OCCASION

This publication has been made available to the public on the occasion of the 50th anniversary of the United Nations Industrial Development Organisation.

DISCLAIMER

FAIR USE POLICY

CONTACT

Please contact publications@unido.org for further information concerning UNIDO publications.

For more information about UNIDO, please visit us at www.unido.org

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Tel: (+43-1) 26026-0 · www.unido.org · unido@unido.org

21611

Project Proposal for the Multilateral Fund for the Implementation of the Montreal Protocol Financing

XD9700167

Country	**Brazil**	
Project Title	Elimination of 1,1,1 Trichloroethane at VICUNHA	
Sector Covered	Solvents	
ODS Use in Sector	650.6 MT (ODP-weighted) of ODS solvents in 1993	
Project Impact	Phase-out annual consumption of 12 MT of (total 1.2 ODP-weighted MT)	
Project Duration	12 months	
Project Economic Life	10 years	
Total Project Cost	Investment (capital) costs, US$	39,050
	Incremental operating savings, US$	24,725
	Total Project Costs, US$	14,330
Ownership Structure	100 per cent Brazilian	
Proposed MF Financing	US$ 14,330	
Cost Effectiveness	US$ 11.94 per Kg ODP	
Unit Abatement Cost	US$ (1.20) per Kg of phased-out ODS	
Implementing Agency	UNIDO	
Coordinating Ministry	Interministerial Ozone Working Group (PROZON)	

PROJECT SUMMARY

This project will substitute the total consumption of 1,1,1 Trichloroethane at VICUNHA, through the adoption of a hydrocarbon non chlorinated formulation to remove oil and grease spots in textiles, generated during manufacturing process.

12

1. Project Objective

This project will substitute the total consumption of 1,1,1 Trichloroethane at VICUNHA, through the adoption of a hydrocarbon non chlorinated formulation to remove oil and grease spots in textiles, generated during manufacturing process.

2. Sector Background

In 1993, the total ODS consumption in Brazil was estimated to be 8,918 ODP tonnes. In the same year, Brazil produced 4,010 tonnes of CFC-11 and 7,483 tonnes of CFC-12, and exported 1,444 tonnes of CFC-11 and 2,793 tonnes of CFC-12. Out of 43,970 tonnes of carbon tetrachloride produced in 1993, 18,770 tonnes were used as feedstock for the production of CFCs, 25,154 tonnes were exported and only 46 tonnes were used as solvent. The distribution of ODP by subsector is given in Exhibit 1. The distribution by ODP-weighted substance is shown in Exhibit 2 and the annual consumption of controlled substances is shown in Exhibit 3. The total consumption of ODS solvents in Brazil in 1993 was 6,174 tonnes or 753 ODP-weighted tonnes. In 1993, It was used 6,000 tonnes of 1,1,1-1,1,1 Trichloroethane, 46 tonnes of CTC and 128.0 tonnes of CFC-113.

Exhibit 1. Distribution of ODP tonnes by sector

Sector	Aerosol	Foam	Halon	Refrigerator	Solvent
Consumption (tonnes)	255.0	1,950.0	68.0	5,748.0	897.0
Percent of total:	2.95%	21.9%	0.8%	64.5%	7.3%

Exhibit 2. Distribution of ODP by substance

CFCs	Halon	CTC, MCF
91.9%	0.8%	7.3%

Exhibit 3. Consumption of controlled substances (1993)
14,291 1,1,1 Trichloroethane tonnes
8,918.2 weighted tonnes (ODP)

Sub.	CFC						Halon			Solvents		
(ton)	11	12	113	114	115	Tot.	1211	1301	Tot.	CTC	MCF	Tot.
ODS	2,726	5,338	128	20	22	8,324	6.0	5.0	11.0	46.0	6,000	6,046
ODP	2,726	5,338	102.0	20.0	13.2	8,199	18.0	50.0	68.0	50.6	600.0	650.6

The Government of Brazil is committed to phase-out the consumption of ODS within the shortest period of time, namely 1994 for halons, 2000 for methyl chloroform and 2001 for the other controlled substances.

3. Company Background

VICUNHA is one of the largest Brazilian textile groups. With around 1,200 employees, have revenues over US$ 25 MM, to the local market (there are no representative exports, since international competition is this field is very strong in this field). Their product line are textiles and woven fabrics in natural and/or synthectic fibers, manufactured in 7 different facilities. The two units, object of this project are located one in São Paulo and other in the city of Anápolis (1,200 km far from São Paulo). Today the whole group is passing through a reestructuration, in order to reduce costs and make it much more competitive.

4. Project Description

VICUNHA uses 1,1,1 Trichloroethane for the removal of oil and grease spots from natural crude cotton fabrics, today in two different plants, that will not receive any other treatment after, just when they visually inspect them for defects. This is done on a inspection table, and if spots appear they are cleaned with 1,1,1 Trichloroethane using a single spray gun .

Alternatives to the current technology are:

- Perchloroethilene, widely used in the dry cleaning, but not foreseen to be adequate to this application that will produce very dangerous atmosphere fro the workers due the known toxicity of PERC.
- Non-chlorinated hydrocarbons, which are petroleum distillates, but these compounds are flammable and therefore adequate fire protection equipment must be considered. Some formulations have less lingering

odor, higher flash points (~ 60 ° C) and could be adequately used in this application as they are in dry cleaning. And are recommended to the current case as part of formulations that improve the evaporation. As the operation of crude cotton fabrics will be combined in just one location, all the investment is for one single cleaning (oil/grease spots removal) line.

5. Project Costs

Total project costs:

As described below and presented in the relevant annexes, the total project incremental cost is US$. The total project incremental cost of US$ 14,330 was calculated as the economic capital costs plus the net incremental costs for four years discounted at 10 per cent.

Investment (capital) cost (see Annex 1):

As detailed in Annex 1, the total investment cost is US$ 39,050 . Major components of this cost include the purchase of new spray guns and the necessary equipment and modifications to assure fire protection.

Incremental operating savings (see Annex 2):

If the project were not undertaken, the annual operating cost, exclusive of tax, would be US$ 34,800 . If the project is implemented, the annual operating cost will be US$ 27,000 , resulting in an annual operating savings of US$ 7,800 . Given an equipment lifetime of 10 years and a discount rate of 10 per cent, the net present value of the first four years of incremental operating savings is US$ 24,725 . a more detailed breakdown of operating costs is provided in Annex 2.

Revenues:

This project will not provide the company with any incremental revenue.

Local ownership ratio:

A local ownership fraction of 100 per cent was considered to determine the amount of eligible MF grant financing. Since the total project incremental cost should be multiplied by the fraction of local ownership to determine the proposed grant amount, total proposed MF financing is US$ 14,330 .

Contingencies:

For contingencies purposes a 10 per cent has been included in the total investment costs.

Breakdown of total project costs

The breakdown of total project costs is given in Exhibit 4 . Although the economic life of the project is 10 years, the incremental operating costs/savings are calculated for a period of 4 years.

Exhibit 4 . Breakdown of total project costs

Description of cost	10 year period, US$	First four years, US$
Investment (capital) costs	39,050	39,050
NPV of incremental operating savings	47,928	24,725
NPV of incremental operating revenues	0	0
Total costs	(8,878)	14,330

Proposed MF Grant:

The proposed MF grant for this project is US$ 14,330 and has been calculated by multiplying the total project cost by 100 % local ownership fraction.

Unit Abatement Cost (UAC) and Cost Efficiency Factor:

As shown in Annex 3, the UAC for this project is US$ (1.20) per ODP-weighted kilogram of ODS phased out per year. In the same annex is demonstrated that the cost efficiency factor is US$ 11.94 per ODP-weighted kilogram of ODS phased out in the first year. These numbers are derived from an annualized incremental cost of capital of US$ 39,050 , first year incremental annual operating savings of US$ 7,800 , phasing out 1.2 MT (ODP-weighted) of ODS per year and a total MF grant of US$ 14,330 .

6. Project Implementation

Management

The Interministerial Ozone Working Group (PROZON) will oversee the successful implementation of this project, which will be carried by the enterprise. UNIDO will also provide technical assistance to the project during its implementation.

Procurement

Project procurement will comply with the UNIDO procurement procedures. These are described in the related UNIDO documents.

Disbursements

Fund disbursements will comply with UNIDO financial procedures. These guidelines are described in the related UNIDO documents. The schedule for disbursements will be decided upon at the beginning of project implementation.

Audits

For auditing, UNIDO's project evaluation procedures and project financial management data will be used.

Schedule of activities

The project road map is given in Exhibit 5.

