. This has been proposed as a more cost effective alternative. The changes proposed in this proposal are entirely to ensure safety and make the facilities suitable for handling HAP. Aero Industries has adequate space for the proposed changes.

JUSTIFICATION FOR SELECTION OF ALTERNATIVE TECHNOLOGY:

Hydrocarbon aerosol propellants (HAPs) have been the principal alternatives to CFC 12 employed worldwide. They are approved by the 1993 UNEP Technical Options Report on Aerosols, Sterilants, and Miscellaneous Uses and Carbon Tetrachloride.

Aerosol grade hydrocarbon propellant is not currently available in India, but the Government of India has agreed to provide this material from one or more of the Government owned refineries shortly.

PROJECT COSTS:

The total project cost of $125,500 was calculated as the economic capital cost. The break down is provided in Annexure A.

---

[1] CPM is cans per minute of actual production. This is multiplied by 100,000 minutes (400 effective production minutes per day for 250 days per year) to give cans per year (CPY). Capacity is the sum of the cans per year of the various filling lines.

RECURRING COSTS/SAVINGS:

Aero Industries is a contract filler. There are no recurring savings as a result of switch over to HAPs, as explained in the cover memo.

UNIT ABATEMENT COST AND GRANT EFFECTIVENESS:

UAC = $0.72 per kilogram. Grant Effectiveness = $4.4 (Annexure B).

PROJECT IMPLEMENTATION SCHEDULE:

The project can be implemented within 12 months of the grant amount being made available:

Task	Q1	Q2	Q3	Q4
Purchase of equipment	XXX			
Construction work		XXX		
Install Equipment			XXX	
Training/Start-up				XXX

REQUIRED REGULATORY ACTION:

Once all aerosol manufactures have had an opportunity to convert, personnel have been trained and certified, the use of CFC in aerosol industry in India should be prohibited.

RESULTS:

The project would phase-out 27.7 tons of CFC usage per year. If this company's volume increases as per past trend, the actual reduction will be considerably higher in the next few years.

ENVIRONMENTAL IMPACT:

The substitute propellant, a mixture of butane and propane, does not damage the ozone layer. It does not contribute to acid rain, is not carcinogenic, mutagenic, or toxic. The butane/propane mix does not pollute the soil or ground water. This mixture is a volatile organic compound (VOC) that contributes somewhat to ground level contamination. This mixture does have a global warming potential, albeit very low. Hydrocarbons are extremely flammable, and explosive. The storage of the Hydrocarbon propellants must be accomplished by strict adherence to local codes and regulations.

Annexure A

CAPITAL COSTS
(Figures in US$)

No.	Qty	Description	Local	Foreign or import
1	1	Automatic filling line		65,000
2	lot	Wall in lot + site preparation	10,000	
3	lot	Additional fire extinguishers	1,500	
4	1	Set of Quality Control Gauges (Crimp height, crimp diameter, pressure, vacuum etc.)		3,200
5	1	Portable Gas Detector		1,000
6	lot	Piping	3,000	
7	lot	Storage Tank	15,000	
8	lot	Tank Foundation	3,000	
9	lot	Shipping & Handling		5,000
10	lot	Plant Safety Training		4,000
		SUB TOTALS	32,500	78,200
		Total (local and foreign expenses)		110,700

Summary :	Cost
Capital Cost	110,700
+ 10 % contingency	11,100
+ 3 % Financial agent's fee	3,700
Total Project Cost	125,500

Annexure B

UNIT ABATEMENT COSTS AND GRANT EFFECTIVENESS:

The unit abatement cost of the **Aero Industries** conversion project is calculated as follows :-

Using the formula $A = \frac{C(F) + (OC - OS)}{W}$

Where C = US $ 121,800 OC=0
C(F) = US $ 20,031 OS=0
W= 27,667 kg

Doing the calculation, unit abatement cost = US $ 0.72 /kg.

The existing filling lines would have to be scrapped to prevent it from being used. There would, therefore, be no disposal value for the existing equipment.

The grant effectiveness of the Aero Industries conversion project is calculated as follows:

Using the formula $A = \frac{C + (OC - OS)}{W}$

Where C = US $ 121,800 OC=0
OS=0
W= 27,667 kg

Doing the calculation, cost effectiveness = US $ 4.4 / kg.

AEROPRES
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May 26, 1995

TO : Naimeh Hadjitarkhani FAX: 202-477-7352
Operations Officer
SA2CI, South Asia Country Dept. II

COPY TO : Tom Waltz FAX: 202-522-3258
ENVGC

FROM : Harry B. McCain

1. **Country of origin:** India

2. **Project title:** Aero Industries Conversion

3. **Sector/sub-sector:** Aerosols

4. **Relationship to country programme**

5. **Technology**

(a) Hydrocarbon propellants have long been the preferred substitute for CFCs when used as an aerosol propellant. Hydrocarbon propellants are selected because of their zero ozone depleting potentials. The only environmental shortcoming of the hydrocarbon aerosol propellants (HAPs) is their flammability which can be correctly handled with the appropriate and now well established HAP technology. The U.S.A. has been using HAPs in aerosols instead of CFCs since 1978. In 1994 approximately 3 billion aerosol cans were filled with HAPs.

(b) The technology for the use of HAPs as a substitute for CFCs in aerosol products is well established, permanent, and not transitional. There are no transitional technologies that could be used in the aerosol sector that would be appropriate.

(c) It is totally feasible that the HAP technology required for this project can be transferred from Western Europe and the U.S.A. using the free market system.
   (i) No technology transfer agreement is required.
   (ii) There is no licensing agreement required.

(iii) The reviewer agrees with the determination to use HAPs as a replacement technology for CFCs used as propellants in aerosol products.
(iv) HAP is the most cost effective technology for this conversion.

6. **Environmental impact**

(a) This project will phase out 27.7 tons/year of CFC-12 and CFC-11/12 (ODS). Global warming potential is negligible. Unit Abatement Cost is $0.72/Kg U.S.
(b) Costs are appropriate to minimize health and safety and other environmental impacts.

7. **Project costs**

(a) All cost components identified in the project are essential for the conversion from CFCs to hydrocarbon aerosol propellants.
(b) Many cost components are present that will facilitate the conversion to hydrocarbon aerosol propellants.
(c) Cost of equipment
  (i) The cost of existing equipment is addressed in a manner that is consistent with the reviewer's experience.
  (ii) The reviewer agrees with the finding that all of the base line equipment in the report should be acquired.
  (iii) No additional equipment requests are essential for the conversion.
  (iv) Much of the base line equipment in this project must be replaced.
  (v) The existing filling lines would have to be scrapped to prevent it from being used. There would, therefore, be no disposal value for the existing equipment.
  (vi) Same as above.
  (vii) The capacity of the automatic line proposed is less than the present installed capacity.
(d) The training cost of $4,000.00 is probably appropriate. The number of people to be trained, however, is not given.
(e) Operating costs
  (i) The operating costs are appropriate.
  (ii) This project considers that short-term savings, if any, will cover some of the increased maintenance costs, and that thereafter Aero Industries would absorb these extra costs. The operating costs and operating savings are considered to be equal. Hence, the project cost is the incremental cost.
  (iii) N/A

8. **Implementation time frame**

The time frame of four quarters is appropriate.

9. **Recommendations**

(a) This project is approved as proposed.

OORG/UNDP Technical Reviewer: Harry B. McCain

Date Review Completed: May 26, 1995

SUB PROJECT PROPOSAL REPORT

COUNTRY	INDIA	
PROJECT TITLE	Aeropres Conversion, Vapi	
SECTOR COVERED	Aerosols	
ODS USE IN SECTOR	1100 tons CFCs (= ODP) in 1991	
PROJECT IMPACT	50 tons CFC-12 and CFC 11/12 mixture / Y = ODP; Base 1994	
PROJECT DURATION	1 Year	
PROJECT ECONOMIC LIFE	10 Years	
TOTAL PROJECT COSTS	Incremental Capital Costs:	US$133,700
	Contingencies @ 10%:	US$13,400
	Project Capital Cost:	US$147,100
	FA Fee @ 3%:	US$4,400
	Total Project Cost:	US$151,400
PROPOSED OTF FINANCING	US $ 151,400	
UNIT ABATEMENT COST	US $ 0.48/kg/y	
COST EFFECTIVENESS	US $ 2.94/kg/y	
IMPLEMENTING ENTERPRISE	Aeropres, Vapi	
COORDINATING MINISTRY	Ministry of Environment and Forests	
IMPLEMENTING AGENCY	The World Bank	

PROJECT SUMMARY

Aeropres has already started implementation of the phase out and has commenced use of non-ODS substitutes. The project includes replacement of the existing fillings lines which are old and not considered suitable for handling flammable propellants. Further, LPG detection system is required to be installed, and additional fire fighting equipment are needed. Present production capacity includes two semi-automatic lines with a capacity up to 30 cans per minute each. These two lines are proposed to be replaced with an imported automatic filling line which would be more cost effective than 2 semi-automatic line. Considering the HAP requirement a stationery tank is advisable as it is safer than cylinder filling.

Technical Assessment: This proposal has been reviewed and endorsed by OORG reviewer, Mr. Harry McCain whose comments are attached.

PROJECT OBJECTIVE:

The project objective is to phase-out the use of 50 tons of CFC 11/12 annually after completion of the conversion process already initiated.

SECTOR BACKGROUND:

In India, two tiered market exists in aerosols, with light weight, flammable HAPs aerosols selling at much lower prices than heavy, CFC aerosols, so there is little incentive to change. Also it is estimated that there are over 200 fillers of aerosols in India, so that competition is very keen, and there is a general fear of switching to HAP before the competition, and losing market share due to poor quality.

A government task force has estimated aerosol fillings at over 40,000,000 units per year, and a consumption of over 1,400 metric tons of CFC (1993). Final country program estimates place CFC consumption at 1100 m.t. in 1991, and the market has grown substantially since then.

ENTERPRISE BACKGROUND:

AEROPRES is part of the Asian Aerosol group, an industrial consortium consisting of several companies. The group had a total sales of almost US$ 2 million last year.

Aeropres is a partnership firm of Shankarbhai Patel and B. L. Patel, and is a 100% Indian owned. It is the largest filler (in terms of unit sales) of industrial aerosols.

Aeropres have their own brand of industrial aerosol products and are also engaged in contract packaging for various other units. This project when completed would account for 50 ton ODP phase-out.

Unit sales are as follows:

Year	Cans Filled	CFC used mt	LPG used mt
1992-93	210,000	36	18.0
1993-94	190,000	35	16.0
1994-95	240,000	50	20.5

Break down by product in 1994-94:

Product	Weight gm	% of Total	CFC used mt
CFC Mould Release	550	42	50
LPG Mould Release	335	25	-
LPG Contract Filling	100	33	-

Production machinery is as follows:

Line	Type	CPM[1]	CPY[1]
1	Semi-Automatic	25	250,000
2	Semi-Automatic	25	250,000
Total		50	500,000

PROJECT DESCRIPTION:

Aeropres has adequate space for the proposed changes, and safe handling of flammable propellants. This project will purchase an automatic filling line to replace the existing two semi-automatic filling lines. LPG detection system will have to be incorporated and non-absorbant spark-proof flooring provided. Fire protection system also will be incorporated.

A storage tank for HAP is required and a compound wall would have to be erected. The authorities have specified a water storage facility for the enterprise, which would have to be provided.

The hot water test bath is not explosion proof and would have to be replaced. A set of quality control gauges and safety training are required and would be provided.

The capacity of the automatic line proposed would be lesser than the currently installed two semi-automatic lines. This has been proposed as it is more cost effective. The changes proposed in This proposal are entirely to ensure safety and make the facilities suitable for handling HAP.

JUSTIFICATION FOR SELECTION OF ALTERNATIVE TECHNOLOGY

Hydrocarbon aerosol propellants (HAPs) have been the principal alternatives to CFC 12 employed worldwide. They are approved by the 1993 UNEP Technical Options Report on Aerosols, Sterilants, and Miscellaneous Uses and Carbon Tetrachloride.

Aerosol grade hydrocarbon propellant currently is not available in India, but the Government of India has agreed to provide this material from one or more of the Government owned refineries shortly.

PROJECT COSTS:

The total project cost of$151,400 was calculated as the economic capital cost. The break down is provided in Annexure A.

[1] CPM is cans per minute of actual production. This is multiplied by 100,000 minutes (400 effective production minutes per day for 250 days per year) to give cans per year (CPY). Capacity is the sum of the cans per year of the various filling lines.

RECURRING COSTS/SAVINGS:

Aeropres is a contract filler for silicon sprays. There are no recurring savings for this project as explained in the cover memo.

UNIT ABATEMENT COST and GRANT EFFECTIVENESS:

UAC = 0.48 per kilogram. Grant Effectiveness = $2.94 (Annexure B).

PROJECT IMPLEMENTATION SCHEDULE:

The project can be implemented within 12 months of the grant amount being available.

Task	Q1	Q2	Q3	Q4
Purchase of Equipment	XXX			
Construction work		XXX		
Install Equipment			XXX	
Training/Start-up				XXX

REQUIRED REGULATORY ACTION:

Once all aerosol manufactures have had an opportunity to convert, personnel have been trained and certified, the use of CFC in aerosol industry in India should be prohibited.

RESULTS:

The project is for the phase-out of 50 tons of CFC usage per year. If this company's volume increases as per past trend, the actual reduction will be considerably higher in the next few years.

ENVIRONMENTAL IMPACT:

The substitute propellant, a mixture of butane and propane, does not damage the ozone layer. It does not contribute to acid rain, is not carcinogenic, mutagenic, or toxic. The butane/propane mix does not pollute the soil or ground water. This mixture is a volatile organic compound (VOC) that contributes somewhat to ground level contamination. This mixture does have a global warming potential, albeit very low. Hydrocarbons are extremely flammable, and explosive. The storage of the Hydrocarbon propellants must be accomplished by strict adherence to local codes and regulations.

Annexure A

CAPITAL COSTS
(Figures in US$)

No.	Qty	Description	Local	Foreign or import
1	1	Automatic filling line		65,000
2	lot	Wall in lot	10,000	
3	lot	Water Storage Facility	8,000	
4	lot	Additional fire extinguishers	1,500	
5	1	Set of Quality Control Gauges (Crimp height, crimp diameter, pressure, vacuum etc.)		3,200
6	lot	Fixed Gas Detectors		8,000
7	1	Portable Gas Detector		1,000
8	lot	Piping	3,000	
9	1	Leak Test Tank	4,000	
10	lot	Storage Tank	15,000	
11	lot	Tank Foundation	3,000	
12	lot	Site Preparation	3,000	
13	lot	Shipping & Handling		5,000
14	lot	Plant Safety Training		4,000
		SUB TOTALS	47,500	86,200
		Total (local and foreign expenses)		133,700

Summary :	Cost
Project Capital Cost	133,700
+ 10 % contingency	13,400
+ 3 % Financial agent's fee	4,400
Total Project Cost	151,400

Annexure - B

UNIT ABATEMENT COSTS AND GRANT EFFECTIVENESS

The unit abatement cost of the Aeropres conversion project is calculated as follows :-

$$\text{Using the formula } A = \frac{C(F) + (OC - OS)}{W}$$

Where C = US $ 147,100 OC=0
C(F) = US $ 24,193 OS=0
W= 50,000 kg

Doing the calculation, unit abatement cost = US 0.48 / kg.

The existing filling lines would have to be scrapped to prevent it from being used. There would, therefore, be no disposal value for the existing equipment.

The grant effectiveness of the Aeropres conversion project is calculated as follows :-

$$\text{Using the formula } A = \frac{C + (OC - OS)}{W}$$

Where C = US $ 147,100 OC=0
OS=0
W= 50,000 kg

Doing the calculation, cost effectiveness = US $ 2.94 / kg.

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May 26, 1995

TO	:	Naimeh Hadjitarkhani Operations Officer SA2CI, South Asia Country Dept. II	FAX: 202-477-7352
COPY TO	:	Tom Waltz ENVGC	FAX: 202-522-3258
FROM	:	Harry B. McCain	

1. **Country of origin:** India

2. **Project title:** Aeropres Conversion

3. **Sector/sub-sector:** Aerosols

4. **Relationship to country programme:** N/A

5. **Technology**

(a) Hydrocarbon propellants have long been the preferred substitute for CFCs when used as an aerosol propellant. Hydrocarbon propellants are selected because of their zero ozone depleting potentials. The only environmental shortcoming of the hydrocarbon aerosol propellants (HAPs) is their flammability which can be correctly handled with the appropriate and now well established HAP technology. The U.S.A. has been using HAPs in aerosols instead of CFCs since 1978. In 1994 approximately 3 billion aerosol cans were filled with HAPs.

(b) The technology for the use of HAPs as a substitute for CFCs in aerosol products is well established, permanent, and not transitional. There are no transitional technologies that could be used in the aerosol sector that would be appropriate.

(c) It is totally feasible that the HAP technology required for this project can be transferred from Western Europe and the U.S.A. using the free market system.

(i) No technology transfer agreement is required.
(ii) There is no licensing agreement required.

(iii) The reviewer agrees with the determination to use HAPs as a replacement technology for CFCs used as propellants in aerosol products.
(iv) HAP is the most cost effective technology for this conversion.

6. **Environmental Impact**

(a) This project will phase out 57 tons/year of CFC-12 and CFC-11/12 (ODS). Global warming potential of hydrocarbons is negligible. Unit Abatement Cost is $0.48/Kg U.S.
(b) Costs are appropriate to minimize health and safety and other environmental impacts.