Exhibit 5 . Project road map

	Activity	Description	Responsible	Timing
1	Approval of the project		Multilateral Fund	Start
2	Carry out reliability and performance tests	Evaluate the effectiveness of alternative products/processes	VICUNHA	1Q
3	Select technology	Prepare the list and specifications of equipment and materials	VICUNHA	1Q
4	Carry out international bidding, including evaluation and commercial negotiations	Prepare bidding documents, invite bids and hold commercial negotiations based on the selected technology, selected equipment and sign the contact(s).	UNIDO	2Q
5	Prepare facilities	Engineering and construction	VICUNHA	3Q
6	Acceptance test, installation and commissioning of equipment		VICUNHA	3Q
7	Start utilizing new cleaning processes		VICUNHA	4Q
8	Evaluate the processes		UNIDO, VICUNHA	4Q
9	Evaluate the project		UNIDO	4Q

7. Required Regulatory Actions

No regulatory actions, other than routine permitting, are required to implement this project. Under the existing agreement with the UNDP, equipment and machinery imported as part of this project will be exempt from import duties levied by the Government of Brazil.

8. Results

Direct and indirect impacts

The project will eliminate annually 1.2 MT of ODSs (ODP-weighted) at VICUNHA .As far as the indirect effect such as transfer of technology to other enterprises in subsequent projects is concerned, this project will have a big impact. The project has been designed to maximize this impact. Particularly, the involvement of PROZON will ensure the successful repetition of ODS phase-out projects in the Brazil engineering industry.

9. Environmental Assessment

Under the present proposal, VICUNHA will use a non-chlorinated hydrocarbon based formulation in a similar spray gun application for oil/grease spots removal. Because this solvents may have flammability and VOC concerns, VICUNHA will acquire equipment and fixtures to guarantee that possible vapor concentration in room environment is safe and that any discharges to the outer atmosphere are properly treated in a gas washer. The recuperated solvent that is to be disposed may be hazardous and must be handled properly.

Annex 1. Breakdown of Investment (Capital) Costs

	Description of cost item	Unit	Unit cost, US$	Qty	Total cost, US$
A	Application equipment modification (spray gun, nozzles, solvent reservoir)	1	3,000	1	3,000
B	Exhaust and gas washing system	1	12,000	1	12,000
C	Fire protection (alarm system, detectors, extra exhaust and fire extinguishers)				13,500
D	Training				1,000
E	UNIDO mission				6,000
F	Contingency (10%)				3,550
	TOTAL INVESTMENT COSTS				**39,050**

Annex 2. Breakdown of Incremental Operating Costs/Savings

	Description of cost item	Unit	Unit cost, US$	Qty	Pre-project total cost, US$	Post-project total cost, US$
	Solvent media					
1	1,1,1 Trichloroethane	Kg	2.9	12,000	34,800	
2	Spot removal, non-chlorinated hydrocarbon formulation	Kg	4.5	6,000		27,000
	TOTAL PRE-PROJECT COSTS/YEAR				**34,800**	
	TOTAL POST-PROJECT COSTS/YEAR					**27,000**
	TOTAL INCREMENTAL SAVINGS/YEAR					**7,800**
	NPV OF 4 YEARS INCREMENTAL SAVINGS @ 10%/YEAR					**24,725**

Annex 3. Calculation of unit abatement cost and cost efficiency factor

A	ODS phase out		
A1	Average use of 1,1,1 Trichloroethane	Kg	12,000
A2	ODP of 1,1,1 Trichloroethane		
A3	ODP-weighted 1,1,1 Trichlorocthanc phasc out	Kg	1,200
B	Annualized capital costs		
B1	Total investment cost (from annex 1)	US$	39,050
B2	Equipment economic life	Year	10
B3	Discount rate	%	10
B4	Annualized capital cost (10 years @ 10%0	US$	6,355
C	Annual operating savings (from annex 2)	US$	7,800
D	Unit abatcmcnt cost		
D1	Annualized capital cost per kg ODS phased out	US$/kg	5.30
D2	Annual incremental operating savings per kg ODS phased out	US$/kg	6.50
D3	**UNIT ABATEMENT COST (D1 + D2)**	**US$/kg**	**(1.20)**

E	MF grant	US$	14,330
F	ODP-weighted 1,1,1 Trichloroethane phase out	Kg	1,200
G	**COST EFFICIENCY FACTOR (E/F)**	**US$/kg**	**11.94**

Project Proposal for the Multilateral Fund for the Implementation of the Montreal Protocol Financing

Country	**Brazil**	
Project Title	Elimination of 1,1,1 Trichloroethane at the tapping fluids formulation at TAPMATIC	
Sector Covered	Solvents	
ODS Use in Sector	650.6 MT (ODP-weighted) of ODS solvents in 1993	
Project Impact	Phase-out annual consumption of 98.7 MT of TCA (total 9.9 ODP-weighted MT)	
Project Duration	9 months	
Project Economic Life	10 years	
Total Project Cost	Investment (capital) costs, US$	246,100
	Incremental operating costs, US$	712,009
	Total Project Costs, US$	958,109
Ownership Structure	100 per cent Brazilian	
Proposed MF Financing	US$ 375,212	
Cost Effectiveness	US$ 38.00 per Kg ODP	
Unit Abatement Cost	US$ 26.81 per Kg of phased-out ODS	
Implementing Agency	UNIDO	
Coordinating Ministry	Interministerial Ozone Working Group (PROZON)	

PROJECT SUMMARY

This project will enable TAPMATIC to completely phase out the utilization of 1,1,1 Trichloroethane used in the formulation of unique tapping fluids. Substitution will be reached after the proper qualification tests and consequent customer approval in which TAPMATIC will prove to their customers the new formulation performance and permit a fast introduction in the market in spite of initial non favorable costs.

1. Project Objective

Machining of threads is a very sensitive part of general mechanical works in the industry in general. Cost reductions, decreased machining times, increased machining speeds and tight dimensional tolerances had driven to the search of high performance machining fluids. TAPMATIC was professionally successful in the development of a unique formulation which utilizes 1,1,1 Trichloroethane as the basic component not only as being a volatile solvent, but to some extra benefits as refrigeration of cutting tool and extra lubricity which allows a better metal chip formation meeting all the customer needs. One aspect is very important to point out: 1,1,1 Trichloroethane is used as part of the formulation (95.5%) as a component mixed during the manufacturing operation, since there are no chemical reactions, it can not be considered as a process agent which would be consumed and transformed in the process.

Since the users are very dependent on reliability and need high performance fluids, TAPMATIC will need to invest in their customer support and application engineering with a special Tapping Torque Test Machine, in order to prove, convince and confirm that their proposed new formulation of tapping fluid without ODS is as good as the current one being sold

2. Sector Background

In 1993, the total ODS consumption in Brazil was estimated to be 8,918 ODP tonnes. In the same year, Brazil produced 4,010 tonnes of CFC-11 and 7,483 tonnes of CFC-12, and exported 1,444 tonnes of CFC-11 and 2,793 tonnes of CFC-12. Out of 43,970 tonnes of carbon tetrachloride produced in 1993, 18,770 tonnes were used as feedstock for the production of CFCs, 25,154 tonnes were exported and only 46 tonnes were used as solvent. The distribution of ODP by subsector is given in Exhibit 1. The distribution by ODP-weighted substance is shown in Exhibit 2 and the annual consumption of controlled substances is shown in Exhibit 3. The total consumption of ODS solvents in Brazil in 1993 was 6,174 tonnes or 753 ODP-weighted tonnes. In 1993, it was used 6,000 tonnes of 1,1,1-trichloroethane, 46 tonnes of CTC and 128.0 tonnes of CFC-113.

Exhibit 1. Distribution of ODP tonnes by sector

Sector	Aerosol	Foam	Halon	Refrigerator	Solvent
Consumption (tonnes)	255.0	1,950.0	68.0	5,748.0	897.0
Percent of total:	2.95%	21.9%	0.8%	64.5%	7.3%

Exhibit 2. Distribution of ODP by substance

CFCs	Halon	CTC, MCF
91.9%	0.8%	7.3%

Exhibit 3. Consumption of controlled substances (1993)
14,291 metric tonnes
8,918.2 weighted tonnes (ODP)

Sub.	CFC						Halon			Solvents		
(ton)	11	12	113	114	115	Tot.	1211	1301	Tot.	CTC	MCF	Tot.
ODS	2,726	5,338	128	20	22	8,324	6.0	5.0	11.0	46.0	6,000	6,046
ODP	2,726	5,338	102.0	20.0	13.2	8,199	18.0	50.0	68.0	50.6	600.0	650.6

The Government of Brazil is committed to phase-out the consumption of ODS within the shortest period of time, namely 1994 for halons, 2000 for methyl chloroform and 2001 for the other controlled substances.

3. Company Background

TAPMATIC is a private fully Brazilian owned company, with a plant located in Barueri, 45 km far from São Paulo. Established since 1981, with sales of US$ 2.5 MM all for the domestic market, as a chemical formulation company, with no technological dependency, manufacturing and selling machining fluids (thread cutting fluids, soluble oils) and general maintenance chemical products (liquid insulating tape, machine cleaning agents, rust removers, rust inhibitors, cold oxidation products, rust protectants, cold galvanizers, metal cleaners and metal protectants) . In the field of thread machining fluids, TAPMATIC has more than 90% of the total market and can assure the supply to all high performance fluid users in this field.