7. **Project costs**

(a) All cost components identified in the project are essential for the conversion from CFCs to hydrocarbon aerosol propellants.
(b) Many cost components are present that will facilitate the conversion to hydrocarbon aerosol propellants.
(c) Cost of equipment
  (i) The cost of existing equipment is addressed in a manner that is consistent with the reviewer's experience.
  (ii) The reviewer agrees with the finding that all of the base line equipment in the report should be acquired.
  (iii) No additional equipment requests are essential for the conversion.
  (iv) Much of the base line equipment for this conversion has already been replaced with appropriate conversion equipment.
  (v) The fate of scrapped equipment is not addressed in this report. Perhaps the term "scrapped equipment" should be changed to "destroyed equipment" with no cash value.
  (vi) The report states that old equipment is to be scrapped and consequently will have no value.
  (vii) The capacity of the automatic filling line proposed is less than the present installed capacity. This is acceptable to the enterprise as the most cost effective change.
(d) The safety and training cost of $4,000.00 is probably appropriate, but the number of persons to be trained is not given. Aeropres India is aware of the necessity of training and most of the personnel are already trained in the use of hydrocarbon propellant.
(e) Operating costs
  (i) The operating costs are appropriate.
  (ii) Net recurring costs and recurring savings are equal ($0.00) because Aeropres will absorb any additional maintenance costs.
  (iii) N/A

8. **Implementation time frame**

The time frame of four quarters is appropriate.

9. **Recommendations**

(a) This project is approved as proposed.

OORG/UNDP Technical Reviewer: Harry B. McCain

Date Review Completed: May 26, 1995

SUB PROJECT PROPOSAL REPORT

COUNTRY	India		
SECTOR COVERED	Aerosols		
ODS USE IN SECTOR (1991)	1100 tons CFC (1100 ton ODP)		
PROJECT TITLE	**Asian Aerosols Pvt. Ltd. Aerosol Conversion**		
PROJECT IMPACT	Phaseout 25 tons per year of CFC 12 and CFC-11/12 Mixture (25 tons ODP).		
PROJECT ECONOMIC LIFE	10 Years		
PROJECT DURATION	12 months		
TOTAL PROJECT COST	Incremental Capital Cost	US$	82,700
	Contingencies @ 10%		8,300
	Project Capital Cost		91,000
	FA Fee @ 3%		2,700
	Total Project Cost	US$	93,700
PROPOSED OTF FINANCING	US $ 93,700		
UNIT ABATEMENT COST	US$ 0.59/kg		
GRANT EFFECTIVENESS	US$ 3.64/kg		
IMPLEMENTING ENTERPRISE	Asian Aerosols Pvt. Ltd.		
COORDINATING NATIONAL BODY	Ozone Cell of MOEF		
IMPLEMENTING AGENCY	The World Bank /IDBI		

PROJECT SUMMARY

This project will accomplish the conversion to hydrocarbon aerosol propellant (HAP) at Asian Aerosols. This company is part of the "Asian Aerosols group" that mostly contract packages insecticides and industrial products. One of the filling machines inAsian Aerosols is not safe for filling HAPs. The enterprise has no open air filling room, for which they need transport conveyors. A leak test tank, quality control instruments, racks for propellant cylinders and other small items are also required.

Technical Assessment: This proposal has been reviewed and supported by OORG technical reviewer, Mr. H. McCain, whose comments are attached.

PROJECT OBJECTIVES:

The project objective is to phase out the use of 25 tons of CFC 12 or CFC 11/CFC 12 annually by completing the conversion process from CFCs to HAPs.

SECTOR BACKGROUND:

In India, two tiered market exists in aerosols, with light weight, flammable HAPs aerosols selling at much lower prices than heavy, CFC aerosols, so there is little incentive to change. Also it is estimated that there are over 200 fillers of aerosols in India, so that competition is very keen, and there is a general fear of switching to HAP before the competition, and losing market share due to poor quality.

A government task force has estimated aerosol fillings at over 40,000,000 units per year, and a consumption of over 1,400 metric tons of CFC (1993). Final country programme estimates place CFC consumption at 1100 m.t. in 1991, and the market has grown substantially since then.

ENTERPRISE BACKGROUND:

This enterprise is a member of the Asian Aerosols group, one of the largest contract filling companies in the aerosol industry in India. They fill various brands for many customers, with this company dedicated mostly to household and personal aerosols products. The Asian Aerosols group has chosen to operate several small facilities rather than one large one, such that they do not need to package for two or more competitors at the same facility, but rather can seprate competing interests at different contract filling plants. They wish to convert entirely to HAPs. Actual consumption of CFC is 25 tons per year. Asian Aerosols has their own CFC consumption that is not claimed by any other enterprise in the group. The Asian Aerosols group is family owned and 100% Indian capital.

Unit sales are as follows:

Year	Cans Filled	CFC used mt	HAPs used
1992-93	1,50,000	18.0	-
1993-94	2,00,000	25.2	-
1994-95	2,00,000	25.2	-

Breakdown by product in 1994-95:

Product	Weight gm	Percent total	CFC used mt
Household	160	25%	7.5
Household contract	160	50%	15.0
Personal Contract	100	25%	2.7
Total		100	25.2

Production machinery is as follows:

Line	Type	CPM[1]	CPY[1]
1	Semi automatic machine	25	25,00,000
Capacity	same	same	same

Capacity of the new recommended machine with this product is 1,000,000 CPY (10 CPM), the same as the actual installed capacity. The company will destroy the old machine when the new one is operating.

PROJECT DESCRIPTION:

Asian Aerosols is located in the industrial area of Vapi. One of their filling machines is unsafe for filling HAPs. They must install an open air filling room, for which they need conveyors. They have small molecular sieve towers, which they will continue to use with LPG until proper HAPs propellant is available.

Some installations are needed, including a water bath (required for safe filling of aerosols with HAPs propellant), racks for propellant cylinders, piping, and site preparation. A set of quality control gauges, a portable gas detector, and additional fire extinguishers are also needed. total conversion costs includes shipping and handling of the filling machine and safety training which will be provided initially by a foreign expert until a local Indian firm is trained to provide this services.

[1] CPM is cans per minute of actual production. This is multiplied by 100,000 minutes (400 effective production minutes per day for 250 days per year) to give cans per year (CPY). Capacity is the sum of the cans per year of the various filling lines.

JUSTIFICATION FOR ALTERNATE TECHNOLOGY SELECTION:

Hydrocarbon aerosol propellants (HAPs) have been the principal alternatives to CFC 12 employed worldwide. They are approved by the 1993 UNEP Technical Options Report on Aerosols, Sterilants, and Miscellaneous Uses and Carbon Tetrachloride.

Aerosol grade hydrocarbon propellant is not currently available in India, but the government of India has agreed to provide this material from one or more of the government owned refineries shortly.

PROJECT COSTS:

The total project incremental cost of $ 93,700.00 was calculated as the economic capital cost.

RECURRING COSTS/SAVINGS:

Asian Aerosols is contract filler and its principal proudcts are household and personal products which accounted for 100% of 1994 sales. There are no recurring savings for this projects as explained in the cover memo.

UNIT ABATEMENT COST AND GRANT EFFECTIVENESS:

UAC = $ 0.59 per kilogram. Grant Effectiveness = $3.64 (Annexure B).

PROJECT IMPLEMENTATION SCHEDULE:

This is a very simple project to implement, as it can be completed during 4 quarters:

Task	Q1	Q2	Q3	Q4
Purchase of Equipment	XXX			
Install Open Air Filling Room		XXX		
Install Equipment			XXX	
Start up/Testing				XXX

REQUIRED REGULATORY ACTIONS:

Once all aerosol manufacturers have had an opportunity to convert, and once the technical expert contracted to do the training has audited safety and certified that plant personnel are fully trained, the use of CFCs in aerosols in India should be prohibited.

RESULTS:

This project will result in the immediate reduction of 25,000 kilograms of CFC usage in the first year. If the company's volume continues to grow as expected, it is estimated that the actual reduction will be considerably higher in 2 or 3 years time.

ENVIRONMENTAL IMPACT:

The substitute propellant, a mixture of butane and propane, does not damage the ozone layer. It does not contribute to acid rain, not is it carcinogenic, mutagenic, or toxic. The butane/ propane mix does not pollute the soil or ground water. This mixture is a volatile organic compound (VOC) that contributes somewhat to ground level contamination. This mixture does have a global warming potential, albeit very low, but safety requirements are such that leakage is kept to an absolute minimum, and thus GWP considerations are negligible.

Hydrocarbons are extremely flammable and explosive. The storage of the hydrocarbonpropellants must be accomplished by strict adherence to all applicable Indian and local codes and regulations.

Annexure A

Capital Cost in US$

No.	Quant.	Description	Local	Foreign or Import
1	1	Semi automatic aerosol filling machine		37,000.0
2	lot	Site Preparation/Wall in Lot	3,000.0	
3	lot	Construct Open Air Filling Room	4,000.0	
4	lot	Piping	1,200.0	
5	1	Racks for Propellant Cylinders	800.0	
6	16	Cylinders (50 kgs)	800.0	
7	lot	Additional Fire Extinguishers	700.0	
8	1	Manual Leak Test Tank w/heater (water bath)	4,000.0	
9	1	Set of Quality Control Gauges (crimp height, crimp diameter, pressure, vacuum, etc.		3,200.0
10	1	Portable Gas Detector		1,000.0
11	lot	Shipping and Handling		5,000.0
12	lot	Plant Safety Training		4,000.0
13	2	Transport Conveyors (to and fro OAFR)		18,000.0
		Sub-totals	14,500.0	68,200.0

Summary	Cost
Capital Cost	82,700.0
+ 10% Contingency	8,300.0
+ 3% Financial Agents Fee	2,700.0
Total Project Cost	$ 93,700.0

Annexure B

UNIT ABATEMENT COST AND GRANT EFFECTIVENESS:

The **unit abatement cost** of the Asian Aerosols aerosol conversion project is calculated as follows:

Using the formula $A = \frac{C(F) + (OC-OS)}{W}$

Where C	=	$ 82,700 + 8,300	OC = 0
(C)F	=	$ 14,806.3	OS = 0
W	=	25,000	

Doing the calculation, unit abatement cost = $ 0.59/kg.

The **grant effectiveness** of this project is $91,000.0 divided by 25,000 = $ 3.64

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May 25, 1995

TO	:	Naimeh Hadjitarkhani Operations Officer SA2CI, South Asia Country Dept. II	FAX: 202-477-7352
COPY TO	:	Tom Waltz ENVGC	FAX: 202-522-3258
FROM	:	Harry B. McCain	

1. **Country of origin:** India

2. **Project title:** Asian Aerosols Pvt. Ltd. Aerosol Conversion

3. **Sector/sub-sector:** Aerosols

4. **Relationship to country programme**

5. **Technology**

   (a) Hydrocarbon propellants have long been the preferred substitute for CFCs when used as an aerosol propellant. Hydrocarbon propellants are selected because of their zero ozone depleting potentials. The only environmental shortcoming of the hydrocarbon aerosol propellants (HAPs) is their flammability which can be correctly handled with the appropriate and now well established HAP technology. The U.S.A. has been using HAPs in aerosols instead of CFCs since 1978. In 1994 approximately 3 billion aerosol cans were filled with HAPs.

   (b) The technology for the use of HAPs as a substitute for CFCs in aerosol products is well established, permanent, and not transitional. There are no transitional technologies that could be used in the aerosol sector that would be appropriate.

   (c) It is totally feasible that the HAP technology required for this project can be transferred from Western Europe and the U.S.A. using the free market system.

      (I) No technology transfer agreement is required.
      (II) There is no licensing agreement required.

(iii) The reviewer agrees with the determination to use HAPs as a replacement technology for CFCs used as propellants in aerosol products.
(iv) HAP is the most cost effective technology for this conversion.

6. **Environmental Impact**

(a) This project will result in the phaseout of 25 tons/year of CFC-12 and CFC-11/12 (ODS). Global warming potential is negligible. Unit Abatement Cost is $0.59/Kg U.S.
(b) Costs are appropriate to minimize health and safety and other environmental impacts.

7. **Project costs**

(a) All cost components identified in the project are essential for the conversion from CFCs to hydrocarbon aerosol propellants.
(b) Many cost components are present that will facilitate the conversion to hydrocarbon aerosol propellants.
(c) Cost of equipment
  (i) The cost of existing equipment is addressed in a manner that is consistent with the reviewer's experience.
  (ii) The reviewer agrees with the finding that all of the base line equipment in the report should be acquired.
  (iii) No additional equipment requests are essential for the conversion.
  (iv) All of the base line equipment will necessarily have to be replaced.
  (v) The old equipment will be destroyed once the new equipment is installed.
  (vi) There will be no salvage value with the destroyed equipment.
  (vii) The production capacity of one million cans/year will remain unchanged with the installation of new equipment the destruction of the old.
(d) Training costs are appropriate, although the number of persons to be trained per the $4,000.00 U.S. was not given.
(e) Operating costs
  (i) The operating costs are appropriate.
  (ii) Net recurring costs and recurring savings are equal ($0.00) because Asian Aerosols Pvt. Ltd. will absorb any additional maintenance costs.
  (iii) N/A

8. **Implementation time frame**

The time frame of four quarters is appropriate.

9. **Recommendations**

(a) This project is approved as proposed.
(b) It would be much better if all of these projects that use cylinders could be consolidated in a lessor number of industries using bulk storage. Since they cannot, special precautions must be taken for handling cylinders.

OORG/UNDP Technical Reviewer: Harry B. McCain

Date Review Completed: May 25, 1995

SUB PROJECT PROPOSAL REPORT

COUNTRY	India		
SECTOR COVERED	Aerosols		
ODS USE IN SECTOR (1991)	1100 tons CFC (1100 ton ODP)		
PROJECT TITLE	**Aero Pack Products Conversion Project**		
PROJECT IMPACT	Phaseout 20.4 tons per year of CFC 12 and CFC-11/12 Mixture (20.4 tons ODP).		
PROJECT ECONOMIC LIFE	10 Years		
PROJECT DURATION	12 months		
TOTAL PROJECT COST	Incremental Capital Cost	US$	63,200
	Contingencies @ 10%		6,300
	Project Capital Cost		69,500
	FA Fee @ 3%		2,100
	Total Project Cost	US$	71,600
PROPOSED OTF FINANCING	US $ 71,600		
UNIT ABATEMENT COST	US$ 0.55/kg		
GRANT EFFECTIVENESS	US$ 3.38/kg		
IMPLEMENTING ENTERPRISE	Aero Pack Products		
COORDINATING NATIONAL BODY	Ozone Cell of MOEF		
IMPLEMENTING AGENCY	The World Bank /IDBI		

PROJECT SUMMARY

This project will accomplish the conversion to hydrocarbon aerosols propellant (HAP) at Aero Pack Products. The plant is located in MIDC, New Bombay, with sufficient space to use the open air filling method.

We have a semi automatic filling machine which is not safe to fill HAP. They require assistance to construct an open air filling room, a small semi-automatic machine and quality control equipment and instruments.

Technical Assessment: This proposal has been reviewed and supported by OORG technical reviewer, Mr. H. McCain, whose comments are attached.

PROJECT OBJECTIVES:

The project objective is to phase out the use of 20.4 tons of CFC 12 or CFC 11/CFC 12 annually by completing the conversion process from CFCs to HAPs.

SECTOR BACKGROUND:

In India, two tiered market exists in aerosols, with light weight, flammable HAPs aerosols selling at much lower prices than heavy, CFC aerosols, so there is little incentive to change. Also it is estimated that there are over 200 fillers of aerosols in India, so that competition is very keen, and there is a general fear of switching to HAP before the competition, and losing market share due to poor quality.

A government task force has estimated aerosol fillings at over 40,000,000 units per year, and a consumption of over 1,400 metric tons of CFC (1993). Final country programme estimates place CFC consumption at 1100 m.t. in 1991, and the market has grown substantially since then.

ENTERPRISE BACKGROUND:

Aero Pack is currently filling their own brands, mainly industrial and household products. They are under competitive pressure to convert to HAPs, as several companies are filling the same types of products as they are with HCs, and selling at a much lower price. Actual consumption (1994) of CFC is 20.4 m.t. This company is family owned and 100% Indian capital.

Unit sales are as follows:

Year	Cans Filled	CFC used mt	HAPs used mt
1992-93	55,380	15.9	3.5
1993-94	60,647	16.2	4.2
1994-95	73,058	20.4	6.9

Breakdown by product in 1994-95:

Product	Weight gm	Percent total	CFC used mt
CFC Mold Release	550	50.2%	18.4
HAPs Mold Release	335	30.0%	0
CFC Other Prods.	200	13.8%	2.0
HC Contract Filling	(various)	6.0%	0
TOTAL		100.0	20.4

Production machinery is as follows:

Line	Type	CPM[1]	CPY
1	Semi automatic pneumatic	3	300,000
Capacity	same	same	same

Capacity of the new recommended machine (slow filling valve, large propellent fill, and two gassing strokes peer can) is 300,000 CPY (3 CPM), the same as the actual installed capacity. The company will destroy the old machine when the new one is operating.

PROJECT DESCRIPTION:

Aero Pack Products India has sufficient space to use an open air filling room (OAFR) at their current volume of production at the present plant. They proposed grant would provide for a new filling machine and construction of the filling room.

The self made filling machine has always leaked, and is not suitable for safe filling of HAPs, and a new small semi-automatic filling machine is needed to replace it. The enterprise must install a roofed in "open air filling room" on the plant property.

Aero Pack Products currently does not leak test all of the production - a manual water test tank is needed. Safe filling procedures for hydrocarbons requires the use of a leak test tank, and gauges to guarantee that the cans are properly sealed. A portable inspection gas detector is also necessary. Safety equipment and safety training are required. Safety training is initially to be provided by a foreign expert until a local Indian firm is trained to provide this service.

JUSTIFICATION FOR ALTERNATE TECHNOLOGY SELECTION:

Hydrocarbon aerosol propellants (HAPs) have been the principal alternatives to CFC 12 employed worldwide. They are approved by the 1993 UNEP Technical Options Report on Aerosols, Sterilants, and Miscellaneous Uses and Carbon Tetrachloride. Aerosol grade

[1] CPM is cans per minute of actual production. This is multiplied by 100,000 minutes (400 effective production minutes per day for 250 days per year) to give cans per year (CPY). Capacity is the sum of the cans per year of the various filling lines.

hydrocarbon propellant is not currently available in India, but the government of India has agreed to provide this material from one or more of the government owned refineries.

PROJECT COST:

The total project incremental cost of $ 71,600 was calculated as the economic capital cost. The breakdown is provided in Annexure A.

RECURRING COSTS/SAVINGS:

The Aero Pack Product's principal product, Silicon Mold Release, accounted for 80.2% of 1994 sales. There is no operating savings due to the switch to HAP for this project as explained in the cover memo.

UNIT ABATEMENT COST AND GRANT EFFECTIVENESS:

UAC = $ 0.548 per kilogram. Grant Effectiveness = $3.38 (Annexure B).

PROJECT IMPLEMENTATION SCHEDULE:

The project can be implemented within 12 months of the grant amount being made available.

Task	Q1	Q2	Q3	Q4
Purchase of Equipment	XXX			
Install Open Air Filling Room		XXX		
Install Equipment			XXX	
Start up/Testing				XXX

REQUIRED REGULATORY ACTIONS:

Once all aerosol manufacturers have had an opportunity to convert, and once the technical expert contracted to do the training has audited safety and certified that plant personnel are fully trained, the use of CFCs in aerosols in India should be prohibited.

RESULTS:

This project will result in the immediate reduction of 20,400 kilograms of CFC usage in the first year. If the company's volume continues to grow as expected, it is estimated that the actual reduction will be considerably higher in 2 or 3 years time.

ENVIRONMENTAL IMPACT:

The substitute propellant, a mixture of butane and propane, does not damage the ozone layer. It does not contribute to acid rain, not is it carcinogenic, mutagenic, or toxic. The butane/ propane mix does not pollute the soil or ground water. This mixture is a volatile organic compound (VOC) that contributes somewhat to ground level contamination. This mixture does have a global warming potential, albeit very low, but safety requirements are such that leakage is kept to an absolute minimum, and thus GWP considerations are negligible.

Hydrocarbons are extremely flammable and explosive. The storage of the hydrocarbon propellants must be accomplished by strict adherence to all applicable Indian and local codes and regulations.

Annexure A

Project Costs in US$

No.	Quant.	Description	Local	Foreign or Import
1	1	Semi automatic aerosol filling machine		37,000.0
2	lot	Site Preparation/Wall in Lot	3,000.0	
3	lot	Construct Open Air Filling Room	4,000.0	
4	lot	Piping	1,200.0	
5	1	Racks for Propellant Cylinders	800.0	
6	16	Cylinders (50 kgs)	800.0	
7	lot	Additional Fire Extinguishers	700.0	
8	1	Manual Leak Test Tank w/heater (water bath)	4,000.0	
9	1	Set of Quality Control Gauges (crimp height, crimp diameter, pressure, vacuum, etc.		3,200.0
10	1	Portable Gas Detector		1,000.0
11	lot	Shipping and Handling		3,500.0
12	lot	Plant Safety Training		4,000.0
		Sub-totals	14,500.0	48,700.0

Summary	Cost
Capital Cost	63,200.0
+ 10% Contingency	6,300.0
+ 3% Financial Agents Fee	2,100.0
Total Project Cost	71,600.0

Annexure B

UNIT ABATEMENT COST AND GRANT EFFECTIVENESS:

The **unit abatement cost** of the Aero Pack Product's aerosol conversion project is calculated as follows:

Using the formula $A = \frac{C(F) + (OC-OS)}{W}$

Where C	=	$ 63,200 + 6,300	OC = 0
(C)F	=	$ 11,315.1	OS = 0
W	=	20,400	

Doing the calculation, unit abatement cost = $ 0.55/kg.

The **grant effectiveness** of this project is $69,500.0 divided by 20,400 = $ 3.38

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May 25, 1995

TO	:	Naimeh Hadjitarkhani Operations Officer SA2CI, South Asia Country Dept. II	FAX: 202-477-7352
COPY TO	:	Tom Waltz ENVGC	FAX: 202-522-3258
FROM	:	Harry B. McCain	

1. **Country of origin:** India

2. **Project title:** Aero Pack Products Pvt. Ltd. Conversion Project

3. **Sector/sub-sector:** Aerosols

4. **Relationship to country programme**

5. **Technology**

   (a) Hydrocarbon propellants have long been the preferred substitute for CFCs when used as an aerosol propellant. Hydrocarbon propellants are selected because of their zero ozone depleting potentials. The only environmental shortcoming of the hydrocarbon aerosol propellants (HAPs) is their flammability which can be correctly handled with the appropriate and now well established HAP technology. The U.S.A. has been using HAPs in aerosols instead of CFCs since 1978. In 1994 approximately 3 billion aerosol cans were filled with HAPs.

   (b) The technology for the use of HAPs as a substitute for CFCs in aerosol products is well established, permanent, and not transitional. There are no transitional technologies that could be used in the aerosol sector that would be appropriate.

   (c) It is totally feasible that the HAP technology required for this project can be transferred from Western Europe and the U.S.A. using the free market system.

      (i) No technology transfer agreement is required.
      (ii) There is no licensing agreement required.

(iii) The reviewer agrees with the determination to use HAPs as a replacement technology for CFCs used as propellants in aerosol products.
(iv) HAP is the most cost effective technology for this conversion.

6. **Environmental Impact**

(a) Project will result in the reduction of 20.4 tons/year of CFC-12 and CFC-11/12 (ODS). Global warming potential of hydrocarbon aerosol propellants is negligible. Unit Abatement Cost is $0.65/Kg U.S.
(b) Costs are appropriate to minimize health and safety and other environmental impacts.

7. **Project costs**

(a) All cost components identified in the project are essential for the conversion from CFCs to hydrocarbon aerosol propellants.
(b) There are few, if any, cost components present that will facilitate the conversion to hydrocarbon aerosol propellant.
(c) Cost of equipment
  (i) The cost of existing equipment is addressed in a manner that is consistent with the reviewer's experience.
  (ii) The reviewer agrees with the finding that all of the base line equipment in the report should be acquired.
  (iii) No additional equipment requests are essential for the conversion.
  (iv) The base line equipment for this conversion cannot be modified to perform functions needed in the conversion.
  (v) The old equipment will be destroyed once new equipment is installed.
  (vi) There will be no salvage value with the destroyed equipment.
  (vii) The production capacity will be unchanged (300,000 cans/year) after the installation of new equipment.
(d) Total cost of training ($4,000.00) is probably appropriate, but the number of persons to be trained was not delineated.
(e) Operating costs
  (i) The operating costs are appropriate.
  (ii) Net recurring costs and recurring savings are equal ($0.00) because Aero Pack will absorb any additional maintenance costs.
  (iii) N/A

8. **Implementation time frame**

The time frame of four quarters is appropriate.

9. **Recommendations**

(a) This project is approved as proposed.
(b) It would be much better if all of these projects that use cylinders could be consolidated in a lessor number of industries using bulk storage. Since they cannot, special precautions must be taken for handling cylinders.

OORG/UNDP Technical Reviewer: Harry B. McCain

Date Review Completed: May 25, 1995

SUBPROJECT PROPOSAL REPORT

COUNTRY	INDIA	
PROJECT TITLE	Ultra Tech Specialty Chemicals Pvt Ltd. Conversion, Bombay	
SECTOR COVERED	Aerosols	
ODS USE IN SECTOR	1100 tons CFCs (= ODP) in 1991	
PROJECT IMPACT	30.8 tons CFC-12 and CFC 11/12 mixture/Y = ODP; Base 1994	
PROJECT DURATION	1 Year	
PROJECT ECONOMIC LIFE	10 Years	
TOTAL PROJECT COSTS	Incremental Capital Costs:	US$63,700
	Contingencies @ 10%:	US$6,400
	Project Capital Cost:	US$70,100
	FA Fee @ 3%:	US$2,100
	Total Project Cost:	US$72,200
PROPOSED OTF FINANCING	US$ 72,200	
UNIT ABATEMENT COST	US$ 0.37/kg/y	
COST EFFECTIVENESS	US$ 2.27/kg/y	
IMPLEMENTING ENTERPRISE	Ultra Tech Specialty Chemicals Pvt Ltd, Bombay	
COORDINATING MINISTRY	Ministry of Environment and Forests	
IMPLEMENTING AGENCY	The World Bank	

PROJECT SUMMARY

The project will accomplish the conversion to hydrocarbon aerosol propellant (HAP) at **Ultra Tech Specialty Chemicals Pvt Ltd.** The plant is located in an independent shed in an industrial area with insufficient space to use HAP. The enterprise has a semi-automatic and a manual filling machine for CFCs, which would not be suitable for HAP. They require a new semi-automatic filling line, assistance to install a safe "open air filling room (OAFR), quality control testing equipment/instruments and safety training.

Technical Assessment: This proposal has been reviewed and endorsed by OORG reviewer, Mr. Harry McCain whose comments are attached.

PROJECT OBJECTIVES:

The project objective is to phase-out the use of 30.8 tons of CFC 11/12 annually after completion of the conversion process already initiated.

SECTOR BACKGROUND:

In India, two tiered market exists in aerosols, with light weight, flammable HAPs aerosols selling at much lower prices than heavy, CFC aerosols, so there is little incentive to change. Also it is estimated that there are over 200 fillers of aerosols in India, so that competition is very keen, and there is a general fear of switching to HAP before the competition, and losing market share due to poor quality.

A government task force has estimated aerosol fillings at over 40,000,000 units per year, and a consumption of over 1,400 metric tons of CFC (1993). Final country program estimates place CFC consumption at 1100 m.t. in 1991, and the market has grown substantially since then.

ENTERPRISE BACKGROUND:

Ultra Tech is currently manufacturing Industrial sprays and marketing the same under their own brand names and also contract filling small quantities of electronic cleaners. The Company directors and share-holders are Mr. Ravi Bhatia and his two brothers, and the ownership is 100% Indian.

Unit sales are as follows:

Year	Cans Filled	CFC used mt	LPG used
1992-93	25,000	13	Nil
1993-94	42,000	24	Nil
1994-95	64,000	34	Nil

Break down by product in 1994-95

Product	Weight gm	Percent Total	CFC used mt
Silicone Spray	550	70.0	24.2
Silicone Spray	550	20.0	5.9
Air freshener	300	5.0	0.5
Contact cleaner	100	5.0	0.2
TOTAL		100.0	30.8

Production machinery is as follows:

Line	Type	CPM[1]	CPY[1]
1	Semi-Automatic	5	500,000
2	Manual	1	100,000
3	Manual	1	100,000
Total		7	700,000

The capacity of the semi-automatic line given above is low since party is operating with a 2 h.p. compressor, and hence is not operating at rated capacity. Capacity of the new semi-automatic line is 1,000,000 cpy (10 cpm) is comparable to present installed capacity. The company will destroy the old lines when the new one is operating.

PROJECT DESCRIPTION:

Texas Enterprises would not be able to handle HAP at their present premises, however, they are willing to relocate at their own expense. The enterprise has a semi-automatic and two manual filling lines which is used for CFC filling but will not be suitable for HAP. It is proposed to replace the three current filling machines with a new semi automatic filling one, and install a roofed in "open air filling room" (OAFR).

Texas Enterprises are not currently leak testing their products, however, this testing would be necessary as part of safe filling procedures for hydrocarbons. Moreover, they will require a leak test hot water bath; a set of quality control gauges and safety equipment and safety training.

The semi-automatic line proposed would not materially alter the installed capacity. All changes proposed are to ensure safety in handling and filling HAP.

JUSTIFICATION FOR SELECTION OF ALTERNATIVE TECHNOLOGY:

Hydrocarbon aerosol propellants (HAPs) have been the principal alternatives to CFC 12 employed worldwide. They are approved by the 1993 UNEP Technical Options Report on Aerosols, Sterilants, and Miscellaneous Uses and Carbon Tetrachloride.

Aerosol grade hydrocarbon propellant is not currently available in India, but the Government of India has agreed to provide this material from one or more of the Government owned refineries shortly.

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[1] CPM is cans per minute of actual production. This is multiplied by 100,000 minutes (400 effective production minutes per day for 250 days per year) to give cans per year (CPY). Capacity is the sum of the cans per year of the various filling lines.

PROJECT COSTS:

The total project cost of $72,200 was calculated as the economic capital cost. The break down is provided in Annexure A.

RECURRING COSTS/SAVINGS:

Texas Enterprises is a manufacturer of industrial sprays. There are no recurrent savings as a result of switch over to HAPs, as explained in the cover memo.

UNIT ABATEMENT COST AND GRANT EFFECTIVENESS:

UAC = $0.37 per kilogram. Grant effectiveness = $2.24 (Annexure B).

PROJECT IMPLEMENTATION SCHEDULE:

The project can be implemented within 12 months of the grant amount being made available:

Task	Q1	Q2	Q3	Q4
Purchase of equipment & lot	XXX			
Construction of OAFR		XXX		
Install Equipment			XXX	
Training/Start-up				XXX

REQUIRED REGULATORY ACTION:

Once all aerosol manufactures have had an opportunity to convert, personnel have been trained and certified, the use of CFC in aerosol industry in India should be prohibited.

RESULTS:

The project would phase-out of 31.3 tons of CFC usage per year. If this company's volume increases as per past trend, the actual reduction will be considerably higher in the next few years.

ENVIRONMENTAL IMPACT:

The substitute propellant, a mixture of butane and propane, does not damage the ozone layer. It does not contribute to acid rain, is not carcinogenic, mutagenic, or toxic. The butane/propane mix does not pollute the soil or ground water. This mixture is a volatile organic compound (VOC) that contributes somewhat to ground level contamination. This mixture does have a global warming potential, albeit very low. Hydrocarbons are extremely flammable, and explosive. The storage of the Hydrocarbon propellants must be accomplished by strict adherence to local codes and regulations.

Annexure A

CAPITAL COSTS
(Figures in US$)

No.	Qty	Description	Local	Foreign or import
1	1	Semi Automatic filling line		37,000
2	lot	Wall in lot + site preparation	3,000	
3	lot	Construct OAFR	4,000	
4	lot	Additional fire extinguishers	700	
5	1	Set of Quality Control Gauges (Crimp height, crimp diameter, pressure, vacuum etc.)		3,200
6	1	Rack for Propellant Tanks	800	
7	1	Portable Gas Detector		1,000
8	lot	Piping	1,200	
9	1	Leak Test Tank	4,000	
10	lot	25 nos. Cylinders	1,250	
11	lot	Shipping & Handling		3,500
12	lot	Plant Safety Training		4,000
		SUB TOTALS	14,950	48,700
		Total (local and foreign expenses)		63,700

Summary :	Cost
Capital Cost	63,700
+ 10 % contingency	6,400
+ 3 % Financial agent's fee	2,100
Total Project Cost	72,200

Annexure B

UNIT ABATE COSTS AND GRANT EFFECTIVENESS:

The unit abatement cost of the **Texas Enterprises** conversion project is calculated as follows:

Using the formula $A = \frac{C(F) + (OC - OS)}{W}$

Where C = US $ 70,100 OC=0
C(F) = US $ 11,517 OS=0
W= 31,300 kg

Doing the calculation, unit abatement cost = US $ 0.37/kg.

The existing filling lines would have to be scrapped to prevent it from being used. There would, therefore, be no disposal value for the existing equipment.

The grant effectiveness of the Texas Enterprises conversion project is calculated as follows :-

Using the formula $A = \frac{C + (OC - OS)}{W}$

Where C = US $ 70,100 OC=0
OS=0
W= 31,300 kg

Doing the calculation, cost effectiveness = US $ 2.24 / kg.

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May 26, 1995

TO : Naimeh Hadjitarkhani FAX: 202-477-7352
Operations Officer
SA2CI, South Asia Country Dept. II

COPY TO : Tom Waltz FAX: 202-522-3258
ENVGC

FROM : Harry B. McCain

1. **Country of origin:** India

2. **Project title:** Texas Enterprises Conversion

3. **Sector/sub-sector:** Aerosols

4. **Relationship to country programme:** N/A

5. **Technology**

(a) Hydrocarbon propellants have long been the preferred substitute for CFCs when used as an aerosol propellant. Hydrocarbon propellants are selected because of their zero ozone depleting potentials. The only environmental shortcoming of the hydrocarbon aerosol propellants (HAPs) is their flammability which can be correctly handled with the appropriate and now well established HAP technology. The U.S.A. has been using HAPs in aerosols instead of CFCs since 1978. In 1994 approximately 3 billion aerosol cans were filled with HAPs.

(b) The technology for the use of HAPs as a substitute for CFCs in aerosol products is well established, permanent, and not transitional. There are no transitional technologies that could be used in the aerosol sector that would be appropriate.