4. Project Description

4.1 Current process and technology

The total TCA based formulation is placed in cans with additives to obtain a cutting fluid used 90% in cutting threads. Up to now only a cutting fluid which contains TCA assures the highest precision of threads cutting since the diametrical difference between the original hole and the thread hole is the smallest possible. Also only TCA based cutting fluids assure a good finishing on the newly formed threads, which assures tighter fits and the possibility of higher torque applied on the thread components with the smallest risk of leakage of gas or liquids.

The present product process uses a mixer (2,000 liters volume) made of carbon steel, which pumps into a gravity controlled filling machine for eight 1/2 liter cans simultaneously. Company already spent US$ 68,000 in this line made to their specification to use TCA in the formulation of the threading fluids. During the process a common average loss of TCA of 9% in weight is observed.

To make the cutting fluid lubricant additives are heated in order to liquefy them and incorporate in the formula (95.5% of the formulation is TCA), than ad special refrigeration additives and fragrances (to cover the strong odor from components).

TCA is by far the best temperature controlling cooling additive because the higher the temperature of machining, because of friction, the faster the TCA evaporates than the part and tool rapidly cool down.

4.2 Selection of alternative technologies

Current formulation is approved and used in all companies that demand high performance thread machining fluids and there is a big resistance to change until a factual proof could be made available.

After spending a lot of time, efforts and money in research, TAPMATIC managed to determine that the functional part of 1,1,1 TRICHLOROETHANE which is responsible for all the unique quality for machining ,and so far has not being substituted, is the combination of chlorine and carbon in the molecule. Potential substitutes are:

1. Chloroform based mixtures, which were functionally approved, but due to its carcinogenicy , possible illness to the operator and local regulations it was abandoned.
2. A new special heavy chlorinated ester solvent was developed with the cooperation of TAPMATIC, which has the same functional group of TCA, maintaining part of the important characteristics. This new formulation beside the properties from the ester need to have lubricity additives, corrosion inhibitors, bactericides and cooling additives in order to assure that the fluid will have the same properties and will not affect adversely the media or environment where they are stored or used. Special bactericides (to prevent bacteria growth inside the machine reservoir) are used and are different from regular ones in not being acid types, that could adversely affect the lubricant properties and negatively impact the other components.

3. Another promising product tested was a special bromide ester, which failed due to manufacturing complications, making it dangerous and highly poisonous to the operators.
4. Hydrocarbons (petroleum distillates) formulations, which have been used until 30 years ago, before the introduction of current fluids, have been again evaluated. But still in various formulations they do not reach the point of friction developed at the point of chip removing (metal shearing), are negatively flammable in a product that is exposed to high temperatures (aprox. 250° C).

After performing several analysis, performance testing and comparisons, TAPMATIC selected the alternative 2 (chlorinated ester based solvent) that performed the best results, meeting the customer requirements:

- New fluid is (as minimum) as good as current one
- Good refrigeration of tool and part
- Finishing
- Lowering of chip forming resistance
- Increase of cutting tool life
- Easy metal chip removal
- Compatible cost

4.3 Equipment to run new formulation selection

In order to formulate the new specially designed fluid an new mixing, dosing and filling controlled line processing machine will be needed with components as follows:

A new mixturer is needed, because the requirements of stainless steel due the use of certain corrosive new components, also that the new formulation is more difficult to homogenize and thus need turbinated mixing. That need to be closed for environment purposes, in order to not permit a high concentration of bactericide in the area.

Filling machine, hermetically closed, to place the mixture in several sized cans with automatic dosing control (before mixing and during filling) in order to prevent any losses or leakages.

Product after mixing will be controlled by components content and fluid final properties will be checked in a specially designed equipment, which was not necessary before due to the easier handling and unique properties of TCA. And also to assure quality improvements and following of high standards

A international expert will be needed for 1 month in order to stabilize the mixing process and to help in the introduction of technology in process and product as well as product analysis and performance tests.

4.3 New formulation / process cost considerations

Thread fluids are used for a vital process in all metallurgical manufacturing by facilitating machining of threads, which are part of the basic cost calculations., the new fluid, which is essential to the machining process, initially must not be more expense to assure the same cost of the current one and a ramp up of selling prices can be possible after around one year due to environmental awareness of users. After that a special care need to given to TAPMATIC raw materials cost, mainly to the bactericides and higher cost of new solvents that increased the total manufacturing cost cost in about 75%, this will be possible with the consumption increase and better negotiations.

5. Project Costs

Total project costs:

As described below and presented in the relevant annexes, the total project incremental cost is US$ 958,109. The total project incremental cost was calculated as the economic capital costs plus the net incremental costs for four years discounted at 10 per cent.

Investment (capital) cost (see Annex 1):

As detailed in Annex 1, the total investment cost is US$ 246100 . Major components of this cost include the purchase of a special mixing, dosing and filling controled line processing machine.

Incremental operating costs (see Annex 2):

If the project were not undertaken, the annual operating cost, exclusive of tax, would be US$ 289,168 . If the project is implemented, the annual operating cost will be US$ 513,786 , resulting in an annual incremental operating cost of US$ 224,618 . Given an equipment lifetime of 10 years and a discount rate of 10 per cent, the net present value of the first four years of incremental operating costs is US$ 712,009 . A more detailed breakdown of operating costs is provided in Annex 2.

Revenues:

This project will not provide the company with any incremental revenue.

Local ownership ratio:

A local ownership fraction of 100 per cent was considered to determine the amount of eligible MF grant financing. Since the total project incremental cost should be multiplied by the fraction of local ownership to determine the proposed grant amount, total proposed MF financing is US$ 375,212 .

Contingencies:

For contingencies purposes a 5 per cent has been included in the total investment costs.

Breakdown of total project costs

The breakdown of total project costs is given in Exhibit 4 . Although the economic life of the project is 10 years, the incremental operating costs are calculated for a period of 4 years.

Exhibit . Breakdown of total project costs

Description of cost	10 year period, US$	First four years, US$
Investment (capital) costs	246,100	246,100
NPV of incremental operating costs	1,380,180	712,009
NPV of incremental operating revenues	0	0
Total costs	1,626,280	958,109

Enterprise Financial Participation

TAPMATIC is willing to participate with US$ 582,897 from their own financial resources. The balance will enable them to start the necessary operation and procedures to qualify the new product and help to price evenly both products in part of the first year. After that incremental cost will be transferred to the price being paid by the customers with a smooth ramp up in order to not comercialy kill the product.

Proposed MF Grant:

The proposed MF grant for this project is US$ 375,212 and has been calculated by e subtraction of enterprise financial participation from total project cost, and multiplying by the 100% local ownership fraction.

Unit Abatement Cost (UAC) and Cost Efficiency Factor:

As shown in Annex 3, the UAC for this project is US$ 26.81 per ODP-weighted kilogram of ODS phased out per year. In the same annex is demonstrated that the cost efficiency factor is US$ 38.00 per ODP-weighted kilogram of ODS phased out in the first year. These numbers are derived from an annualized incremental cost of capital of US$ 40.052 , first year incremental annual operating costs of US$ 224,618 , phasing out 9.9 MT (ODP-weighted) of ODS per year and a total MF grant of US$ 375,212 .

6. Project Implementation Management

The Interministerial Ozone working group will oversee the successful implementation of this project, which will be carried by the enterprise. UNIDO will also provide technical assistance to the project during its implementation.

Procurement

Project procurement will comply with the UNIDO procurement procedures. These are described in the related UNIDO documents.

Disbursements

Fund disbursements will comply with UNIDO financial procedures. These guidelines are described in the related UNIDO documents. The schedule for disbursements will be decided upon at the beginning of project implementation.

Audits

For auditing, UNIDO's project evaluation procedures and project financial management data will be used.

Schedule of activities

The project road map is given in Exhibit 5.

Exhibit 5 . Project road map

	Activity	Description	Responsible	Timing
1	Carry out reliability and performance tests	Evaluate the effectiveness of alternative products/processes	TAPMATIC	Done
2	Approval of the project		Multilateral Fund	Start
3	Prepare specifications	Prepare the list and specifications of equipment and materials	TAPMATIC	1Q
4	Carry out international bidding, including evaluation and commercial negotiations	Prepare bidding documents, invite bids and hold commercial negotiations based on the selected technology, selected equipment and sign the contact(s).	UNIDO	1Q
5	Prepare facility	Engineering	TAPMATIC	2Q
7	Acceptance test, installation and commissioning of equipment		TAPMATIC	3Q
8	Start utilizing new production line and new formulation		TAPMATIC	3Q
9	Evaluate the process		TAPMATIC	3Q
10	Evaluate the project		UNIDO	3Q

7. Required Regulatory Actions

No regulatory actions, other than routine permitting, are required to implement this project. Under the existing agreement with the UNDP, equipment and machinery imported as part of this project will be exempt from import duties levied by the Government of Brazil.

8. Results

Direct and indirect impacts

The project will eliminate annually 9.9 MT of ODSs (ODP-weighted) at TAPMATIC . as far as the indirect effect such as transfer of environmental concern to other enterprises, as well as that the newly developed technology can be palced available to other

companies in this field, this project will have a big impact. The project has been designed to maximize this impact. Particularly, the involvement of PROZON will ensure the successful repetition of ODS phase-out projects in the Brazil engineering industry.