(c) It is totally feasible that the HAP technology required for this project can be transferred from Western Europe and the U.S.A. using the free market system.

(i) No technology transfer agreement is required.

(ii) There is no licensing agreement required.

(iii) The reviewer agrees with the determination to use HAPs as a replacement technology for CFCs used as propellants in aerosol products.
(iv) HAP is the most cost effective technology for this conversion.

6. **Environmental Impact**

(a) This project will phase out 31.3 tons/year of CFC-12 and CFC-11/12 (ODS). Global warming potential is negligible. Unit Abatement Cost is $0.37/Kg U.S.
(b) Costs are appropriate to minimize health and safety and other environmental impacts.

7. **Project costs**

(a) All cost components identified in the project are essential for the conversion from CFCs to hydrocarbon aerosol propellants.
(b) Many cost components are present that will facilitate the conversion to hydrocarbon aerosol propellants.
(c) Cost of equipment
  (i) The cost of existing equipment is addressed in a manner that is consistent with the reviewer's experience.
  (ii) The reviewer agrees with the finding that all of the base line equipment in the report should be acquired.
  (iii) No additional equipment requests are essential for the conversion.
  (iv) Much of the base line equipment in this project must be replaced.
  (v) The existing filling lines would have to be scrapped to prevent it from being used. There would, therefore, be no disposal value for the existing equipment.
  (vi) Same as above.
  (vii) At 700,000 cans/year, Texas Enterprises is presently operating below its installed capacity of one million cans/year. The capacity of the new equipment (semi automatic) is one million cans/year. Therefore, capacity per se will remain the same.
(d) The training cost of $4000.00 is probably appropriate. The number of people to be trained, however, is not given.
(e) Operating costs
  (i) The operating costs are appropriate.
  (ii) This project considers that short-term savings, if any, will cover some of the increased maintenance costs, and that thereafter Texas Enterprises would absorb these extra costs. The operating costs and operating savings are considered to be equal. Hence, the project cost is the incremental cost.
  (iii) N/A

8. **Implementation time frame**

The time frame of four quarters is appropriate.

9. **Recommendations**

(a) This project is approved as proposed.
(b) It would be much better if all of these projects that use cylinders could be consolidated in a lessor number of industries using bulk storage. Since they cannot, special precautions must be taken for handling cylinders.

OORG/UNDP Technical Reviewer: Harry B. McCain

Date Review Completed: May 26, 1995

SUB PROJECT PROPOSAL REPORT

COUNTRY	India	
SECTOR COVERED	Aerosols	
ODS USE IN SECTOR (1991)	1100 tons CFC (1100 ton ODP)	
PROJECT TITLE	**Aerol Formulations Aerosol Conversion**	
PROJECT IMPACT	Phaseout 31 tons per year of CFC 12 and CFC-11/12 Mixture (31 tons ODP).	
PROJECT ECONOMIC LIFE	10 Years	
PROJECT DURATION	12 months	
TOTAL PROJECT COST	Incremental Capital Cost	US$63,200
	Contingencies @ 10%	6,300
	Project Capital Cost	69,500
	FA Fee @3%	2,100
	Total Project Cost	US$71,600
PROPOSED OTF FINANCING	US $ 71,600	
UNIT ABATEMENT COST	US$ 0.365/kg	
GRANT EFFECTIVENESS	US$ 2.24/kg	
IMPLEMENTING ENTERPRISE	Aerol Formulations Pvt. Ltd.	
COORDINATING NATIONAL BODY	Ozone Cell of MOEF	
IMPLEMENTING AGENCY	The World Bank /IDBI	

PROJECT SUMMARY

This project will accomplish the conversion to hydrocarbon aerosol propellants (HAP) at Aerol Formulations. Aerol Formulation is the second largest user of CFCs in aerosols in India. They are currently filling in a non-industrial (basically residential) area in Delhi. In order to be able to install their plant for filling HAP, the company has to relocate to a different location.

The current machineries in use are homemade "Brazzomatic" type that cannot be made safe, therefore, it is proposed to replace them with a semi-automatic machine. The enterprise will use the open air filling method, which is a low cost alternative. Moreover, a test bath, and some quality control intruments are recommended.

Technical Assessment: This proposal has been reviewed and supported by OORG technical reviewer, Mr. H. McCain, whose comments are attached.

PROJECT OBJECTIVES:

The project objective is to phase out the use of 31 tons of CFC 12 or CFC 11/CFC 12 annually by completing the conversion process from CFCs to HAPs.

SECTOR BACKGROUND:

In India, two tiered market exists in aerosols, with light weight, flammable HAPs aerosols selling at much lower prices than heavy, CFC aerosols, so there is little incentive to change. Also it is estimated that there are over 200 fillers of aerosols in India, so that competition is very keen, and there is a general fear of switching to HAP before the competition, and losing market share due to poor quality.

A government task force has estimated aerosol fillings at over 40,000,000 units per year, and a consumption of over 1,400 metric tons of CFC (1993). Final country programme estimates place CFC consumption at 1100 m.t. in 1991, and the market has grown substantially since then.

ENTERPRISE BACKGROUND:

Aerol Formulations is part of an industrial consortium consisting of nine companies. This year's sales are expected to be almost US$ 1.5 million. Capital is 100% Indian. Aerol Formulations is the second largest filler (in terms of CFC consumption) of aerosols in New Delhi (or northern) region. The company presently fills about 100,000 cans per year and uses about 31 metric tons of CFC. Aerol Formulations is contract packagers and also fill their own brands (possibly 25% contract filling; 75% their own brands). They report that in their product area, there are already products with HAP propellants, which sell at a considerably lower price. Aerol is currently filling only industrial aerosols at this facility.

Unit sales are as follows:

Year	Cans Filled		CFC used		DME/HAPs Used	
	Own Brand	Contract Filling	Own Brand kgs	Contract Filling kgs	Own Brand kgs	Contract Filling
1992-93	26,500 cans of 550 ml cap.	26,000 cans of 550 ml Cap.	14,000	13,000	40	Nil
1993-94	71,000 cans of 550 ml cap.	Nil	41,000	Nil	1,200	Nil
1994-95	97,000 cans of 550 ml cap.	30,000 Cans of 550 ml cap.	31,130	17,000	8,500	Nil

Breakdown by product in 1994-95:

Product	Weight gms	Percent total	Propellent used
Silicone Spray	500	78%	31,130 kgs of CFC
Silicone Spray	300	22%	8,500 Kg of HAP/DME

Production machinery is as follows:

Line	Type	CPM[1]	CPY[1]
1	18 Kg, cap. Large Burette	1	100,000
2	18 Kg, cap. Large Burette	1	100,000
3	18 Kg, cap. Large Burette	1	100,000
4	6 Kg, cap. Small Burette	Less than 1	37,500
5	10 nos. Direct Filling Nozzles	4	400,000
Capacity		7-8	737,500

Capacity of the new recommended machine (slow filling valve, large propellent fill, and two gassing strokes per can) is 300,000 CPY (3 CPM), less than the actual installed capacity. The company will destroy the old machines when the new one is operating.

PROJECT DESCRIPTION:

Aerol has sufficient space for on-going operations but would not receive permission to fill hydrocarbons in this basically residential area. However, the enterprise is willing to purchase land and construct an additional facility at its own expense.

Their current machines are "home-made" and consist of burettes (4 units) with the capacity of almost 18 Kg of CFC gas each when full. A failure with this much gas would be catastrophic. Also, they had a hexane explosion 2 years ago, and are now very safety conscious. The proposal is for replacing the current equipment with a small semi-automatic filling machine; and to install a roofed in "open air filling room" on the new lot.

[1] CPM is cans per minute of actual production. This is multiplied by 100,000 minutes (400 effective production minutes per day for 250 days per year) to give cans per year (CPY). Capacity is the sume of the cans per year of the various lines.

Aerol Formulations currently does not leak test all its products - a manual water test tank is needed. safe filling procedures for hydrocarbons requires the use of leak test tank, and gauges to guarantee that the cans are properly sealed. Moreover, a portable inspection gas detector; safety equipment and safety training are required. Safety training will be initially provided by a foreign expert until a local Indian firm is trained to provide this service.

JUSTIFICATION FOR ALTERNATE TECHNOLOGY SELECTION:

Hydrocarbon aerosol propellants (HAPs) have been the principal alternatives to CFC 12 employed worldwide. They are approved by the 1993 UNEP Technical Options Report on Aerosols, Sterilants, and Miscellaneous Uses and Carbon Tetrachloride.

Aerosol grade hydrocarbon propellant is not currently available in India, but the government of India has agreed to provide this material from one or more of the government owned refineries shortly.

PROJECT COSTS:

The total project incremental cost of $71,600 was calculated as the economic capital cost. The break down is provided in Annexure A.

RECURRING COSTS/SAVINGS:

The principal product of Aerol Formulations is Silicon Mold Release, which accounted for 100% of 1994 sales. There are no recurring savings for this project as explained in the cover memo.

UNIT ABATEMENT COST AND GRANT EFFECTIVENESS:

UAC = $ 0.365 per kilogram. Grant Effectiveness = $ 2.24 (see Annexure B).

PROJECT IMPLEMENTATION SCHEDULE:

The project can implemented within 12 months of the grant being made available.

Task	Q1	Q2	Q3	Q4
Purchase of Equipment	XXX			
Install Open Air Filling Room		XXX		
Install Equipment			XXX	
Start up/Testing				XXX

REQUIRED REGULATORY ACTIONS:

Once all aerosol manufacturers have had an opportunity to convert, and once the technical expert contracted to do the training has audited safety and certified that plant personnel are fully trained, the use of CFCs in aerosols in India should be prohibited.

RESULTS:

This project will result in the immediate reduction of 31,000 kilograms of CFC usage in the first year. If the company's volume continues to grow as expected, it is estimated that the actual reduction will be considerably higher in 2 or 3 years time.

ENVIRONMENTAL IMPACT:

The substitute propellant, a mixture of butane and propane, does not damage the ozone layer. It does not contribute to acid rain, not is it carcinogenic, mutagenic, or toxic. The butane/ propane mix does not pollute the soil or ground water. This mixture is a volatile organic compound (VOC) that contributes somewhat to ground level contamination. This mixture does have a global warming potential, albeit very low, but safety requirements are such that leakage is kept to an absolute minimum, and thus GWP considerations are negligible. Hydrocarbons are extremely flammable and explosive. The storage of the hydrocarbon propellants must be accomplished by strict adherence to all applicable Indian and local codes and regulations.

Capital Cost in US$

No.	Quant.	Description	Local	Foreign or Import
1	1	Semi automatic aerosol filling machine		37,000.0
2	lot	Site Preparation/Wall in Lot	3,000.0	
3	lot	Construct Open Air Filling Room	4,000.0	
4	lot	Piping	1,200.0	
5	1	Racks for Propellant Cylinders	800.0	
6	16	Cylinders (50 kgs)	800.0	
7	lot	Additional Fire Extinguishers	700.0	
8	1	Manual Leak Test Tank w/heater (water bath)	4,000.0	
9	1	Set of Quality Control Gauges (crimp height, crimp diameter, pressure, vacuum, etc.		3,200.0
10	1	Portable Gas Detector		1,000.0
11	lot	Shipping and Handling		3,500.0
12	lot	Plant Safety Training		4,000.0
		Sub-totals	14,500.0	48,700.0

Summary	Cost
Capital Cost	63,200.0
+ 10% Contingency	6,300.0
+ 3% Financial Agents Fee	2,100.0
Total Project Cost	71,600.0

Annexure B

UNIT ABATEMENT COST AND GRANT EFFECTIVENESS:

The **unit abatement cost** of the Aerosol Formulations aerosol conversion project is calculated as follows:

Using the formula $A = \frac{C(F) + (OC-OS)}{W}$

Where C	=	$ 63,200 + 6,320	OC = 0
(C)F	=	$ 11,315.10	OS = 0
W	=	31,000	

Doing the calculation, unit abatement cost = $ 0.365/kg.

The **grant effectiveness** of this project is $69,500.0 divided by 31,000 = $ 2.24

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May 25, 1995

TO : Naimeh Hadjitarkhani FAX: 202-477-7352
Operations Officer
SA2CI, South Asia Country Dept. II

COPY TO : Tom Waltz FAX: 202-522-3258
ENVGC

FROM : Harry B. McCain

1. **Country of origin:** India

2. **Project title:** Aerol Formulations Aerosol Conversion

3. **Sector/sub-sector:** Aerosols

4. **Relationship to country programme**

5. **Technology**

(a) Hydrocarbon propellants have long been the preferred substitute for CFCs when used as an aerosol propellant. Hydrocarbon propellants are selected because of their zero ozone depleting potentials. The only environmental shortcoming of the hydrocarbon aerosol propellants (HAPs) is their flammability which can be correctly handled with the appropriate and now well established HAP technology. The U.S.A. has been using HAPs in aerosols instead of CFCs since 1978. In 1994 approximately 3 billion aerosol cans were filled with HAPs.

(b) The technology for the use of HAPs as a substitute for CFCs in aerosol products is well established, permanent, and not transitional. There are no transitional technologies that could be used in the aerosol sector that would be appropriate.

(c) It is totally feasible that the HAP technology required for this project can be transferred from Western Europe and the U.S.A. using the free market system.

(i) No technology transfer agreement is required.
(ii) There is no licensing agreement required.

(iii) The reviewer agrees with the determination to use HAPs as a replacement technology for CFCs used as propellants in aerosol products.
(iv) HAP is the most cost effective technology for this conversion.

6. Environmental impact

(a) This project will result in the phaseout of 31 tons/year of CFC-12 and CFC-11/12 (ODS). Global warming potential is negligible. Unit Abatement Cost is $0.365/Kg U.S.
(b) Costs are appropriate to minimize health and safety and other environmental impacts.

7. Project costs

(a) All cost components identified in the project are essential for the conversion from CFCs to hydrocarbon aerosol propellants.
(b) Many cost components are present that will facilitate the conversion to hydrocarbon aerosol propellants.
(c) Cost of equipment
  (i) The cost of existing equipment is addressed in a manner that is consistent with the reviewer's experience.
  (ii) The reviewer agrees with the finding that all of the base line equipment in the report should be acquired.
  (iii) No additional equipment requests are essential for the conversion.
  (iv) All of the base line equipment will necessarily have to be replaced.
  (v) The old equipment will be destroyed once the new equipment is installed.
  (vi) There will be no salvage value with the destroyed equipment.
  (vii) The production capacity will decrease from 737,500 cans/year to 300,000 cans/year with the installation of new equipment and destruction of the old.
(d) Training costs are appropriate, although the number of persons to be trained per the $4,000.00 U.S. was not given.
(e) Operating costs
  (i) The operating costs are appropriate.
  (ii) Net recurring costs and recurring savings are equal ($0.00) because Aerol Formulations will absorb any additional maintenance costs.
  (iii) N/A

8. Implementation time frame

The time frame of four quarters is appropriate.

9. Recommendations

(a) This project is approved as proposed.
(b) It would be much better if all of these projects that use cylinders could be consolidated in a lessor number of industries using bulk storage. Since they cannot, special precautions must be taken for handling cylinders.

OORG/UNDP Technical Reviewer: Harry B. McCain

Date Review Completed: May 25, 1995

SUBPROJECT PROPOSAL REPORT

COUNTRY	INDIA	
PROJECT TITLE	Meenakshi Aerosol & Cosmetics conversion, Delhi	
SECTOR COVERED	Aerosols	
ODS USE IN SECTOR	1100 tons CFCs (= ODP) in 1991	
PROJECT IMPACT	22.5 tons CFC-12 and CFC 11/12 mixture / Y = ODP; Base 1994	
PROJECT DURATION	1 Year	
PROJECT ECONOMIC LIFE	10 Years	
TOTAL PROJECT COSTS	Incremental Capital Costs:	US$90,000
	Contingencies @ 10%:	US$9,000
	Project Capital Cost:	US$99,000
	FA Fee @ 3%:	US$3,000
	Total Project Cost:	US$102,000
PROPOSED OTF FINANCING	US$ 102,000	
UNIT ABATEMENT COST	US$ 0.72/kg/y	
GRANT EFFECTIVENESS	US $ 4.4/kg/y	
IMPLEMENTING ENTERPRISE	Meenakshi Aerosol and Cosmetics, Delhi	
COORDINATING MINISTRY	Ministry of Environment and Forests	
IMPLEMENTING AGENCY	The World Bank	

PROJECT SUMMARY

This project will accomplish the conversion to hydrocarbon aerosol propellant (HAP) at **Meenakshi Aerosol and Cosmetics.** Filling is presently done on a semi-automatic filling line. They would replace this line, which is old and not considered safe for flammable propellants. The factory is located in an independent filling shed in an industrial area. However, the space available is not considered adequate for HAP handling, however, the company would relocate at its own expense. Meenakshi has agreed to installing a stationary storage tank, as this is safer than filling from cylinders

Technical Assessment: This proposal has been reviewed and endorsed by OORG reviewer, Mr. Harry McCain whose comments are attached.

PROJECT OBJECTIVE:

The project objective is to phase-out the use of 22.5 tons of CFC 11/12 annually after completion of the conversion process from CFCs to HAPs.

SECTOR BACKGROUND:

In India, two tiered market exists in aerosols, with light weight, flammable HAPs aerosols selling at much lower prices than heavy, CFC aerosols, so there is little incentive to change. Also it is estimated that there are over 200 fillers of aerosols in India, so that competition is very keen, and there is a general fear of switching to HAP before the competition, and losing market share due to poor quality.

A government task force has estimated aerosol fillings at over 40,000,000 units per year, and a consumption of over 1,400 metric tons of CFC (1993). Final country program estimates place CFC consumption at 1100 m.t. in 1991, and the market has grown substantially since then.

ENTERPRISE BACKGROUND:

Meenakshi Aerosol and Cosmetics is currently manufacturing industrial spray that is marketed in their own brands and contract filling audio-video cleaners for Onida and Videocon.

Mr Sunil Kumar is the proprietor of Meenakshi Aerosol & Cosmetics, and the ownership is 100% Indian.

Unit sales are as follows:

Year	Cans Filled	CFC used kg	LPG used
1992-93	48,504	13,882	Nil
1993-94	42,323	20,986	Nil
1994-95	45,642	24,916	Nil

Breakdown by product in 1994-95:

Product	Weight gm	Percent Total	CFC used mt
Silicone Spray	550	98.25	22.1
Audio Video Cleaners	90	1.75	0.4
Total		100.00	22.5

Production machinery is as follows:

Line	Type	CPM[1]	CPY
1	Semi-Automatic	4	480,000
2	Manual	1/3	34,000
3	Manual	1/3	34,000
Total		6	548,000

The capacity of existing lines given above are lower than the rated capacity as they are run with inadequate air. The new semi-automatic line will have a comparable filling rate. To achieve the rated capacity of 10 CPM (1,000,000 CPY), party will have to install a 10 h.p. compressor. There is, therefore, no increase in capacity as a result of the proposed change.

PROJECT DESCRIPTION:

Meenakshi Aerosol does not have adequate space at their existing premises and would hence relocate at their own expense. They have an old semi-automatic filling line and two laboratory manual lines which is used for CFC filling. Because of the poor condition this line would not be considered safe for HAP filling and would hence have to be replaced. The enterprise will install a roofed-in "open air filling room" (OAFR) at its new lot.

Meenakshi is not currently leak testing its products. However, leak testing will be required as part of safe filling procedures for hydrocarbons. They will require a leak test water bath; a set of quality control gauges; safety equipment, and safety training which would be provided under this proposal.

The enterprise is prepared to incur the additional expenditure for land to install a stationary Storage Tank as this is much safer than filling from cylinders. The Semi-automatic line proposed for this project will not increase the existing installed capacity. The changes proposed are entirely confined to having a safer facility for HAP handling and filling.

JUSTIFICATION FOR SELECTION OF ALTERNATIVE TECHNOLOGY:

Hydrocarbon aerosol propellants (HAPs) have been the principal alternatives to CFC 12 employed worldwide. They are approved by the 1993 UNEP Technical Options Report on Aerosols, Sterilants, and Miscellaneous Uses and Carbon Tetrachloride.

Aerosol grade hydrocarbon propellant is not currently available in India, but the Government of India has agreed to provide this material from one or more of the Government owned refineries shortly.

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[1] CPM is cans per minute of actual production. This is multiplied by 100,000 minutes (400 effective production minutes per day for 250 days per year) to give cans per year (CPY). Capacity is the same of the cans per year of the various filling lines.

PROJECT COSTS:

The total project cost of $102,000 was calculated as the economic capital cost. The break down is provided in Annexure A.

RECURRING COSTS/SAVINGS:

Meenakshi's products are mostly industrial aerosols. There are no recurrent savings for this project as explained in the cover memo.

UNIT ABATEMENT COST AND GRANT EFFECTIVENESS:

UAC = $0.72 per kilogram. Grant Effectiveness = $4.4 (Annexure B).

PROJECT IMPLEMENTATION SCHEDULE:

The project can be implemented within 12 months of the grant amount being made available:

Task	Q1	Q2	Q3	Q4
Purchase of Equipment and lot	XXX			
Construction of OAFR		XXX		
Install Equipment			X X X	
Training / Start-up				XXX

REQUIRED REGULATORY ACTION:

Once all aerosol manufacturers have had an opportunity to convert, personnel have been trained and certified the use of CFC in aerosol industry in India should be prohibited.

RESULTS:

The project is for the phase-out of 22.5 tons of CFC usage per year. If this company's volume increases as per past trend, the actual reduction will be considerably higher in the next few years.

ENVIRONMENTAL IMPACT

The substitute propellant, a mixture of butane and propane, does not damage the ozone layer. It does not contribute to acid rain, is not carcinogenic, mutagenic, or toxic. The butane/propane mix does not pollute the soil or ground water. This mixture is a volatile organic compound

(VOC) that contributes somewhat to ground level contamination. This mixture does have a global warming potential, albeit very low. Hydrocarbons are extremely flammable, and explosive. The storage of the Hydrocarbon propellants must be accomplished by strict adherence to local codes and regulations.

Annexure A

CAPITAL COSTS
(in US$)

No.	Qty	Description	Local	Foreign or import
1	1	Semi Automatic filling line		37,000
2	lot	Wall in lot + Fence in tank farm	4,000	
3	lot	Construct Open Air Filling Room	5,000	
4	lot	Additional fire extinguishers	1000	
5	1	Set of Quality Control Gauges (Crimp height, crimp diameter, pressure, vacuum etc.)		2,000
6	lot	Fixed Gas Detectors		8,000
7	1	Portable Gas Detector		1,000
8	lot	Storage Tank	13,000	
9	lot	Piping	3,000	
10	1	Leak Test Tank	4,000	
11	lot	Tank Foundation	3,000	
12	lot	Site Preparation	1,500	
13	lot	Shipping & Handling		3,500
14	lot	Plant Safety Training		4,000
		SUB TOTALS	34,500	55,500
		Total (local and foreign expenses)		90,000

Summary :	Cost
Capital Cost	90,000
+ 10 % contingency	9,000
+ 3 % Financial agent's fee	3,000
Total Project Cost	102,000

Annexure B

UNIT ABATEMENT COSTS and GRANT EFFECTIVENESS

The unit abatement cost of the Meenakshi Aerosol conversion project is calculated as follows :-

Using the formula $A = \frac{C(F) + (OC - OS)}{W}$

Where C = US $ 99,000 OC=0
C(F) = US $ 16285.5 OS=0
W= 22,500 kg

Doing the calculation, unit abatement cost = US $ 0.72 / kg.

The existing filling lines would have to be scrapped to prevent it from being used. There would, therefore, be no disposal value for the existing equipment.

The grant effectiveness of the Meenakshi Aerosol conversion project is calculated as follows :-

Using the formula $A = \frac{C + (OC - OS)}{W}$

Where C = US $ 99,000 OC=0
OS=0
W= 22,500 kg

Doing the calculation, cost effectiveness = US $ 4.4 / kg.

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May 26, 1995

TO	:	Naimeh Hadjitarkhani Operations Officer SA2CI, South Asia Country Dept. II	FAX: 202-477-7352
COPY TO	:	Tom Waltz ENVGC	FAX: 202-522-3258
FROM	:	Harry B. McCain	

1. **Country of origin:** India

2. **Project title:** Meenakshi Aerosol & Cosmetics Conversion

3. **Sector/sub-sector:** Aerosols

4. **Relationship to country programme:** N/A

5. **Technology**

   (a) Hydrocarbon propellants have long been the preferred substitute for CFCs when used as an aerosol propellant. Hydrocarbon propellants are selected because of their zero ozone depleting potentials. The only environmental shortcoming of the hydrocarbon aerosol propellants (HAPs) is their flammability which can be correctly handled with the appropriate and now well established HAP technology. The U.S.A. has been using HAPs in aerosols instead of CFCs since 1978. In 1994 approximately 3 billion aerosol cans were filled with HAPs.

   (b) The technology for the use of HAPs as a substitute for CFCs in aerosol products is well established, permanent, and not transitional. There are no transitional technologies that could be used in the aerosol sector that would be appropriate.

   (c) It is totally feasible that the HAP technology required for this project can be transferred from Western Europe and the U.S.A. using the free market system.

      (i) No technology transfer agreement is required.

      (ii) There is no licensing agreement required.

(iii) The reviewer agrees with the determination to use HAPs as a replacement technology for CFCs used as propellants in aerosol products.
(iv) HAP is the most cost effective technology for this conversion.

6. **Environmental Impact**

(a) This project will phase out 22.5 tons/year of CFC-12 and CFC-11/12 (ODS). Global warming potential is negligible. Unit Abatement Cost is $0.72/Kg U.S.
(b) Costs are appropriate to minimize health and safety and other environmental impacts.

7. **Project costs**

(a) All cost components identified in the project are essential for the conversion from CFCs to hydrocarbon aerosol propellants.
(b) Many cost components are present that will facilitate the conversion to hydrocarbon aerosol propellants.
(c) Cost of equipment
  (i) The cost of existing equipment is addressed in a manner that is consistent with the reviewer's experience.
  (ii) The reviewer agrees with the finding that all of the base line equipment in the report should be acquired.
  (iii) No additional equipment requests are essential for the conversion.
  (iv) Much of the base line equipment in this project must be replaced.
  (v) The existing filling lines would have to be scrapped to prevent it from being used. There would, therefore, be no disposal value for the existing equipment.
  (vi) Same as above.
  (vii) With the installation of new equipment, the capacity at Meenakshi will increase from 548,000 cans/year to one million cans/year.
(d) The training cost of $4,000.00 is probably appropriate. The number of people to be trained, however, is not given.
(e) Operating costs
  (i) The operating costs are appropriate.
  (ii) This project considers that short-term savings, if any, will cover some of the increased maintenance costs, and that thereafter Meenakshi Aerosol & Cosmetics would absorb these extra costs. The operating costs and operating savings are considered to be equal. Hence, the project cost is the incremental cost.
  (iii) N/A

8. **Implementation time frame**

The time frame of four quarters is appropriate.

9. **Recommendations**

(a) This project is approved as proposed.

OORG/UNDP Technical Reviewer: Harry B. McCain

Date Review Completed: May 26, 1995

SUB PROJECT PROPOSAL REPORT

COUNTRY	India	
SECTOR COVERED	Aerosols	
ODS USE IN SECTOR (1991)	1100 tons CFC (1100 ton ODP)	
PROJECT TITLE	**Stella Industries Aerosol Conversion**	
PROJECT IMPACT	Phaseout 105 tons per year of CFC 12 and CFC-11/12 Mixture (105 tons ODP).	
PROJECT ECONOMIC LIFE	10 Years	
PROJECT DURATION	12 months	
TOTAL PROJECT COST	Incremental Capital Cost	US$ 244,900
	Contingencies @ 10%	24,500
	Project Capital Cost	269,400
	FA Fee @ 3%	8,100
	Total Project Cost	US$ 277,500
PROPOSED OTF FINANCING	US $ 277,500	
UNIT ABATEMENT COST	US$ 0.42kg	
GRANT EFFECTIVENESS	US$ 2.56/kg	
IMPLEMENTING ENTERPRISE	Stella Industries Pvt. ltd.	
COORDINATING NATIONAL BODY	Ozone Cell of MOEF	
IMPLEMENTING AGENCY	The World Bank /IDBI	

PROJECT SUMMARY

This project will accomplish the conversion to hydrocarbon aerosol propellants (HAP) at Stella Industries Pvt. Ltd. They have one 10 year old Pamasol machinery. Their existing facility is enclosed, and cannot be made safe for filling HAP's using the open air filling method. The enterprise does not have storage facility at the existing site as required by law. It is proposed to replace the existing equipment with one semi-automatic filler. They will require an enclosed safe room for filling HAP's along with a test bath; some quality control instrument, and safety training.

Technical Assessment: This proposal has been reviewed and supported by OORG technical reviewer, Mr. H. McCain, whose comments are attached.

PROJECT OBJECTIVES:

The project objective is to phase out the use of 105 tons of CFC 12 or CFC 11/CFC 12 annually by completing the conversion process from CFCs to HAPs.

SECTOR BACKGROUND:

In India, two tiered market exists in aerosols, with light weight, flammable HAPs aerosols selling at much lower prices than heavy, CFC aerosols, so there is little incentive to change. Also it is estimated that there are over 200 fillers of aerosols in India, so that competition is very keen, and there is a general fear of switching to HAP before the competition, and losing market share due to poor quality.

A government task force has estimated aerosol fillings at over 40,000,000 units per year, and a consumption of over 1,400 metric tons of CFC (1993). Final country programme estimates place CFC consumption at 1100 m.t. in 1991, and the market has grown since then.

ENTERPRISE BACKGROUND:

Stella Industries is the largest filler of aerosols in the New Delhi (or northern) region. They currently fill about 200,000 cans per year and about 105 metric tons of CFC. They are a serious and creditworthy company with an excellent reputation within the aerosol industry. Stella is a large contract filler of industrial aerosols and they also have their own brands. Mainly industrial aerosols are currently filled at this facility.

Unit sales are as follows:

Year	Cans Filled	CFC used mt	HAPs used
1992-93	162,931	83	-
1993-94	165,888	103	-
1994-95	198,173	105	-

Breakdown by product in 1994-95:

Product	Weight gm	Percent total	CFC used kg
Silicone Mould Release	550	98%	103,007
Air Refresher	350	0.6%	686
Mosquito Repellent	300	0.3%	36
Touch-up paint	100	0.8%	880
Fire Guard	500	0.1%	6
TOTAL		100%	104,615

Production machinery is as follows:

Line	Type	CPM[1]	CPY[1]
1	Semi-automatic (Pamasol)	25	2,500,000
Capacity	Same	Same	Same

The capacity of the new recommended machine with this product (slow filling valve, large propellent fill, and two gassing strokes peer can) is 1,000,000 CPY (10 CPM), less than the actual installed capacity. The company will destroy the old machine when the new one is operating.

PROJECT DESCRIPTION:

Stella has enough space for it on going operations but it is poorly distributed for filling HAPs. They have an outside patio on the first floor that would be acceptable for filling HAPs. They would install a safe filling room. They need storage tank for propellant. Same installations are needed including pumps, piping, fittings, etc. Site preparation and the installations of fire fighting system is needed.

Stella is not currently leak testing their products, which would be necessary for safe filling procedures for hydrocarbons. They also require inspection guages to perform high quality work in a safe manner. Safety equipment must be purchased and safety training provided, initially by a foreign expert until a local Indian is trained to provide this service.

JUSTIFICATION FOR ALTERNATE TECHNOLOGY SELECTION:

Hydrocarbon aerosol propellants (HAPs) have been the principal alternatives to CFC 12 employed worldwide. They are approved by the 1993 UNEP Technical Options Report on Aerosols, Sterilants, and Miscellaneous Uses and Carbon Tetrachloride.

Aerosol grade hydrocarbon propellant is not currently available in India, but the government of India has agreed to provide this material from one or more of the government owned refineries shortly.

PROJECT COSTS:

The total project incremental cost of $ 277,500 as calculated as the economic capital cost. The breakdown is provided in Annexure A.

[1] CPM is cans per minute of actual production. This is multiplied by 100,000 minutes (400 effective production minutes per day for 250 days per year) to give cans per year (CPY). Capacity is the sum of the cans per year of the various filling lines.

RECURRING COSTS/SAVINGS:

The Stalla Industries's principal product is Silicon Mold Release, which accounted for 98% of 1994 sales. There is no operating savings due to the switch to HAP for this project as explained in the cover memo.

UNIT ABATEMENT COST AND GRANT EFFECTIVENESS:

UAC = $ 0.42 per kilogram. Grant Effectiveness = $ 2.56 (Annexure B).

PROJECT IMPLEMENTATION SCHEDULE:

The project can be implemented within 12 months of the grant amoung being made avaialble:

Task	Q1	Q2	Q3	Q4
Purchase of Equipment	XXX			
Installation explsion proof filing		XXX		
Install Equipment			XXX	
Start up/Testing				XXX

REQUIRED REGULATORY ACTIONS:

Once all aerosol manufacturers have had an opportunity to convert, and the technical expert contracted to do the training has audited safety and certified that plant personnel are fully trained, the use of CFCs in aerosols in India should be prohibited.

RESULTS:

This project will result in the immediate reduction of 105,000 kilograms of CFC usage in the first year. If the company's volume continues to grow as expected, it is estimated that the actual reduction will be considerably higher in 2 or 3 years time.

ENVIRONMENTAL IMPACT:

The substitute propellant, a mixture of butane and propane, does not damage the ozone layer. It does not contribute to acid rain, not is it carcinogenic, mutagenic, or toxic. The butane/ propane mix does not pollute the soil or ground water. This mixture is a volatile organic compound (VOC) that contributes somewhat to ground level contamination. This mixture does

have a global warming potential, albeit very low, but safety requirements are such that leakage is kept to an absolute minimum, and thus GWP considerations are negligible.

Hydrocarbons are extremely flammable and explosive. The storage of the hydrocarbon propellants must be accomplished by strict adherence to all applicable Indian and local codes and regulations.