9. Environmental Assessment

During manufacturing the new fluid, the requested mixing, automatic dosing and filling line processing machine will assure that no losses of bactericides or either chlorinated compounds are vented to the operating zone. An amount of US$ 3,500 is placed inside the project in order to contain and prevent accidental leakage and spill control and contention.

The final product will not be harmful to either the environment and humans, and no extra care need to be taken besides the normal procedures in machining operation, mainly because for each thread just "drops" of fluid are needed in each hole.

Annex 1. Breakdown of Investment (Capital) Costs

	Description of cost item	Unit	Unit cost, US$	Qty	Total cost, US$
A	Mixing, dosing and filling controlled line processing machine, composed of a 2,00 liter tubine mixer, auotomatic dosing for formulating and mixing, filling device and process control fixture.	ea	176,000	1	176,000
B	Ventilation, and civil work for spill and leakage prevention/contention				3,500
C	Training and machinery installation				5,000
D	Shipping (freight & insurance)				17,600
E	Expert mission				15,000
F	UNIDO mission				6,000
G	Contingency (5%)				23,100
	TOTAL INVESTMENT COSTS				**246,100**

Annex 2. Breakdown of Incremental Operating Costs/Savings

	Description of cost item	Unit	Unit cost, US$	Qty	Pre-project total cost, US$	Post-project total cost, US$
	Tapping fluid basic components					
A	Current formula					
	1,1,1 Trichloroethane	Kg	2.70	98,743	266,606	
	Fragrances	Kg	29.50	72	2,124	
	Lubricity additives and corrosion inhibitors	Kg	2,64	3,456	9,124	
	Refrigeration additives	Kg	2.24	504	1,129	
B	New formula					
	Solvents	Kg	5.66	38,664		218,838
	Lubricity and cooling additives	Kg	2.77	32,400		89,748
	Bactericide	Kg	304.00	648		196,992
	Corrosion inhibitors	Kg	38.00	216		8,208
	TOTAL PRE-PROJECT COSTS/YEAR				**289,168**	
	TOTAL POST-PROJECT COSTS/YEAR					**513,786**
	TOTAL INCREMENTAL COSTS/YEAR					**224,618**
	NPV OF 4 YEARS INCREMENTAL COSTS @ 10%/YEAR					**712,009**

obs.: Due to the confidentiality of the formulas, components were grouped, and unit costs are the average.

Annex 3. Calculation of unit abatement cost and cost efficiency factor

A	ODS phase out		
A1	Average use of 1,1,1 Trichloroethane	Kg	98,743
A2	ODP of 1,1,1-Trichloroethane		0.1
A3	ODP-weighted 1,1,1-Trichloroethane phase out	Kg	9,874
B	Annualized capital costs		
B1	Total investment cost (from annex 1)	US$	246,100
B2	Equipment economic life	Year	10
B3	Discount rate	%	10
B4	Annualized capital cost (10 years @ 10%0	US$	40,052
C	Annual operating costs (from annex 2)	US$	224,618
D	Unit abatement cost		
D1	Annualized capital cost per kg ODS phased out	US$/kg	4.06
D2	Annual incremental operating costs per kg ODS phased out	US$/kg	22.75
D3	**UNIT ABATEMENT COST (D1 + D2)**	**US$/kg**	**26.81**

E	MF grant	US$	375,212
F	ODP-weighted 1,1,1-Trichloroethane phase out	MT	9,874
G	**COST EFFICIENCY FACTOR (E/F)**	**US$/kg**	**38.00**

Project Proposal for the Multilateral Fund for the Implementation of the Montreal Protocol Financing

Country	**Brazil**	
Project Title	Elimination of 1,1,1 Thrichloroethane used as solvent at RODABRAS	
Sector Covered	Solvents	
ODS Use in Sector	650.6 MT (ODP-weighted) of ODS solvents in 1993	
Project Impact	Phase-out annual consumption of 41.5 MT of 1,1,1 Trichloroethane (total 4.2 ODP-weighted MT)	
Project Duration	12 months	
Project Economic Life	10 years	
Total Project Cost	Investment (capital) costs, US$	231,220
	Incremental operating savings, US$	73,043
	Total Project Costs, US$	158,180
Ownership Structure	100 per cent Brazilian	
Proposed MF Financing	US$ 158,180	
Cost Effectiveness	US$ 38.11 per Kg ODP	
Unit Abatement Cost	US$ 3.52 per Kg of phased-out ODS	
Implementing Agency	UNIDO	
Coordinating Ministry	Interministerial Ozone Working Group (PROZON)	

PROJECT SUMMARY

RODABRAS currently use 1,1,1 Trichloroethane as a solvent in vapor degreasing wheels for the automotive market. The substitution and phase-out of TCA will be done with the adoption of a new aqueous (detergent based) cleaning line.

1. Project Objective

RODABRAS is currently vapor degreasing with 1,1,1 Trichloroethane all the wheels in their production line before final stage of painting. The phase-out of TCA will be reached with the installation of a new aqueous line that will perfectly meet their cleanliness levels.

2. Sector Background

In 1993, the total ODS consumption in Brazil was estimated to be 8,918 ODP tonnes. In the same year, Brazil produced 4,010 tonnes of CFC-11 and 7,483 tonnes of CFC-12, and exported 1,444 tonnes of CFC-11 and 2,793 tonnes of CFC-12. Out of 43,970 tonnes of carbon tetrachloride produced in 1993, 18,770 tonnes were used as feedstock for the production of CFCs, 25,154 tonnes were exported and only 46 tonnes were used as solvent. The distribution of ODP by subsector is given in Exhibit 1. The distribution by ODP-weighted substance is shown in Exhibit 2 and the annual consumption of controlled substances is shown in Exhibit 3. The total consumption of ODS solvents in Brazil in 1993 was 6,174 tonnes or 753 ODP-weighted tonnes. In 1993, it was used 6,000 tonnes of 1,1,1-trichloethane, 46 tonnes of CTC and 128.0 tonnes of CFC-113.

Exhibit 1. Distribution of ODP tonnes by sector

Sector	Aerosol	Foam	Halon	Refrigerator	Solvent
Consumption (tonnes)	255.0	1,950.0	68.0	5,748.0	897.0
Percent of total:	2.95%	21.9%	0.8%	64.5%	7.3%

Exhibit 2. Distribution of ODP by substance

CFCs	Halon	CTC, MCF
91.9%	0.8%	7.3%

Exhibit 3. Consumption of controlled substances (1993)
14,291 metric tonnes
8,918.2 weighted tonnes (ODP)

Sub.	CFC						Halon			Solvents		
(ton)	11	12	113	114	115	Tot.	1211	1301	Tot.	CTC	MCF	Tot.
ODS	2,726	5,338	128	20	22	8,324	6.0	5.0	11.0	46.0	6,000	6,046
ODP	2,726	5,338	102.0	20.0	13.2	8,199	18.0	50.0	68.0	50.6	600.0	650.6

The Government of Brazil is committed to phase-out the consumption of ODS within the shortest period of time, namely 1994 for halons, 2000 for methyl chloroform and 2001 for the other controlled substances.

3. Company Background

RODABRAS is a private Brazilian owned company located in Sumaré, 250 km far from São Paulo. Established since 1957, today employs 110 people, with annual sales of US$ 4.5 MM all for the domestic market. This is a metallurgical company producing wheels for cars and agricultural implements, boxes and equipment for molding (casting). It is the only Brazilian company in this particular sub-segment, thus their competitors are multinatinational and not eligible for funding.

4. Project Description

4.1 Current technology and proposed substitution

Today all wheels manufactured at RODABRAS after mechanical conforming and welding need to be cleaned before final paint deposition. This is performed in an

conventional vapor degreaser using TCA with a rotary fixture that can handle the wheels during cleaning, and therefore no human handling i necessary. Machine was made in 1989, has an internal capacity of 100 liters of solvent and external dimensions of 2,100 mm x 800 mm x 2,450 mm., with an distillator on its side.

New equipment will be an aqueous system with equivalent capacity, with detergent wash, 2 tap water rinse and drying stages. For proper handling of the wheels during the process an transport system need to be installed in order to substitute the build inside the current machine that is useless for the new. All the steel plates used are free of corrosion encrustation and deposits and there is no need for internal chemical etching at the company, so a water treatment equipment need to be supplied in order to properly mange all the effluent that will be generated due the new cleaning process.

4.2 Reliability testing, qualification and certification

Reliability testing, process and material qualification and certification to determine which cleaning agents are suitable to achieve the desired and needed cleaning results will be performed by RODABRAS prior to the purchase of the alternative cleaning machine. The process development work is to be documented to determine that the cleaning process is a good decision.

4.3 Technology selection

Aqueous cleaning solutions typically are tailored to the requirements of the specific cleaning application. Aqueous cleaners use water as the primary solvent, synthetic detergents and surfactants are combined with special additives such as builders, pH buffers, inhibitors, saponifiers, emulsifiers, etc. The key stages of an aqueous cleaning process are washing, rinsing and drying. Oils, organic films, and greases, inorganic or polar soils can be effectively removed by aqueous chemistry with a properly designed system. The use of ultrassonics measures much more effective in water-based solvents than in 1,1,1 Trichloroethane.

5. Project Costs

Total project costs:

As described below and presented in the relevant annexes, the total project incremental cost is US$ 158,180. The total project incremental cost was calculated as the economic capital costs plus the net incremental costs for four years discounted at 10 per cent.

Investment (capital) cost (see Annex 1):

As detailed in Annex 1, the total investment cost is US$ 231,220 . Major components of this cost include the purchase of aqueous cleaning machine, transport system and waste water treatment equipment.

Incremental operating costs/savings (see Annex 2):

If the project were not undertaken, the annual operating cost, exclusive of tax, would be US$ 125,903 . If the project is implemented, the annual operating cost will be US$ 102,860 , resulting in an annual operating savings of US$ 23,043 . Given an equipment lifetime of 10 years and a discount rate of 10 per cent, the net present value of the first four years of incremental operating savings is US$ 73,043 . a more detailed breakdown of operating costs is provided in Annex 2.

Revenues:

This project will not provide the company with any incremental revenue.

Local ownership ratio:

A local ownership fraction of per cent was considered to determine the amount of eligible MF grant financing. Since the total project incremental cost should be multiplied by the fraction of local ownership to determine the proposed grant amount, total proposed MF financing is US$ 158,180 .

Contingencies:

For contingencies purposes a 10 per cent has been included in the total investment costs.

Breakdown of total project costs

The breakdown of total project costs is given in Exhibit 4 . Although the economic life of the project is 10 years, the incremental operating savings are calculated for a period of 4 years.

Exhibit 4 . Breakdown of total project costs

Description of cost	10 year period, US$	First four years, US$
Investment (capital) costs	231,220	231,220
NPV of incremental operating savings	141,589	73,043
NPV of incremental operating revenues	0	0
Total costs	89,631	158,180

Proposed MF Grant:

The proposed MF grant for this project is US$ 158,180 and has been calculated by multiplying the total project cost by 100 % local ownership fraction.

Unit Abatement Cost (UAC) and Cost Efficiency Factor:

As shown in Annex 3, the UAC for this project is US$ 3.52 per ODP-weighted kilogram of ODS phased out per year. In the same annex is demonstrated that the cost efficiency factor is US$ 38.11 per ODP-weighted kilogram of ODS phased out in the first year. These numbers are derived from an annualized incremental cost of capital of US$ 231,220 , first year incremental annual operating savings of US$ 23,043 , phasing out 4.2 MT (ODP-weighted) of ODS per year and a total MF grant of US$ 158,180 .

6. Project Implementation

Management

The Interministerial Ozone Working Group (PROZON) will oversee the successful implementation of this project, which will be carried by the enterprise. UNIDO will also provide technical assistance to the project during its implementation.

Procurement

Project procurement will comply with the UNIDO procurement procedures. These are described in the related UNIDO documents.

Disbursements

Fund disbursements will comply with UNIDO financial procedures. These guidelines are described in the related UNIDO documents. The schedule for disbursements will be decided upon at the beginning of project implementation.

Audits

For auditing, UNIDO's project evaluation procedures and project financial management data will be used.

Schedule of activities

The project road map is given in Exhibit 5.

Exhibit 5 . Project road map

	Activity	Description	Responsible	Timing
1	Approval of the project		Multilateral Fund	Start
2	Carry out reliability and performance tests	Evaluate the effectiveness of alternative products/processes	RODABRAS	1Q
3	Select technology	Prepare the list and specifications of equipment and materials	RODABRAS	1Q

4	Carry out international bidding, including evaluation and commercial negotiations	Prepare bidding documents, invite bids and hold commercial negotiations based on the selected technology, selected equipment and sign the contact(s).	UNIDO	2Q
5	Design modifications of the site and facilities	Engineering design of utilities (water and electricity), piping and civil engineering.	RODABRAS	3Q
6	Prepare facilities	Engineering and construction	RODABRAS	4Q
7	Acceptance test, installation and commissioning of equipment		RODABRAS	4Q
8	Start utilizing new cleaning processes		RODABRAS	4Q
9	Evaluate the processes		UNIDO, RODABRAS	4Q
10	Evaluate the project		UNIDO	4Q

7. Required Regulatory Actions

No regulatory actions, other than routine permitting, are required to implement this project. Under the existing agreement with the UNDP, equipment and machinery imported as part of this project will be exempt from import duties levied by the Government of Brazil.

8. Results

Direct and Indirect Impacts

The project will eliminate annually 4.2 MT of ODSs (ODP-weighted) at RODABRAS. As far as the indirect effect such as transfer of technology to other enterprises in subsequent projects is concerned, this project will have a big impact. The project has been designed to maximize this impact. Particularly, the involvement of PROZON will ensure the successful repetition of ODS phase-out projects in the Brazil engineering industry.

9. Environmental Assessment

The use of alkaline detergent solutions in metal cleaning always carry out with the waste water some of the additives like surfactants that can potentially cause adverse effects in the environment. To prevent that occurrence a effluent treatment equipment was considered in the project in order to properly treat all waste water generated by the equipment object of this project.

Annex 1. Breakdown of Investment (Capital) Costs

	Description of cost item	Unit	Unit cost, US$	Qty	Total cost, US$
A	Aqueous cleaning machine with spraying (basic tank dimensions 800 mm x 800 mm x 600 mm) with one wash, two rinse and drying stages or cycles	1	125,000	1	125,000
B	Transport system (to handle the wheels during cleaning)	1	15,000	1	15,000
C	Waste water treatment system.				35,000
D	Electrical, piping and civil modifications				5,000
E	Exhaust and ventilation				4,000
F	Installation, testing, qualifying and certification				6,500
G	Training				1,200
H	UNIDO mission				6,000
I	Transportation (freight and insurance)				12,500
J	Contingency (10%)				21,020
	TOTAL INVESTMENT COSTS				**231,220**

Annex 2. Breakdown of Incremental Operating Costs/Savings

	Description of cost item	Unit	Unit cost, US$	Qty	Pre-project total cost, US$	Post-project total cost, US$
A	Solvent media					
A.1	1,1,1 Trichloroethane	Kg	2.7	41,500	112,050	
A.1	Aqueous detergent	Kg	3.8			64,600
	Sub Total				112,050	64,600
B	Electricity					
B.1	Current vapor degreaser (37 kW , 2 shifts, 5 days/week)	kWh	0,09	153,920	13,853	
B.2	New aqueous machine (75 kW, 2 shifts, 5 days/week)	kWh	0.09	312,000		28,020
	Sub-total				13,853	28,020
C	Water					
C.1	Water supply	m^3	4.1	1,600		6,560
C.2	Waste water (effluent) treatment	m^3	2.3	1,600		3,680
	Sub-total				0	10,240
	TOTAL PRE-PROJECT COSTS/YEAR				**125,903**	
	TOTAL POST-PROJECT COSTS/YEAR					**102,860**
	TOTAL INCREMENTAL SAVINGS/YEAR					**23,043**
	NPV OF 4 YEARS INCREMENTAL SAVINGS @ 10%/YEAR					**73,043**

Annex 3. Calculation of unit abatement cost and cost efficiency factor

A	ODS phase out		
A1	Average use of 1,1,1 trichloroethane	Kg	41,.500
A2	ODP of 1,1,1-trichloroethane		0.1
A3	ODP-weighted 1,1,1-trichloroethane phase out	Kg	4,150
B	Annualized capital costs		
B1	Total investment cost (from annex 1)	US$	231,220
B2	Equipment economic life	Year	10
B3	Discount rate	%	10
B4	Annualized capital cost (10 years @ 10%)	US$	37,630
C	Annual operating savings (from annex 2)	US$	(23,043)
D	Unit abatement cost		
D1	Annualized capital cost per kg ODS phased out	US$/kg	9.07
D2	Annual incremental operating savings per kg ODS phased out	US$/kg	(5.55)
D3	**UNIT ABATEMENT COST (D1 + D2)**	**US$/kg**	**3.52**

E	MF grant	US$	158,180
F	ODP-weighted 1,1,1-trichloroethane phase out	Kg	4,150
G	**COST EFFICIENCY FACTOR (E/F)**	**US$/kg**	**38.12**

Project Proposal for the Multilateral Fund for the Implementation of the Montreal Protocol Financing

Country	**Brazil**	
Project Title	Elimination of TCA in auto parts cleaning at BROSOL	
Sector Covered	Solvents	
ODS Use in Sector	650.6 MT (ODP-weighted) of ODS solvents in 1993	
Project Impact	Phase-out annual consumption of 48 MT of TCA (total 4.8 ODP-weighted MT)	
Project Duration	12 months	
Project Economic Life	10 years	
Total Project Cost	Investment (capital) costs, US$	280,500
	Incremental operating savings, US$	102,139
	Total Project Costs, US$	178,361
Ownership Structure	100 per cent Brazilian	
Proposed MF Financing	US$ 178,361	
Cost Effectiveness	US$ 37.16 per Kg ODP	
Unit Abatement Cost	US$ 2.80 per Kg of phased-out ODS	
Implementing Agency	UNIDO	
Coordinating Ministry	Interministerial Ozone Working Group (PROZON)	

PROJECT SUMMARY

This project will completely phase out the consumption of 1,1,1 Trichloroethane used as a solvent to degrease auto parts (motor engine parts) at BROSOL. This will be reached with the substitution of the three existing cleaning lines by two aqueous solution systems and one semi-aqueous (hydrocarbon/water emulsion) machine.