Annexure A

Capital Costs in US$

No.	Quant.	Description	Local	Foreign or Import
1	1	Semi automatic aerosol filling machine		37,000.0
2	lot	Site Development	2,000.0	
3	lot	Modular Safe Gassing Room		75,000.0
4	lot	Conveyor system	6,000.0	
5	1	Various (5) Pumps	8500.0	
6	16	2x10 m.t.Stationary Storage tanks	23000.0	
7	lot	Pressure valves fittings pipes and connections	10200.0	
8	1	Additional Fire Extinguishers fire fighting system (cistern hydrants etc)	21,000.0	
9	1	Manual Leak Test Tank wheater (water bath)	4,000.0	
10	1	Set of Quality Control Gauges (crimp height, crimp diameter, pressure, vacuum, etc.		3,200.0
11	lot	Portable Gas Detector		1,000.0
12	lot	All installations (labor)	18,000.0	
13	lot	All electrical (materials)	20,000.0	
14	lot	Shipping and handling		10,000.0
15	lot	Plant Safety fitting		4,000.0
		Sub-totals	112,700.0	132,200.0

Summary	Cost
Capital Cost	244,900.0
+ 10%	24,500.0
+ 3%	8,100.0
Total Project Cost	277,500.0

Annexure B

UNIT ABATEMENT COST AND GRANT EFFECTIVENESS:

The **unit abatement cost** of the Stella Industries aerosol conversion project is calculated as follows:

Using the formula A $= \frac{C(F) + (OC-OS)}{W}$

Where C = $ 244,900 + 24,500 OC = 0

(C)F = $ 43,846 OS = 0

W = 105,000

Doing the calculation, unit abatement cost = $ 0.417/kg.

The **grant effectiveness** of this project is $269,400 divided by 105,000 = $2.56

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May 25, 1995

TO : Naimeh Hadjitarkhani FAX: 202-477-7352
Operations Officer
SA2CI, South Asia Country Dept. II

COPY TO : Tom Waltz FAX: 202-522-3258
ENVGC

FROM : Harry B. McCain

1. **Country of origin:** India

2. **Project title:** Stella Industries Aerosol Conversion

3. **Sector/sub-sector:** Aerosols

4. **Relationship to country programme**

5. **Technology**

(a) Hydrocarbon propellants have long been the preferred substitute for CFCs when used as an aerosol propellant. Hydrocarbon propellants are selected because of their zero ozone depleting potentials. The only environmental shortcoming of the hydrocarbon aerosol propellants (HAPs) is their flammability which can be correctly handled with the appropriate and now well established HAP technology. The U.S.A. has been using HAPs in aerosols instead of CFCs since 1978. In 1994 approximately 3 billion aerosol cans were filled with HAPs.

(b) The technology for the use of HAPs as a substitute for CFCs in aerosol products is well established, permanent, and not transitional. There are no transitional technologies that could be used in the aerosol sector that would be appropriate.

(c) It is totally feasible that the HAP technology required for this project can be transferred from Western Europe and the U.S.A. using the free market system.

(i) No technology transfer agreement is required.
(ii) There is no licensing agreement required.

(iii) The reviewer agrees with the determination to use HAPs as a replacement technology for CFCs used as propellants in aerosol products.
(iv) HAP is the most cost effective technology for this conversion.

6. **Environmental Impact**

(a) This project will result in the phaseout of 105 tons/year of CFC-12 and CFC-11/12 (ODS). Global warming potential is negligible. Unit Abatement Cost is $0.42/Kg U.S.
(b) Costs are appropriate to minimize health and safety and other environmental impacts.

7. **Project costs**

(a) All cost components identified in the project are essential for the conversion from CFCs to hydrocarbon aerosol propellants.
(b) Many cost components are present that will facilitate the conversion to hydrocarbon aerosol propellants.
(c) Cost of equipment
  (i) The cost of existing equipment is addressed in a manner that is consistent with the reviewer's experience.
  (ii) The reviewer agrees with the finding that all of the base line equipment in the report should be acquired.
  (iii) No additional equipment requests are essential for the conversion.
  (iv) All of the base line equipment will necessarily have to be replaced.
  (v) The scrapped equipment in this project will be destroyed.
  (vi) There will be no salvage value to the scrapped equipment.
  (vii) The conversion equipment will be at a lesser capacity than presently installed equipment. Production capacity will drop from 2.5 million cans/year to one million cans/year.
(d) Training costs are appropriate, although the number of persons to be trained per the $4,000.00 U.S. was not given.
(e) Operating costs
  (i) The operating costs are appropriate.
  (ii) Net recurring costs and recurring savings are equal ($0.00) because Stella Industries will absorb any additional maintenance costs.
  (iii) N/A

8. **Implementation time frame**

The time frame of four quarters is appropriate.

9. Recommendations

(a) This project is approved as proposed.
(b) This is a good project.

OORG/UNDP Technical Reviewer: Harry B. McCain

Date Review Completed: May 25, 1995

SUBPROJECT PROPOSAL REPORT

COUNTRY	INDIA	
PROJECT TITLE	Texas Enterprises Conversion, Bombay	
SECTOR COVERED	Aerosols	
ODS USE IN SECTOR	1100 tons CFCs (= ODP) in 1991	
PROJECT IMPACT	31.3 tons CFC-12 and CFC 11/12 mixture/Y = ODP; Base 1994	
PROJECT DURATION	1 Year	
PROJECT ECONOMIC LIFE	10 Years	
TOTAL PROJECT COSTS	Incremental Capital Costs:	US$63,700
	Contingencies @ 10%:	US$ 6,400
	Project Capital Cost:	US$70,100
	FA Fee @ 3%:	US$ 2,100
	Total Project Cost:	US$72,200
PROPOSED OTF FINANCING	US $ 72,200	
UNIT ABATEMENT COST	US $ 0.37/kg/y	
COST EFFECTIVENESS	US $ 2.24/kg/y	
IMPLEMENTING ENTERPRISE	Texas Enterprises, Bombay	
COORDINATING MINISTRY	Ministry of Environment and Forests	
IMPLEMENTING AGENCY	The World Bank	

PROJECT SUMMARY

The project will accomplish the conversion to hydrocarbon aerosol propellant (HAP) at **Texas Enterprises**. The plant is located in an independent shed in an industrial area with insufficient space to use HAP. The enterprise is willing to relocate at its own cost. The company has a manual filling machine for CFCs, which would not be suitable for HAP. Therefore, it requires a new semi-automatic filling line; assistance to install a safe "open air filling room" (OAFR); quality control testing equipment/instruments and safety training.

Technical Assessment: The proposal has been reviewed and endorsed by OORG reviewer, Mr. Harry McCain, whose comments are attached.

PROJECT OBJECTIVES:

The project objective is to phase-out the use of 31.3 tons of CFC 11/12 annually after completion of the conversion process which is already initiated.

SECTOR BACKGROUND:

In India, two tiered market exists in aerosols, with light weight, flammable HAPs aerosols selling at much lower prices than heavy, CFC aerosols, so there is little incentive to change. Also it is estimated that there are over 200 fillers of aerosols in India, so that competition is very keen, and there is a general fear of switching to HAP before the competition, and losing market share due to poor quality.

A government task force has estimated aerosol fillings at over 40,000,000 units per year, and a consumption of over 1,400 metric tons of CFC (1993). Final country program estimates place CFC consumption at 1100 m.t. in 1991, and the market has grown substantially since then.

ENTERPRISE BACKGROUND:

Texas Enterprise is currently manufacturing industrial sprays and marketing the same under their own brand name. Mr. Rishi Bhatia is the proprietor, and the ownership is 100% Indian.

Unit sales are as follows:

Year	Cans Filled	CFC used mt	LPG used
1992-93	19,000	9	Nil
1993-94	41,000	23	Nil
1994-95	65,000	35	Nil

Breakdown by product in 1994-95:

Product	Percent Total	CFC used mt
Mould Release (550 g gross)	70	24.6
Mould Release (550 g nett)	20	6.0
Air freshener	5	0.5
Contact cleaner	5	0.2
Total	100	31.3

RECURRING COSTS/SAVINGS:

My Fair Lady is engaged in aerosol filling, and has a wide range of personal products. There are no recurrent savings as a result of switch over to HAPs, as explained in the cover memo.

UNIT ABATEMENT COST AND GRANT EFFECTIVENESS:

UAC = $0.32 per kilogram. Grant Effectiveness = $1.92 (Annexure-B).

PROJECT IMPLEMENTATION SCHEDULE:

The project can be implemented within 12 months of the grant being made available.

Task	Q1	Q2	Q3	Q4
Purchase of equipment & lot	XXX			
Construction of OAFR		XXX		
Install Equipment			XXX	
Training / Start-up				XXX

REQUIRED REGULATORY ACTION:

Once all aerosol manufactures have had an opportunity to convert, personnel have been trained and certified, the use of CFC in aerosol industry in India should be prohibited.

RESULTS:

The project would phase-out 59.5 tons of CFC usage per year. If this company's volume increases as per past trend, the actual reduction will be considerably higher in the next few years.

ENVIRONMENTAL IMPACT:

The substitute propellant, a mixture of butane and propane, does not damage the ozone layer. It does not contribute to acid rain, is not carcinogenic, mutagenic, or toxic. The butane/propane mix does not pollute the soil or ground water. This mixture is a volatile organic compound (VOC) that contributes somewhat to ground level contamination. This mixture does have a global warming potential, albeit very low. Hydrocarbons are extremely flammable, and explosive. The storage of the Hydrocarbon propellants must be accomplished by strict adherence to local codes and regulations.

Production machinery is as follows:

Line	Type	CPM[1]	CPY[1]
1	Manual	3	300,000
2	Manual	3	300,000
3	Manual	3	300,000
Total		9	900,000

Capacity of the new line proposed is around 10 CPM or 1,000,000 CPY. There is, therefore, no material change in capacity under this proposal.

PROJECT DESCRIPTION:

My Fair Lady Ltd. The company has sufficient space for the on-going operations but cannot fill hydrocarbons at the existing site as there is not enough space for HAP storage and OAFR. However, the enterprise is willing to relocate at its own expense. Currently, they have 3 manual filling lines, which are not considered safe for filling HAP. Therefore, it is proposed to replace them with a semi-automatic filling line, and to install a roofed-in "open-air filling room" (OAFR) on the new lot.

My Fair Lady is not currently leak testing their products, however, testing would be necessary as part of safe filling procedures for hydrocarbons. In addition, they will require a leak test water bath; a set of quality control gauges, and safety equipment, and safety training. The capacity of the semi-automatic line proposed is comparable to the installed capacity of the existing lines. The changes proposed are to ensure safety at the facility and make it suitable for handling / filling of HAP.

JUSTIFICATION FOR SELECTION OF ALTERNATIVE TECHNOLOGY:

Hydrocarbon aerosol propellants (HAPs) have been the principal alternatives to CFC 12 employed worldwide. They are approved by the 1993 UNEP Technical Options Report on Aerosols, Sterilants, and Miscellaneous Uses and Carbon Tetrachloride.

Aerosol grade hydrocarbon propellant is not currently available in India, but the Government of India has agreed to provide this material from one or more of the Government owned refineries shortly.

PROJECT COSTS:

The total project cost of $117,500 was calculated as the economic capital cost. The break down is provided in Annexure A.

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[1] CPM is cans per minute of actual production. This is multiplied by 100,000 minutes (400 effective production minutes per day for 250 days per year) to give cans per year (CPY). Capacity is the sum of the cans per year of the various filling lines.

Annexure B

UNIT ABATEMENT COSTS AND GRANT EFFECTIVENESS:

The unit abatement cost of the **Ultra Tech Specialty Chemicals** conversion project is calculated as follows :-

Using the formula $A = \frac{C(F) + (OC - OS)}{W}$

Where C = US $ 70,100 OC=0
C(F) = US $ 11,517 OS=0
W= 30,800 kg

Doing the calculation, unit abatement cost = US $ 0.37/kg.

The existing filling lines would have to be scrapped to prevent it from being used. There would, therefore, be no disposal value for the existing equipment.

The grant effectiveness of the Ultra Tech Specialty Chemicals conversion project is calculated as follows:

Using the formula $A = \frac{C + (OC - OS)}{W}$

Where C = US $ 70,100 OC=0
OS=0
W= 30,800 kg

Doing the calculation, cost effectiveness = US $ 2.27 / kg.

Annexure A

CAPITAL COSTS
Figures in US$

No.	Qty	Description	Local	Foreign or import
1	1	Semi Automatic filling line		37,000
2	lot	Wall in lot + site preparation	3,000	
3	lot	Construct OAFR	4,000	
4	lot	Additional fire extinguishers	700	
5	1	Set of Quality Control Gauges (Crimp height, crimp diameter, pressure, vacuum etc.)		3,200
6	1	Rack for Propellant Tanks	800	
7	1	Portable Gas Detector		1,000
8	lot	Piping	1,200	
9	1	Leak Test Tank	4,000	
10	lot	25 nos. Cylinders	1,250	
11	lot	Shipping & Handling		3,500
12	lot	Plant Safety Training		4,000
		SUB TOTALS	14,950	48,700
		Total (local and foreign expenses)		63,700

Summary :	Cost
Capital Cost	63,700
+ 10 % contingency	6,400
+ 3 % Financial agent's fee	2,100
Total Project Cost	72,200

(iii) The reviewer agrees with the determination to use HAPs as a replacement technology for CFCs used as propellants in aerosol products.
(iv) HAP is the most cost effective technology for this conversion.

6. Environmental Impact

(a) This project will phase out 30.8 tons/year of CFC-12 and CFC-11/12 (ODS). Global warming potential is negligible. **Unit Abatement Cost** is $0.37/Kg U.S.
(b) Costs are appropriate to minimize health and safety and other environmental impacts.

7. Project costs

(a) All cost components identified in the project are essential for the conversion from CFCs to hydrocarbon aerosol propellants.
(b) Many cost components are present that will facilitate the conversion to hydrocarbon aerosol propellants.
(c) Cost of equipment
  (i) The cost of existing equipment is addressed in a manner that is consistent with the reviewer's experience.
  (ii) The reviewer agrees with the finding that all of the base line equipment in the report should be acquired.
  (iii) No additional equipment requests are essential for the conversion.
  (iv) Much of the base line equipment in this project must be replaced.
  (v) The existing filling lines would have to be scrapped to prevent it from being used. There would, therefore, be no disposal value for the existing equipment.
  (vi) Same as above.
  (vii) Ultra Tech is presently operating under its capacity of approximately one million cans/year. The new equipment will have a capacity of one million cans/year.
(d) The training cost of $4,000.00 is probably appropriate. The number of persons to be trained, however, is not given.
(e) Operating costs
  (i) The operating costs are appropriate.
  (ii) This project considers that short-term savings, if any, will cover some of the increased maintenance costs, and that thereafter Ultra Tech would absorb these extra costs. The operating costs and operating savings are considered to be equal. Hence, the project cost is the incremental cost.
  (iii) N/A

8. Implementation time frame

The time frame of four quarters is appropriate.

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May 26, 1995

TO	:	Naimeh Hadjitarkhani Operations Officer SA2CI, South Asia Country Dept. II	FAX: 202-477-7352
COPY TO	:	Tom Waltz ENVGC	FAX: 202-522-3258
FROM	:	Harry B. McCain	

1. **Country of origin:** India

2. **Project title:** Ultra Tech Conversion

3. **Sector/sub-sector:** Aerosols

4. **Relationship to country programme:** N/A

5. **Technology**

(a) Hydrocarbon propellants have long been the preferred substitute for CFCs when used as an aerosol propellant. Hydrocarbon propellants are selected because of their zero ozone depleting potentials. The only environmental shortcoming of the hydrocarbon aerosol propellants (HAPs) is their flammability which can be correctly handled with the appropriate and now well established HAP technology. The U.S.A. has been using HAPs in aerosols instead of CFCs since 1978. In 1994 approximately 3 billion aerosol cans were filled with HAPs.

(b) The technology for the use of HAPs as a substitute for CFCs in aerosol products is well established, permanent, and not transitional. There are no transitional technologies that could be used in the aerosol sector that would be appropriate.

(c) It is totally feasible that the HAP technology required for this project can be transferred from Western Europe and the U.S.A. using the free market system.

(i) No technology transfer agreement is required.

(ii) There is no licensing agreement required.

9. **Recommendations**

(a) This project is approved as proposed.
(b) It would be much better if all of these projects that use cylinders could be consolidated in a lessor number of industries using bulk storage. Since they cannot, special precautions must be taken for handling cylinders.

OORG/UNDP Technical Reviewer: Harry B. McCain

Date Review Completed: May 26, 1995

SUB PROJECT PROPOSAL REPORT

COUNTRY	INDIA	
PROJECT TITLE	A. A. Attarwala & Co. Pvt Ltd. Conversion, Bombay	
SECTOR COVERED	Aerosols	
ODS USE IN SECTOR	1100 tons CFCs (= ODP) in 1991	
PROJECT IMPACT	30.7 tons CFC-12 and CFC 11/12 mixture/Y = ODP; Base 1994	
PROJECT DURATION	1 Year	
PROJECT ECONOMIC LIFE	10 Years	
TOTAL PROJECT COSTS	Incremental Capital Costs:	US$122,200
	Contingencies @ 10%:	US$ 12,220
	Project Capital Cost:	US$134,400
	FA Fee @ 3%:	US$ 4,000
	Total Project Cost:	US$138,400
PROPOSED OTF FINANCING	US$ 138,400	
UNIT ABATEMENT COST	US$ 0.72/kg/y	
COST EFFECTIVENESS	US$ 4.38/kg/y	
IMPLEMENTING ENTERPRISE	A. A. Attarwala & Co. Pvt Ltd., Bombay	
COORDINATING MINISTRY	Ministry of Environment and Forests	
IMPLEMENTING AGENCY	The World Bank	

PROJECT SUMMARY

The project will accomplish the conversion to hydrocarbon aerosol propellant (HAP) at **A.A. Attarwala.** This is the largest manufacturers of aerosol perfumes in India. Filling is done on 13 burette type hand filling lines. The enterprise would need to replace the lines with two semi-automatic filling lines to cope with the production levels of 250,000 bottles per month. The factory is located in an congested residential area and hence would need to be relocated. Considering the production levels a stationary storage tank is advisable, as this is safer than filling from cylinders.