1. Project Objective

This project aims the complete phase-out of 1,1,1 Trichloroethane in all metal cleaning processes at BROSOL. The processes that currently use this ODS will be substituted by aqueous and semi-aqueous processes. Due the stringent quality inspection needs, the semi-aqueous may be replaced after qualification tests by an equivalent Solvating/Rinsing agent combined vapor degreaser.

2. Sector Background

In 1993, the total ODS consumption in Brazil was estimated to be 8,918 ODP tonnes. In the same year, Brazil produced 4,010 tonnes of CFC-11 and 7,483 tonnes of CFC-12, and exported 1,444 tonnes of CFC-11 and 2,793 tonnes of CFC-12. Out of 43,970 tonnes of carbon tetrachloride produced in 1993, 18,770 tonnes were used as feedstock for the production of CFCs, 25,154 tonnes were exported and only 46 tonnes were used as solvent. The distribution of ODP by subsector is given in Exhibit 1. The distribution by ODP-weighted substance is shown in Exhibit 2 and the annual consumption of controlled substances is shown in Exhibit 3. The total consumption of ODS solvents in Brazil in 1993 was 6,174 tonnes or 753 ODP-weighted tonnes. In 1993, it was used 6,000 tonnes of 1,1,1-trichloethane, 46 tonnes of CTC and 128.0 tonnes of CFC-113.

Exhibit 1. Distribution of ODP tonnes by sector

Sector	Aerosol	Foam	Halon	Refrigerator	Solvent
Consumption (tonnes)	255.0	1,950.0	68.0	5,748.0	897.0
Percent of total:	2.95%	21.9%	0.8%	64.5%	7.3%

Exhibit 2. Distribution of ODP by substance

CFCs	Halon	CTC, MCF
91.9%	0.8%	7.3%

Exhibit 3. Consumption of controlled substances (1993)
14,291 metric tonnes
8,918.2 weighted tonnes (ODP)

Sub.	CFC						Halon			Solvents		
(ton)	11	12	113	114	115	Tot.	1211	1301	Tot.	CTC	MCF	Tot.
ODS	2,726	5,338	128	20	22	8,324	6.0	5.0	11.0	46.0	6,000	6,046
ODP	2,726	5,338	102.0	20.0	13.2	8,199	18.0	50.0	68.0	50.6	600.0	650.6

The Government of Brazil is committed to phase-out the consumption of ODS within the shortest period of time, namely 1994 for halons, 2000 for methyl chloroform and 2001 for the other controlled substances.

3. Company Background

BROSOL is an auto parts manufacturer, located in Ribeirão Pires 50 km far from São Paulo, being a private, 100% Brazilian owned company. Employing 1,600 people, with sales of US$ 150 MM, have exports to other Latin American countries (Article 5) representing less than 7% from the total sales. Their product line is splitted in two major divisions: Systems and Components for Motors (fuel distributors, water pumps, carburetors, fuel pumps, motor components and electronic fuel injection mechanical components) and Systems and Components for Car Bodies (windows systems, door lockers and handles, and general auto door locking/closing system parts). BROSOL is by far the leader in carburetor kits and parts, with expected life (of this product) for more than 15 years due

the need for reposition and is also merging into the new developing electronic fuel injection market.

4. Project Description

4.1 Current technology and proposed substitution

The consumption of TCA and objective of present project is divided in three areas:

I)Automatic machining of general parts:

Vapor degreasing in an automatic feed, closed degreaser with vapor recovery and destilation unit, for general machined parts to be used in all assemblies from the plant. Current machine is a TA UDAPECH with three sumps (780mm x 560mm x 380mm and 400 liters load capacity).

This will be substituted by an aqueous system with equivalent dimensions and capacity, with ultrassonics, internal automatic basket transport system and double drying stage in order to reach the same production rate as today.

II) Fuel pumps pre-assembly:

Vapor degreasing in an TCA single sump machine of fuel pumps parts and bodies and general "braised" parts. Equipment dimensions are 1000mm x 800mm x 1200mm , with an average charge of 80 liters because parts are sprayed and vapor cleaned.

This will be substituted by a simple spray aqueous machine with equivalent capacity.

III) Carburetor components and parts:

Cleaning in TCA using ultrassonics of variety of internal carburetor parts (injector and parts that control the flow of fuel and air) in three single sump (500mm x 300mm x 300mm) and following the cleaning process all this parts are highly inspected and tested due the fact that al holes inside the parts have, due the need of calibration, very small diameter and extremely tight tolerances.

The main approach to substitute this process will be an semi-aqueous (aliphatic hydrocarbon/water emulsion) system, an alternative will also be tested (solvating/rinsing using vapor degrease) to evaluate best process that result in no deposits in the internal orifices from parts. Just one machine is needed to perform the cleaning in this area

4.2 Reliability testing, qualification and certification

Reliability testing, process and material qualification and certification to determine which cleaning agents are suitable to achieve the desired and needed cleaning results will be performed by BROSOL prior to the purchase of the alternative cleaning machines. The process development work is to be documented to determine that the cleaning process is a good decision.

4.3 Technology selection

Aqueous cleaning solutions typically are tailored to the requirements of the specific cleaning application. Aqueous cleaners use water as the primary solvent, synthetic detergents and surfactants are combined with special additives such as builders, pH buffers, inhibitors, saponifiers, emulsifiers, etc. The key stages of an aqueous cleaning process are washing, rinsing and drying. Oils, organic films, and greases, inorganic or polar soils can be effectively removed by aqueous chemistry with a properly designed system. The use of ultrassonics measures much more effective in water-based solvents than in 1,1,1 Trichloroethane.

Semi-aqueous cleaning uses hydrocarbon/surfactant cleaners which are emulsion cleaners that can be substitutes for 1,1,1 Trichloroethane in metal cleaning applications. Hydrocarbon/surfactant have been used in many different cleaners formulated for different purposes. Hydrocarbon/surfactants are used in cleaning processes in two ways. They are either emulsified in water solutions and applied in a manner similar to standard aqueous cleaners or they are applied in concentrated form and then rinsed with water. In

general they have the same characteristics of water based solutions with the exception of being more efficient in removing certain soils. The use of emulsions controls the risk of flammability of the pure solvent. Popper water/solvent separator prior to discharge is needed in order to not increase common water treatment facilities.

New mixed hydrocarbon cleaning agents (solvating agent) combined with halogenated agents (rinsing agent) using vapor cleaning opened new perspectives for metal cleaning, mainly were water could not be afforded because of material compatibility or complex geometry parts. The original process used PFC (perfluorocarbons), which have a very long atmospheric lifetime and where abandoned in the majority of candidate applications. With the recent introduction of HFE (hydrofluroethers) with improved solvency and much shorter atmosferic lifetime as well as the possible use of HFC, brought back this alternative solution to cases where above mentioned solutions could not reach cleaning and reliability requirements . Equipment is a improved two sump vapor degreaser with extra vapor recovery coils with comparable cost results to other alternatives and since the boiling agent is a non flammable solvent, explosion proof requirements could not be required if solvating agent is a hydrocarbon mixture (e.g. PETROFERM/3M - AVD process).

5. Project Costs

Total project costs:

As described below and presented in the relevant annexes, the total project incremental cost is US$ 178,361. The total project incremental cost was calculated as the economic capital costs plus the net incremental savings for four years discounted at 10 per cent per year.

Investment (capital) cost (see Annex 1):

As detailed in Annex 1, the total investment cost is US$ 280,500 . Major components of this cost include the purchase of three new cleaning machines, installation, modification, training and quality costs.

Incremental operating savings (see Annex 2):

If the project were not undertaken, the annual operating cost, exclusive of tax, would be US$ 139,501 . If the project is implemented, the annual operating cost will be US$ 107,279 , resulting in an annual operating saving of US$ 32,222 . Given an equipment lifetime of 10 years and a discount rate of 10 per cent, the net present value of the first four years of incremental operating savings is US$ 102,139 . A more detailed breakdown of operating costs is provided in Annex 2.

Revenues:

This project will not provide the company with any incremental revenue.

Local ownership ratio:

A local ownership fraction of 100 per cent was considered to determine the amount of eligible MF grant financing. Since the total project incremental cost should be multiplied by the fraction of local ownership to determine the proposed grant amount, total proposed MF financing is US$ 178,361 .

Contingencies:

For contingencies purposes a 10 per cent has been included in the total investment costs.