Technical Assessment: The proposal has been reviewed and endorsed by OORG reviewer, Mr. Harry McCain whose comments are attached.

PROJECT OBJECTIVES:

The project objective is to phase-out the use of 30.7 tons of CFC 11/12 annually after completion of the conversion process already initiated.

SECTOR BACKGROUND:

In India, two tiered market exists in aerosols, with light weight, flammable HAPs aerosols selling at much lower prices than heavy, CFC aerosols, so there is little incentive to change. Also it is estimated that there are over 200 fillers of aerosols in India, so that competition is very keen, and there is a general fear of switching to HAP before the competition, and losing market share due to poor quality.

A government task force has estimated aerosol fillings at over 40,000,000 units per year, and a consumption of over 1,400 metric tons of CFC (1993). Final country program estimates place CFC consumption at 1100 m.t. in 1991, and the market has grown substantially since then.

ENTERPRISE BACKGROUND:

A.A. Attarwala is the for largest company filling perfumes sprays in India. The company has a wide range of personal products and enjoys a good reputation in their line of business.

The Company directors are Mr. Yunus Attarwala and other family members, and the ownership is 100% Indian.

Unit sales are as follows:

Year	Bottles Filled	CFC used mt	LPG used
1992-93	2,200,000	22	NA
1993-94	2,500,000	25	NA
1994-95	3,000,000	30	NA

Break down by product in 1994-95:

Product	**Content in ml**	**Percent Total**	**CFC used mt**
Perfume	20	75	15.6
	40	10	3.9
	60	10	6.0
	100	5	5.2
Total			30.7

The details of machinery currently use are given below:

Attarawala has 13 units of manual filling lines with a capacity of 300,000 bottles per year (3 bottles per minute) each, and a total capacity of 3.9 million bottles per year.

The capacity of the two new semi-automatic filling machine proposed under the project would not increase the present installed capacity. The company will destroy the old machines when the new lines are functional.

PROJECT DESCRIPTION:

A.A. Attarwala has sufficient space for the on-going operations but cannot fill hydrocarbons as the local administration will not permit HAP filling in a plant situated in a densely populated area. **A.A. Attarwala** is willing to relocate at its own cost and have already identified a suitable site for the purpose. The enterprise has 13 manual machines which are not considered safe for filling HAP, and it is proposed to replace them by two semi-automatic filling lines. A roofed-in "open-air filling room" (OAFR) will be installed on the new lot. The enterprise is not currently leak testing their products. However, leak testing will be required as part of safe filling procedures for hydrocarbons. Moreover, Attarwala will require a set of quality control gauges, safety equipment and safety training.

In addition to purchasing the land at its own cost, Attarwala is agreeable to incur the additional expenditure for land to install a stationary storage tank as this is much safer than filling from cylinders. The changes proposed above are entirely confined to ensuring a safe facility for HAP handling and filling.

JUSTIFICATION FOR SELECTION OF ALTERNATIVE TECHNOLOGY:

Hydrocarbon aerosol propellants (HAPs) have been the principal alternatives to CFC 12 employed worldwide. They are approved by the 1993 UNEP Technical Options Report on Aerosols, Sterilants, and Miscellaneous Uses and Carbon Tetrachloride.

Aerosol grade hydrocarbon propellant is not currently available in India, but the Government of India has agreed to provide this material from one or more of the Government owned refineries shortly.

PROJECT COSTS:

The total project cost of $ 138,400 was calculated as the economic capital cost. The break down is provided in Annexure A.

RECURRING COSTS/SAVINGS:

Attarwala is engaged in perfumes sprays filling, and has a wide range of personal products. There are no recurrent savings from switching over to HAPs in this project as explained in the cover memo.

UNIT ABATEMENT COST AND GRANT EFFECTIVENESS:

UAC = $0.72 per kilogram. Grant Effectiveness = $4.38 (Annexure B).

PROJECT IMPLEMENTATION SCHEDULE:

The project can be implemented within 12 months of the grant amount being made available:

Task	Q1	Q2	Q3	Q4
Purchase of equipment & lot	XXX			
Construction of OAFR		XXX		
Install Equipment			XXX	
Training/Start-up				XXX

REQUIRED REGULATORY ACTION:

Once all aerosol manufactures have had an opportunity to convert, personnel have been trained and certified, the use of CFC in aerosol industry in India should be prohibited.

RESULTS:

The project would phase-out 30.7 tons of CFC per year. If this company's volume increases as per past trend, the actual reduction will be considerably higher in the next few years.

ENVIRONMENTAL IMPACT:

The substitute propellant, a mixture of butane and propane, does not damage the ozone layer. It does not contribute to acid rain, is not carcinogenic, mutagenic, or toxic. The butane/propane mix does not pollute the soil or ground water. This mixture is a volatile organic compound (VOC) that contributes somewhat to ground level contamination. This mixture does have a global warming potential, albeit very low. Hydrocarbons are extremely flammable, and explosive. The storage of the Hydrocarbon propellants must be accomplished by strict adherence to local codes and regulations.

Annexure A

CAPITAL COSTS
(Figures in US$)

No.	Qty	Description	Local	Foreign or import
1	2	Semi Automatic filling line		74,000
2	lot	Construct OAFR	4,000	
3	lot	Wall in lot	3,000	
4	lot	Additional fire extinguishers	1,000	
5	1	Set of Quality Control Gauges (Crimp height, crimp diameter, pressure, vacuum etc.)		1,500
6	lot	Fixed Gas Detectors		8,000
7	1	Portable Gas Detector		700
8	lot	Piping	3,000	
9	1	Magnetic Leak Test Tank		4,000
10	lot	Storage Tank	13,000	
11	lot	Tank Foundation	2,000	
12	lot	Shipping & Handling		4,000
13	lot	Plant Safety Training		4,000
		SUB TOTALS	26,000	96,200
		Total (local and foreign expenses)		122,200

Summary :	Cost
Capital Cost	122,200
+ 10 % contingency	12,200
+ 3 % Financial agent's fee	4,000
Total Project Cost	138,400

Annexure B

UNIT ABATEMENT COSTS AND GRANT EFFECTIVENESS:

The unit abatement cost of the A. A. Attarwala conversion project is calculated as follows :-

Using the formula $A = \frac{C(F) + (OC - OS)}{W}$

Where C= US $ 134,400 OC=0
C(F)= US $ 22,112 OS=0
W= 30,700 kg

Doing the calculation, unit abatement cost = US $ 0.72 / kg.

The existing filling lines would have to be scrapped to prevent it from being used. There would, therefore, be no disposal value for the existing equipment.

The grant effectiveness of the A. A. Attarwala conversion project is calculated as follows:

Using the formula $A = \frac{C + (OC - OS)}{W}$

Where C = US $ 134,400 OC=0
OS=0
W= 30,700 kg

Doing the calculation, cost effectiveness = US $ 4.38 / kg.

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May 26, 1995

TO : Naimeh Hadjitarkhani FAX: 202-477-7352
Operations Officer
SA2CI, South Asia Country Dept. II

COPY TO : Tom Waltz FAX: 202-522-3258
ENVGC

FROM : Harry B. McCain

1. **Country of origin:** India

2. **Project title:** A.A. Attarwala Conversion

3. **Sector/sub-sector:** Aerosols

4. **Relationship to country programme:** N/A

5. **Technology**

(a) Hydrocarbon propellants have long been the preferred substitute for CFCs when used as an aerosol propellant. Hydrocarbon propellants are selected because of their zero ozone depleting potentials. The only environmental shortcoming of the hydrocarbon aerosol propellants (HAPs) is their flammability which can be correctly handled with the appropriate and now well established HAP technology. The U.S.A. has been using HAPs in aerosols instead of CFCs since 1978. In 1994 approximately 3 billion aerosol cans were filled with HAPs.

(b) The technology for the use of HAPs as a substitute for CFCs in aerosol products is well established, permanent, and not transitional. There are no transitional technologies that could be used in the aerosol sector that would be appropriate.

(c) It is totally feasible that the HAP technology required for this project can be transferred from Western Europe and the U.S.A. using the free market system.

(i) No technology transfer agreement is required.

(ii) There is no licensing agreement required.

(iii) The reviewer agrees with the determination to use HAPs as a replacement technology for CFCs used as propellants in aerosol products.
(iv) HAP is the most cost effective technology for this conversion.

6. **Environmental Impact**

(a) This project will phase out 30.7 tons/year of CFC-12 and CFC-11/12 (ODS). Global warming potential is negligible. Unit Abatement Cost is $0.72 Kg/year U.S.
(b) Costs are appropriate to minimize health and safety and other environmental impacts.

7. **Project costs**

(a) All cost components identified in the project are essential for the conversion from CFCs to hydrocarbon aerosol propellants.
(b) Many cost components are present that will facilitate the conversion to hydrocarbon aerosol propellants.
(c) Cost of equipment
  (i) The cost of existing equipment is addressed in a manner that is consistent with the reviewer's experience.
  (ii) The reviewer agrees with the finding that all of the base line equipment in the report should be acquired.
  (iii) No additional equipment requests are essential for the conversion.
  (iv) Much of the base line equipment in this project must be replaced.
  (v) The existing filling lines would have to be scrapped to prevent it from being used. There would, therefore, be no disposal value for the existing equipment.
  (vi) Same as above.
  (vii) Capacity of the two new semi-automatic lines recommended would not increase the present installed capacity.
(d) The training cost of $4,000.00 is probably appropriate. The number of people to be trained, however, is not given.
(e) Operating costs
  (i) The operating costs are appropriate.
  (ii) This project considers that short-term savings, if any, will cover some of the increased maintenance costs, and that thereafter A. A. Attarwala would absorb these extra costs. The operating costs and operating savings are considered to be equal. Hence, the project cost is the incremental cost.
  (iii) N/A

8. **Implementation time frame**

The time frame of four quarters is appropriate.

9. **Recommendations**

(a) This project is approved as proposed.

OORG/UNDP Technical Reviewer: Harry B. McCain

Date Review Completed: May 26, 1995

SUB PROJECT PROPOSAL REPORT

COUNTRY	INDIA	
PROJECT TITLE	My Fair Lady Ltd. Conversion, Delhi	
SECTOR COVERED	Aerosols	
ODS USE IN SECTOR	1100 tons CFCs (= ODP) in 1991	
PROJECT IMPACT	59.5 tons CFC-12 and CFC 11/12 mixture / Y = ODP; Base 1994	
PROJECT DURATION	1 Year	
PROJECT ECONOMIC LIFE	10 Years	
TOTAL PROJECT COSTS	Incremental Capital Costs:	US$103,700
	Contingencies @ 10%:	US$10,400
	Project Capital Cost:	US$114,100
	FA Fee @ 3%:	US$3,400
	Total Project Cost:	US$117,500
PROPOSED OTF FINANCING	US$ 117,500	
UNIT ABATEMENT COST	US$ 0.32/kg/y	
GRANT EFFECTIVENESS	US$ 1.92 /kg /y	
IMPLEMENTING ENTERPRISE	My Fair Lady Ltd, Delhi	
COORDINATING MINISTRY	Ministry of Environment and Forests	
IMPLEMENTING AGENCY	The World Bank	

PROJECT SUMMARY

This project will accomplish the conversion to hydrocarbon aerosol propellant (HAP) at **My Fair Lady Ltd**. Filling is currently done by three manual filling lines. The enterprise would replace these lines with a semi-automatic filling line. The factory is located in an independent filling shed in an industrial area. However, adequate space for HAP handling is not available and hence relocation will be required. They will relocate at their own expense. Considering the HAP requirement a stationary storage tank is advisable as it is safer than filling from cylinders.

Technical Assessment: This proposal has been reviewed and endorsed by OORG reviewer, Mr. Harry McCain whose comments are attached.

PROJECT OBJECTIVES:

The project objective is to phase-out the use of 59.5 tons of CFC 11/12 annually after completion of the conversion process which has already initiated.

SECTOR BACKGROUND:

In India, two tiered market exists in aerosols, with light weight, flammable HAPs aerosols selling at much lower prices than heavy, CFC aerosols, so there is little incentive to change. Also it is estimated that there are over 200 fillers of aerosols in India, so that competition is very keen, and there is a general fear of switching to HAP before the competition, and losing market share due to poor quality.

A government task force has estimated aerosol fillings at over 40,000,000 units per year, and a consumption of over 1,400 metric tons of CFC (1993). Final country program estimates place CFC consumption at 1100 m.t. in 1991, and the market has grown substantially since then.

ENTERPRISE BACKGROUND:

My Fair Lady is the only public limited company in India engaged in aerosol filling. It has a wide range of personal products. The aerosol range includes room fresheners, hair sprays and deodorants.

Mr. Chopra is the Chairman of the Company, and the ownership is 100% Indian.

Unit sales are as follows:

Year	Cans Filled	CFC used mt	LPG used
1992-93	275,100	29.5	Nil
1993-94	376,800	42.3	Nil
1994-95	502,400	59.5	Nil

Break down by product in 1994-95:

Product	Weight gm	Percent Total	CFC used mt
Room spray	160	15.5	9.2
Room spray	120	32.9	19.6
Room spray	100	12.9	7.7
Hair spray	120	29.3	17.4
Deodorants	120	9.4	5.6
Total		100	59.5

Production machinery is as follows:

Line	Type	CPM[1]	CPY[1]
1	Semi-Automatic	5	500,000
2	Manual	1	100,000
TOTAL		6	600,000

Capacity of the semi-automatic line given above is low since party is operating with a 2 h.p. compressor, and hence is not operating at rated capacity. Capacity of the new semi-automatic line is 1,000,000 cpy (10 cpm) and comparable to present installed capacity. The company will destroy the old lines when the new one is operating.

PROJECT DESCRIPTION:

Ultra Tech has sufficient space at its existing facilities to undertake HAP filling. They have a manual and a 'house-made' semi-automatic filling line which are used for CFC filling but will not be suitable for HAP. It is proposed to replace the existing filling machines with a new semi-automatic filling machine, and to install a roofed in open air filling room (OAFR).

Ultra Tech is not currently leak testing their products, however, testing would be required as part of safe filling procedures for hydrocarbons. The enterprise would require a leak test hot water bath; a set of quality control gauges; safety equipment and safety training.

The changes proposed under this proposal are entirely confined to having a safer facility for HAP handling and filling. It does not materially alter the installed capacity.

JUSTIFICATION FOR SELECTION OF ALTERNATIVE TECHNOLOGY:

Hydrocarbon aerosol propellants (HAPs) have been the principal alternatives to CFC 12 employed worldwide. They are approved by the 1993 UNEP Technical Options Report on Aerosols, Sterilants, and Miscellaneous Uses and Carbon Tetrachloride.

Aerosol grade hydrocarbon propellant is not currently available in India, but the Government of India has agreed to provide this material from one or more of the Government owned refineries shortly.

PROJECT COSTS:

The total project cost of $72,200 was calculated as the economic capital cost. The break down is provided in Annexure A.

---

[1] CPM is cans per minute of actual production. This is multiplied by 100,000 minutes (400 effective production minutes per day for 250 days per year) to give cans per year (CPY). Capacity is the sum of the cans per year of the various filling lines.

RECURRING COSTS/SAVINGS:

Ultra Tech is engaged in industrial products, and is also a contract filler. There are no recurrent savings for this project as a result to switch over to HAPs as explained in the cover memo.

UNIT ABATEMENT COST AND GRANT EFFECTIVENESS:

UAC = $0.37 per kilogram. Grant Effectiveness = $2.27 (Annexure B).

PROJECT IMPLEMENTATION SCHEDULE:

The project can be implemented within 12 months of the grant amount being made available.

Task	Q1	Q2	Q3	Q4
Purchase of equipment & lot	XXX			
Construction of OAFR		XXX		
Install Equipment			XXX	
Training / Start-up				XXX

REQUIRED REGULATORY ACTION:

Once all aerosol manufactures have had an opportunity to convert, personnel have been trained and certified, the use of CFC in aerosol industry in India should be prohibited.

RESULTS:

The project would phase-out 30.8 tons of CFC usage per year. If this company's volume increases as per past trend, the actual reduction will be considerably higher in the next few years.

ENVIRONMENTAL IMPACT:

The substitute propellant, a mixture of butane and propane, does not damage the ozone layer. It does not contribute to acid rain, is not carcinogenic, mutagenic, or toxic. The butane/propane mix does not pollute the soil or ground water. This mixture is a volatile organic compound (VOC) that contributes somewhat to ground level contamination. This mixture does have a global warming potential, albeit very low. Hydrocarbons are extremely flammable, and explosive. The storage of the Hydrocarbon propellants must be accomplished by strict adherence to local codes and regulations.