Breakdown of total project costs

The breakdown of total project costs is given in Exhibit 4 . Although the economic life of the project is 10 years, the incremental operating savings are calculated for a period of 4 years.

Exhibit 4 . Breakdown of total project costs

Description of cost	10 year period, US$	First four years, US$
Investment (capital) costs	280,500	280,500
NPV of incremental operating savings	197,990	102,139
NPV of incremental operating revenues	0	0
Total costs	82,510	178,361

Proposed MF Grant:

The proposed MF grant for this project is US$ 178,361 and has been calculated by multiplying the total project cost by 100 % local ownership fraction.

Unit Abatement Cost (UAC) and Cost Efficiency Factor:

As shown in Annex 3, the UAC for this project is US$ 2.80 per ODP-weighted kilogram of ODS phased out per year. In the same annex is demonstrated that the cost efficiency factor is US$ 37.16 per ODP-weighted kilogram of ODS phased out in the first year. These numbers are derived from an annualized incremental cost of capital of US$ 280,500 , first year incremental annual operating savings of US$ 32,222 , phasing out 4.8 MT (ODP-weighted) of ODS per year and a total MF grant of US$ 178,361 .

6. Project Implementation

Management

The Interministerial Ozone Working Group (PROZON) will oversee the successful implementation of this project, which will be carried out by the enterprise. UNIDO will also provide technical assistance to the project during its implementation.

Procurement

Project procurement will comply with the UNIDO procurement procedures. These are described in the related UNIDO documents.

Disbursements

Fund disbursements will comply with UNIDO financial procedures. These guidelines are described in the related UNIDO documents. The schedule for disbursements will be decided upon at the beginning of project implementation.

Audits

For auditing, UNIDO's project evaluation procedures and project financial management data will be used.

Schedule of activities

The project road map is given in Exhibit 5.

Exhibit 5 . Project road map

	Activity	Description	Responsible	Timing
1	Approval of the project		Multilateral Fund	Start
2	Carry out reliability and performance tests	Evaluate the effectiveness of alternative products/processes	BROSOL	1Q
3	Select technology	Mainly for internal carburetor parts In general , finalize the optimum cleaning technology and prepare the list and specifications of equipment and materials	BROSOL	1Q
4	Carry out international bidding, including evaluation and commercial negotiations	Prepare bidding documents, invite bids and hold commercial negotiations based on the selected technology, selected equipment and sign the contact(s).	UNIDO	2Q
5	Design modifications of the site and facilities	Engineering design of utilities (water and electricity), piping and civil engineering.	BROSOL	3Q

6	Prepare facilities	Engineering and construction	BROSOL	4Q
7	Acceptance test, installation and commissioning of equipment		BROSOL	4Q
8	Start utilizing new cleaning processes		BROSOL	4Q
9	Evaluate the processes		UNIDO, BROSOL	4Q
10	Evaluate the project		UNIDO	4Q

7. Required Regulatory Actions

No regulatory actions, other than routine permitting, are required to implement this project. Under the existing agreement with the UNDP, equipment and machinery imported as part of this project will be exempt from import duties levied by the Government of Brazil.

8. Results

Direct and Indirect Impacts

The project will eliminate annually 4.8 MT of ODSs (ODP-weighted) at BROSOL . As far as the indirect effect such as transfer of technology to other enterprises in subsequent projects is concerned, this project will have a big impact. The project has been designed to maximize this impact. Particularly, the involvement of PROZON will ensure the successful repetition of ODS phase-out projects in the Brazil engineering industry.

9. Environmental Assessment

Since BROSOL has internal water treatment facilities with sufficient capacity to receive the amount generated by this project, followed by proper internal training and handling procedures, there are no expected negative impact to the environment. One point to be commented is that BROSOL is in an area of extreme consciousness of environmental effect and impacts and thus this effort is part from their basic industrial philosophy.

Annex 1. Breakdown of Investment (Capital) Costs

	Description of cost item	Unit	Unit cost, US$	Qty	Total cost, US$
1	Water based cleaning systems				
1.1	Aqueous cleaning machine with ultrassonics and internal automatic basket transport system (basic tank dimensions of 800mmx600mmx400mm) with one wash, two tap water rinse (with spraying before exit) and double drying stages.	ea	90,000	1	90,000
1.2	Aqueous cleaning machine with spray cleaning/rinsing features (basic tank capacity of 80 liters) with one wash, two tap water rinse and drying stages.	ea	50,000	1	50,000
1.3	Semi-aqueous cleaning machine with ultrassonics and internal basket transport system (basic tank dimensions of 500mmx350mmx300mm) with one emulsion wash, two tap water rinse (with spraying before exit) and improved drying stages.	ea	70,000	1	70,000
2	Plant modifications				
2.1	Exhaust and ventilation equipment and features	ea	1,500	3	4,500
2.2	Electrical and piping modifications and civil work				5,000
3	Miscellaneous				
3.1	Installation, reliability testing, qualification and certification				7,500
3.2	Training				1,000
3.3	Transport (freight and insurance)				21,000
3.4	UNIDO mission				6,000
3.3	Contingency (10%)				25,500
	TOTAL INVESTMENT COSTS				**280,500**

Annex 2. Breakdown of Incremental Operating Costs/Savings

	Description of cost item	Unit	Unit cost, US$	Qty	Pre-project total cost, US$	Post-project total cost, US$
A	Solvent/media costs per year					
A.1	1,1,1 Trichloroethane	kg	2.70	48,000	129,600	
A.2	Alkaline detergent	kg	3.80	12,000		45,600
A.3	Aliphatic hydrocarbon based solvent	kg	9.00	4,000		36,000
	Sub-total				129,600	81,600
B	Electricity					
B.1	Current 5 TCA machines (34 kW, 2 shifts)	kWh	0.07	141,440	9,901	
B.2	New aqueous machine for general machines parts (35 kW 2 shifts)	kWh	0.07	145,600		10,192
B.3	New aqueous machine for combustible pumps (25 kW, 2 shifts)	kWh	0.07	104,000		7,280
B.4	New semi-aqueous machine for internal carburetor parts (20kW, 2 shifts)	kWh	0.07	83,200		5,824
	Sub-total				9,091	23,296
C	Water					
C.1	Water supply (consumed in new process)	m^3	0.10	1,610		161
C.2	Waste water treatment	m^3	1.38	1,610		2,222
	Sub-total					2,383
	TOTAL PRE-PROJECT COSTS/YEAR				**139,501**	
	TOTAL POST-PROJECT COSTS/YEAR					**107,279**
	TOTAL INCREMENTAL SAVINGS PER YEAR					**32,222**
	NPV OF 4 YEARS INCREMENTAL SAVINGS @ 10%/YEAR					**102,139**

Annex 3. Calculation of unit abatement cost and cost efficiency factor

A	ODS phase out		
A1	Average use of 1,1,1 Trichloroethane	Kg	48,000
A2	ODP of 1,1,1-Trichloroethane		0.1
A3	ODP-weighted 1,1,1-Trichloroethane phase out	Kg	4,800
B	Annualized capital costs		
B1	Total investment cost (from annex 1)	US$	280,500
B2	Equipment economic life	Year	10
B3	Discount rate	%	10
B4	Annualized capital cost (10 years @ 10%0	US$	45,650
C	Annual operating savings (from annex 2)	US$	(32,222)
D	Unit abatement cost		
D1	Annualized capital cost per kg ODS phased out	US$/kg	9.51
D2	Annual incremental operating savings per kg ODS phased out	US$/kg	(6.71)
D3	**UNIT ABATEMENT COST (D1 + D2)**	**US$/kg**	**2.80**

E	Proposed MF Grant	US$	178,361
F	ODP-weighted 1,1,1-Trichloroethane phase out	Kg	4,800
G	**COST EFFICIENCY FACTOR (E/F)**	**US$/kg**	**337.16**

Project Proposal for the Multilateral Fund for the Implementation of the Montreal Protocol Financing

Country	**Brazil**	
Project Title	Phase-out of 1,1,1 Trichloroethane at TEPERMAN	
Sector Covered	Solvents	
ODS Use in Sector	650.6 MT (ODP-weighted) of ODS solvents in 1993	
Project Impact	Phase-out annual consumption of 64.4 MT of 1,1,1, Trichloroethane (total 6.4 ODP-weighted MT)	
Project Duration	24 months	
Project Economic Life	10 years	
Total Project Cost	Investment (capital) costs, US$	263,127
	Incremental operating savings, US$	82,600
	Total Project Costs, US$	180,527
Ownership Structure	100 per cent Brazilian	
Proposed MF Financing	US$ 180,527	
Cost Effectiveness	US$ 28.02 per Kg ODP	
Unit Abatement Cost	US$ 2.61 per Kg of phased-out ODS	
Implementing Agency	UNIDO	
Coordinating Ministry	Interministerial Ozone Working Group (PROZON)	

PROJECT SUMMARY

TEPERMAN utilizes 1,1,1 Trichloroethane as a solvent in vapor degreasing of parts and components for auto seats. The complete substitution will be reached with the installation and start up of an aqueous cleaning line.