Annexure A

CAPITAL COSTS
(figures in US $)

No.	Qty	Description	Local	Foreign or import
1	1	Semi-Automatic filling line		37,000
2	lot	Wall in lot	10,000	
3	lot	Construct OAFR	8,000	
4	lot	Additional fire extinguishers	1,500	
5	1	Set of Quality Control Gauges (Crimp height, crimp diameter, pressure, vacuum etc.)		3,200
6	lot	Fixed Gas Detectors		8,000
7	1	Portable Gas Detector		1,000
8	lot	Piping	3,000	
9	1	Leak Test Tank	4,000	
10	lot	Storage Tank	13,000	
11	lot	Tank Foundation	3,000	
12	lot	Site Preparation	2,000	
13	lot	Shipping & Handling		6,000
14	lot	Plant Safety Training		4,000
		SUB TOTALS	44,500	59,200
		Total (local and foreign expenses)		103,700

Summary :	Cost
Capital Cost	103,700
+ 10 % contingency	10,400
+ 3 % Financial agent's fee	3,400
Total Project Cost	117,500

Annexure B

UNIT ABATEMENT COSTS AND GRANT EFFECTIVENESS:

The unit abatement cost of the **My Fair Lady** Enterprise conversion project is calculated as follows :-

Using the formula $A = \frac{C(F) + (OC - OS)}{W}$

Where C = US $ 114,100 OC=0
C(F) = US $ 18,765 OS=0
W= 59,500 kg

Doing the calculation, unit abatement cost = US $ 0.32/kg.

The existing filling lines would have to be scrapped to prevent it from being used. There would, therefore, be no disposal value for the existing equipment.

The grant effectiveness of the My Fair Lady conversion project is calculated as follows :-

Using the formula $A = \frac{C + (OC - OS)}{W}$

Where C = US $ 114,070 OC=0
OS=0
W= 59,500 kg

Doing the calculation, cost effectiveness = US $ 1.92 / kg.

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May 26, 1995

TO : Naimeh Hadjitarkhani FAX: 202-477-7352
Operations Officer
SA2CI, South Asia Country Dept. II

COPY TO : Tom Waltz FAX: 202-522-3258
ENVGC

FROM : Harry B. McCain

1. **Country of origin:** India

2. **Project title:** My Fair Lady

3. **Sector/sub-sector:** Aerosols

4. **Relationship to country programme:** N/A

5. **Technology**

(a) Hydrocarbon propellants have long been the preferred substitute for CFCs when used as an aerosol propellant. Hydrocarbon propellants are selected because of their zero ozone depleting potentials. The only environmental shortcoming of the hydrocarbon aerosol propellants (HAPs) is their flammability which can be correctly handled with the appropriate and now well established HAP technology. The U.S.A. has been using HAPs in aerosols instead of CFCs since 1978. In 1994 approximately 3 billion aerosol cans were filled with HAPs.

(b) The technology for the use of HAPs as a substitute for CFCs in aerosol products is well established, permanent, and not transitional. There are no transitional technologies that could be used in the aerosol sector that would be appropriate.

(c) It is totally feasible that the HAP technology required for this project can be transferred from Western Europe and the U.S.A. using the free market system.

(i) No technology transfer agreement is required.

(ii) There is no licensing agreement required.

(iii) The reviewer agrees with the determination to use HAPs as a replacement technology for CFCs used as propellants in aerosol products.
(iv) HAP is the most cost effective technology for this conversion.

6. **Environmental impact**

(a) This project will phase out 59.5 tons/year of CFC-12 and CFC-11/12 (ODS). Global warming potential is negligible. Unit Abatement Cost is $0.32/Kg U.S.
(b) Costs are appropriate to minimize health and safety and other environmental impacts.

7. **Project costs**

(a) All cost components identified in the project are essential for the conversion from CFCs to hydrocarbon aerosol propellants.
(b) Many cost components are present that will facilitate the conversion to hydrocarbon aerosol propellants.
(c) Cost of equipment
  (i) The cost of existing equipment is addressed in a manner that is consistent with the reviewer's experience.
  (ii) The reviewer agrees with the finding that all of the base line equipment in the report should be acquired.
  (iii) No additional equipment requests are essential for the conversion.
  (iv) Much of the base line equipment in this project must be replaced.
  (v) The existing filling lines would have to be scrapped to prevent it from being used. There would, therefore, be no disposal value for the existing equipment.
  (vi) Same as above.
  (vii) Present production at My Fair Lady is 900,000 cans/year. The new filling line proposed will have a capacity of one million cans/year.
(d) The training cost of $4,000.00 is probably appropriate. The number of people to be trained, however, is not given.
(e) Operating costs
  (i) The operating costs are appropriate.
  (ii) This project considers that short-term savings, if any, will cover some of the increased maintenance costs, and that thereafter My Fair Lady would absorb these extra costs. The operating costs and operating savings are considered to be equal. Hence, the project cost is the incremental cost.
  (iii) N/A

8. **Implementation time frame**

The time frame of four quarters is appropriate.

9. **Recommendations**

(a) This project is approved as proposed.

OORG/UNDP Technical Reviewer: Harry B. McCain

Date Review Completed: May 26, 1995

SUBPROJECT PROPOSAL

MASTER
done in office

COUNTRY	:	India
PROJECT TITLE	:	Phase out of CTC in the Manufacti
SECTOR COVERED	:	Solvent (Pesticides Manufacture)
ODS USE IN SECTOR	:	4806 Tonnes in 1991
PROJECT IMPACT(IN TONNES OF ODP) IN THE YEAR 1996-97	:	374 Tonnes of ODP (excluding recycling) 340 tonnes of CTC (ODP1.1)
PROJECT DURATION	:	18 months
PROJECT ECONOMIC LIFE	:	10 years
TOTAL PROJECT COST (US$)	:	Investment cost 533,000 Contingency @ 10% 53,300 Incremental Operating Cost 24,300 FA Fee @ 3% 18,300 Total Project Cost 629,000
COST EFFECTIVENESS	:	US$ 1.63 / ODP weighted kg of ODS phased out
PROPOSED OTF FINANCING (US$)	:	629,000
IMPLEMENTING ENTERPRISE	:	Excel Industries Unit:Bhav Nagar Gujarat
CO-ORDINATING NATIONAL BODY	:	Ministry of Environment & Forests (MOEF)
IMPLEMENTING AGENCY	:	World Bank

PROJECT SUMMARY

The project will phase out 340 tonnes of Carbon Tetra Chloride (CTC) in the production of endosulphan at Excel Industries Limited, Bombay by converting the production process and using Ethyelene Di Chloride, a non-ODS solvent. The proposed technology developed in house by Excel is non transitional.

Technical Assessment: The project proposal was reviewed by the OORG expert Mr. Brian Baxter and his comments are attached.

PROJECT OBJECTIVE:

The project objective is to phase out the use of CTC in the manufacture of endosulphan by redesigning the plant with a non-ODS solvent.

SECTOR BACKGROUND:

The solvent sector in India consumed ODS having 4,806 tonnes of ODP in the year 1991. CTC accounts for 80% of the total consumption of ODS in this sub sector. CTC is widely used by units in the pharmaceutical formulations (1,060 tpa), pesticide formulations (800 tpa) and chlorinated rubber (320 tpa). Besides, there are over 1,200 smaller units which use ODS as solvents (having consumption less than 1 tpa per unit). The country program has envisaged a growth of 20% and 15% in use of ODS for the pharmaceutical and pesticide industries over the next fifteen years under the unconstrained scenario.

The pesticide industry has reported consumption of 1,100 tpa of CTC during 1992 thereby exceeding the projections of the country program. There are 3 major players in the pesticide sector, manufacturing endosulphan, dicofol, etc.

The Ozone Cell, MOEF , is leading the efforts in the phase out of CTCs in co-operation with the users/suppliers. Complete phase out in Solvent sub sector is targeted by the year 2005. As a phase out strategy for solvent sector, the country program has suggested hydro carbons, chlorinated solvents, process modifications and a combination of these as alternatives for ODS in the pesticide and pharmaceutical formulation units.

ENTERPRISE BACKGROUND:

Excel is a leading manufacturer in India of wide range of agro-chemicals including pesticides and insecticides; phosphorous compounds and other chemicals. The enterprise was established in 1960. The registered office and head office of Excel is located at Bombay and has four production facilities at Bombay, Roha, Lote Parsuram (all in Maharashtra) and Bhavnagar in Gujarat. Endosulphan is produced at the Bhavnagar plant.

Excel is a 100% Indian owned Public Limited Company with a turnover of US$78 million for the year ended March 1994. It had posted a net profit of US$2.8 million for the same period.

The installed capacity of endosulphan at the Bhavnagar plant is 5,000 tpa and for the year ended March 1994, the production was 5,070 tonnes. The consumption of CTC was 340 tonnes for the year based on a production of 5,000 tonnes.

The enterprise has installed reactors, crystallizers, centrifuges, distillators, heat exchangers and storage facilities at the plant suitable for production of endosulphan.

PROJECT DESCRIPTION:

In this project Excel proposes to switch to use a non-ODS solvent as a medium for the reaction of HET DIOL with Thionyl Chloride to produce endosulphan. The details of present process and proposed modifications are furnished below.

Starting Block: (Common to both present and proposed processes)

Hexachloro Cyclo pentadiene (HCCP) is reacted with Butene diol in presence of a carrier solvent at controlled temperature and the adduct formed is called HET DIOL.

Second Stage:

Present Process:

HETDIOL is reacted with Thionyl Chloride (T.C.) in CTC (the carrier solvent medium). After the reaction is complete, the solution is distilled to recover the solvent, which is recycled & molten Endosulphan is flaked and packed in drums.

Proposed Process:

HETDIOL is reacted with T.C. in Ethylene Di Chloride (EDC), (the carrier solvent medium). After the reaction is complete, the solution is distilled to recover solvent which is recycled and molten Endosulphan is flaked and packed in drums.

JUSTIFICATION FOR SELECTION OF ALTERNATIVE TECHNOLOGY

The ODS phase out technologies for CTC are as follows:

(1) Trichloroethylene
(2) Methylene Chloride
(3) Ethylene Di Chloride
(4) Toluene

Excel has already conducted in house R&D efforts on these alternatives, before zeroing in on EDC. The endosulphan meeting the FAO specification of isomers, could be achieved by Excel, only through the EDC route. Further, with the use of EDC as solvent, the impurity profile of the end product is comparable to the one with use of CTC. Thus the choice of EDC would ensure that Excel produces consistent quality of endosulphan acceptable to the end users and ensure its market share in the international market as well. In view of the above factors, the choice of EDC is justified. Before, implementing the project, Excel would ensure compliance with all the statutory requirements with respect to safety and environmental point of view including the health aspects of the workers. The alternative is also consistent with those provided in the country program.

PROJECT COST:

The total project costs are estimated at US$629,000. The estimates for investment of US$533,000 in capital cost include investment in reaction vessels, flame proof electrical fixtures, utilities and piping as per details furnished in **ANNEXURE I.** The incremental operating costs estimated at US$24,300 is based on the increase in operating costs for one year computed based on the use of new solvent, as per details furnished in **ANNEXURE II.** Other costs of US$71,600 include 10% provision for contingency for adequate funding of the project costs following the project appraisal and 3% to cover the Financial Agency fee, who will oversee implementation of the project (procurement, disbursement and audits).

COST EFFECTIVENESS:

The cost effectiveness works out to US$1.63/ kg of ODP to be phased out, which is well below the limits fixed for other solvents i.e. CFC 113 (CE US$19.73) and TCA (CE US$38.50), Annexure III.

REQUIRED REGULATORY ACTION:

The GOI has already issued directives for waiver of excise duty for procurements under the ODS phase out project. The enterprise would obtain all statutory approvals and environmental clearances required for implementing the phase out project before seeking disbursement.

RESULTS:

This project would eliminate the use of 340 MT of CTC (ODP of 374 MT) in the first year of implementation.

PROJECT IMPLEMENTATION SCHEDULE:

TASK	Q1	Q2	Q3	Q4	Q5	Q6
(a) MPEC Approval	xx					
(b) Design of Equipment	xx					
(c) Supplier selection		xx				
(d) Delivery of Equipment		xx	xx	xx	xx	
(e) Installation			xx	xx	xx	
(f) Training					xx	
(g) Trial runs					xx	
(h) Production with new system						xx
(i) Discarding of ODS Lines						xx

ANNEXURE I

Capital Cost
(US$)

Process Facility	
(a) Distillation Pots (2 nos 6300 Ltrs.each)}	114,290
(b) Jacketed Receiver	50,880
(c) High vacuum ejector system	9,500
(d) Settler 2 Nos.	12,700
(e) Holding and Storage tanks	23,800
(f) Installation & Erection expenses	30,100
Subtotal	241,270
Utility Facility	
(a) Chilled Water Unit (for 60 TR unit)	44,440
(b) Electrical fixtures including Flame proof enclosures for fixtures	72,700
(c) Piping for utility & process facility}	101,590
(d) Insulation & painting of process facility	63,490
(e) Effluent treatment plant	9,520
Subtotal	291,740
TOTAL (rounded off)	533,000

ANNEXURE II

INCREMENTAL OPERATING COST

Item	Consumption		Cost estimates for one year @ 5,000 tpa production level		Incremental cost
	Base Line	Post Project	Base Line	Post Project	
Solvent Consumption Kg/Tonne and CTC @ US$ 0.7936/kg EDC @ US$ 0.6666/kg	68 of CTC	80 of EDC	269,824	266,640	(3,184)
Power kW/Tonne of production and @ US$ 0.0825/Kwh	13.26	19.89	5,472	8,208	2,736
Steam Tonnes/tonne of production @ US$ 15.9/tonne	0.335	0.543	26,633	43,168	16,535
Power increase in Kwh for removal of excess steam @ US$ 0.0825/Kwh (Chiller plant)	Nil	6.8	Nil	2,805	2,805
Increase in Chilled water load @ US$ 0.0984/TR	Nil	11	Nil	5,413	5,413

Net incremental operating cost works out to US$ 24,305 Rounded off 24,300.

ANNEXURE III

COST EFFECTIVENESS

	Figures in US$	
Capital costs (i)	533,018	533,000
Operating Cost (ii)	24,305	24,300
10% Contingency (iii)	53,300	53,300
FA fee= 0.03* (i+ii+iii)=(iv)	18,318	18,300
Total Incremental costs(i+ii+iii+iv)=(v)	628,941	629,000
Costs for computing CE (A)= (v)-(iv) (rounded to US$'000)	611,00	611,000
ODP to be replaced (B)	374,000	
CE= (A)/(B)	1.63	

Ozone Operations Resources Group
(OORG)

TECHNICAL REVIEW

1. Country of origin: India.

2. Project title: Phase out of CTC in the manufacture of ENDOSULPHAN.

3. Sector Covered: Solvent uses in Pesticide manufacture.

3a ODS use in sector: 4806 tonnes in 1991.

4. Relationship to Country programme. Phase out of 374 ODP tonnes of CTC (340 tonnes of CTC ODP 1.1). Unconstrained use of CTC could lead to an increase of 15% in the pesticide manufacturing sector.

5. Technology:

a) **Please note** the use of the term "EDC or ethylene dichloride" is understood by the reviewer to refer to 1,2 dichloroethane, boiling range 82 to 84°C.

The choice of EDC is defined by the purity and chemical composition (isomer ratio) of the product. In additional data supplied by the proposer, he shows that only EDC will give the required FAO ratio of 65-67% alpha isomer. Other safer non-flammable solvents give unacceptably high alpha isomer levels.

b) The technology is not transitional, as it does not depend upon a solvent or chemicals which might face future bans.

c) Feasibility of transfer to the country concerned

i) There is no formal technology transfer, all the process development has been done in-house.

ii) There is no licensing agreement.

iii) Other reaction solvents were tried in the development programme, including trichloroethylene, 1,1,1, trichloroethane, methylene chloride and toluene. All gave either the wrong alpha isomer content or reaction was incomplete. Thus EDC is the only choice.

iv) The Unit abatement costs are $ 1.62 per ODP Kg. This is a very low figure and reflects well on the project.

6. Environmental Impact:

(a) The ODP of the substitute solvent is zero. There will however an increase in indirect GWP owing to the increase in energy consumption inall of the main proces areas, electrical energy per tonne, steam generation, steam condensation, and increased chiller demand.

(b) The major Health and Safety hazard in this proposal is the flammability risk of the use of ethylene dichloride in place of the non-flammable CTC. The process however has an inherent safety factor in that solvent handling will take place in enclosed reaction vessels and evaporators, and there has been considerable modification to the plant to install flameproofed switching gear etc.. There is considerable emphasis on solvent recycling and re-use which further reduces the flammability hazard both during the process and in the storage and disposal of waste.

7. Project costs:

(a) All the cost components identified in the project are essential to the conversion, and the proposed equipment will maintain the existing level of service.

(b) Essentially this proposal refers to a plant modification to incorporate a new reaction solvent, rather than a plant redesign. It appears that there will be somee reuse of existing plant which will be modified to meet with the changes in the solvent properties. However the original process using CTC was virtually the same in principle to that using the EDC.

(c) Cost of equipment.

(i) The base line costs are addressed properly.

(ii) Proper use has been made of existing equipment where possible but there is also extensive upgrading as dictated by the introduction of a flammable solvent.

(iii) All the requests for equipment are consistent with the project plan.

(iv) There appears to be efficient use of existing equipment where possible.

(v) The fate of any scrapped equipment is not described.

(vi) NA.

(vii) The new plant will maintain the previous production rate.

(d) Appropriateness of training and related costs, if any.

The majority of training will be provided by Excel in house.

e) Operating costs

(i) There will be an annual increase of operating costs of $27489 due to increased energy demand in nearly all processes; solvent costs are actually lower.

(ii) All of the increased operating costs are defined by the introduction of a different reaction solvent, that appears to be the only material available and which will result in an unchanged product. As a result there is little opportunity for reduction in costs.

(iii) The operating cost given and their relation to the technology chosen appear to be consistent with the process as described.

8. Implementation timeframe.

The timeframe proposed is feasible.

9. Recommendations

(a) Approval as proposed.

OORG Technical reviewer: .....P.M.Baxter.....

Date Review completed: .....26th May 1995.