1. Project Objective

This project aims the complete phase-out of 1,1,1 Trichloroethane in the metal cleaning process of parts and components for auto seats at TEPERMAN. The process that currently uses this ODS will be substituted by an aqueous process. Currently the cleaned parts after inspection will receive a chemical treatment and/or paint coating deposit, with the installation of a complete new line parts will be cleaned in 2 different types of detergents, rinsed and then receive a chemical deposition of paint, therefore no needing any other chemical treatment or conventional painting; this technology is considered to be acceptable achieving quality levels required by the automotive industry.

2. Sector Background

In 1993, the total ODS consumption in Brazil was estimated to be 8,918 ODP tonnes. In the same year, Brazil produced 4,010 tonnes of CFC-11 and 7,483 tonnes of CFC-12, and exported 1,444 tonnes of CFC-11 and 2,793 tonnes of CFC-12. Out of 43,970 tonnes of carbon tetrachloride produced in 1993, 18,770 tonnes were used as feedstock for the production of CFCs, 25,154 tonnes were exported and only 46 tonnes were used as solvent. The distribution of ODP by subsector is given in Exhibit 1. The distribution by ODP-weighted substance is shown in Exhibit 2 and the annual consumption of controlled substances is shown in Exhibit 3. The total consumption of ODS solvents in Brazil in 1993 was 6,174 tonnes or 753 ODP-weighted tonnes. In 1993, it was used 6,000 tonnes of 1,1,1-trichloethane, 46 tonnes of CTC and 128.0 tonnes of CFC-113.

Exhibit 1. Distribution of ODP tonnes by sector

Sector	Aerosol	Foam	Halon	Refrigerator	Solvent
Consumption (tonnes)	255.0	1,950.0	68.0	5,748.0	897.0
Percent of total:	2.95%	21.9%	0.8%	64.5%	7.3%

Exhibit 2. Distribution of ODP by substance

CFCs	Halon	CTC, MCF
91.9%	0.8%	7.3%

Exhibit 3. Consumption of controlled substances (1993)
14,291 metric tonnes
8,918.2 weighted tonnes (ODP)

Sub.	CFC						Halon			Solvents		
(ton)	11	12	113	114	115	Tot.	1211	1301	Tot.	CTC	MCF	Tot.
ODS	2,726	5,338	128	20	22	8,324	6.0	5.0	11.0	46.0	6,000	6,046
ODP	2,726	5,338	102.0	20.0	13.2	8,199	18.0	50.0	68.0	50.6	600.0	650.6

The Government of Brazil is committed to phase-out the consumption of ODS within the shortest period of time, namely 1994 for halons, 2000 for methyl chloroform and 2001 for the other controlled substances.

3. Company Background

TEPERMAN is located in the city of São Paulo, being a 100% private owned Brazilian company. Founded in 1957, this company produces complete seats for vehicles in general, seat parts and interior parts for vehicles. Their productive line is driven to seats for cars, busses, trains, subways, and tractors as well as components like: base and back of polyurethane foam, head support, back of vegetable fibers (coconut), lateral overlay for doors, structures and springs, stamped parts in general. Employing 850 people in two

plants, has sales over US$ 45 MM. Exports represent around 10% of sales value and the major portion is to other Latin American article 5 countries (to non article 5 are less than 5%).

4. Project Description

4.1 Current technology and proposed substitution

All metallic parts and components for seats are currently being vapor degreased in a single sump machine with internal dimensions of 2,200 mm x 0,900 mm x 1,500 mm. Vapor condensation is done through a refrigeration coil with cold water. In order to improve the lay-out and permit the parts flow in the sector where the machine is located al the parts and basket movement is done with a traveling crane.

Today parts are vapor degreased in TCA, after go to several tanks as: a acid solution for metal scouring, two rinses, phosphatization, rinse, pasivation, rinse and dry before final powder paint deposition and thermal cure of paint.

After a long research TEPERMAN decide to adopt a new concept in the complete cleaning/chemical treatment/painting line, this technology is called "AUTOPHORETIC".

After test and final decision to switch, enterprise found that another company (RENNER) bought equipment (made by BOILER and sold for about US$ 650,000) that could be easily adapted to their needs because of the individual tank dimensions and capacity be the same they needed. The original company had just tested the line and the main reason to buy it was withdrawed for business reasons, and therefore the new equipment was useless and placed for sale. TEPERMAN arranged to buy it for US$ 250,000, with first payment of US$ 50,000 already made, with the balance to be paid after final installation that will happen before year end. This is the fact that makes **this project call for retroactive financing.**

The substitution of ODS cleaning technology will be done with a new aqueous cleaning line with equivalent capacity, drying is not in this case a concern in cleaning since the "AUTOPHORETIC" process completely aqueous. To accommodate the new equipment a modification of the existing traveling crane is necessary. The complete description of new process follows in the next paragraphs.

4.2 Reliability testing, qualification and certification

Final reliability testing, process and material qualification and certification will be done to determine and prove to their customers that the whole process is suitable to achieve and outperform the desired and needed cleaning and protecting results, driven by the stringent automotive standards.

4.3 Technology selection

Aqueous cleaning solutions typically are tailored to the requirements of the specific cleaning application. Aqueous cleaners use water as the primary solvent, synthetic detergents and surfactants are combined with special additives such as builders, pH buffers, inhibitors, saponifiers, emulsifiers, etc. The key stages of an aqueous cleaning process are washing, rinsing and drying. Oils, organic films, and greases, inorganic or polar soils can be effectively removed by aqueous chemistry with a properly designed system. The use of ultrasonics measures much more effective in water-based solvents than in 1,1,1 Trichloroethane.

4.3.1 New cleaning/painting line description:

"AUTOPHORETIC" is a new revolutionary system for metal surface treatment. This process is characterized by the auto-deposition, through chemical reactions, of a organic layer over ferrous surfaces, conjugating the pre-treatment with the final finishing, all in one operation. The general advantages of the "AUTOPHORETIC" process are: elimination of steps from the conventional painting process, overall operational costs and occupied area decrease, and non aggression to the environment because it is an process without organic solvents and heavy metals, thus reducing effluent treatment costs.

To use the above mentioned process the following stages and procedures are necessary:

① Alcaline solution heavy degreasing (1 tank):

Degreasing in a tank with a 6% AUTOPHORETIC CLEANER 2860 alkaline detergent solution, during 120 seconds at 80° C, with spray under immersion (18 nozzles with 20 psi). For heavy degreasing, cleaning and removal of oxides.

② Alcalyne solution degreasing (1 spray chamber and 2 tanks)

Degreasing in a tank with a 12.5% AUTOPHORETIC CLEANER 2592 B alkaline detergent solution, during 120 seconds at 80° C, with spray under immersion (18 nozzles with 20 psi). For a better and final degreasing and cleaning required prior to the layer applications by auto-deposition.

③Tap Water Rinsing

③ - Spray rinsing of parts using tap water at room temperature, using 45 nozzles with 20 psi.

③A - Immersion cascade rinsing of parts during 30 seconds using tap water at room temperature.

③B - Immersion cascade rinsing of parts during 30 seconds using tap water at room temperature.

④ DI Water Rinsing (1 tank)

Dynamic immersion rinsing followed by spray before exiting of parts during 30 seconds using DI water at room temperature, using 15 nozzles with 20 psi.

⑤ Organic reactive finishing (1 tank)

Deposition of a coating on the parts by immersion in a DI water solution of AUTOPHORETIC 866, STARTER 300 and OXIDIZER 24 (according to proper concentration indicated by supplier), during 2 minutes at 21° C.

⑥ Spay rinsing (1 tank)

Rinse parts with tap water during 30 seconds at room temperature, using 12 nozzles with 20 psi.

⑦ Rinsing (1 tank)

Dynamic immersion rinsing of parts during 30 seconds using DI water at room temperature.

⑧ Stabilization rinse

Inmersion of parts in a solution of AUTOPHORETIC RR 2150 in DI water at room temperature during 60 seconds.

⑨ Drying (1 stove tunnel)

Final step in order to dry the parts by passing through a stove (drying tunnel) using hot air during 1,800 seconds.

4.3.2 New equipment

The new equipment that was contacted is described bellow:

A) 9 (nine) tanks in carbon steel, individual capacity of 3,000 liters, with pertinent individual accessories.

B) Drying tunnel with 22,300 mm length and accessories.

C) Transport system for parts movement.

D) Gas washing system, to treat gases, fumes and vapors before discharging to atmosphere.

The cleaning and degreasing part of the equipment (object of present project) is composed of 6 tanks out the total of 9. So, TEPERMAN will only request the reimbursement of 67% of total contacted value of US$ 250,00 for equipment. As our focus will consume only 25% of total DI water, the same rate will be applied to DI water generator.

5. Project Costs

Total project costs:

As described below and presented in the relevant annexes, the total project incremental cost is US$ 180,527 . The total project incremental cost was calculated as the economic capital costs plus the net incremental costs for four years discounted at 10 per cent.

Investment (capital) cost (see Annex 1):

As detailed in Annex 1, the total investment cost is US$ 263,127 . Major components of this cost include the reinbursement of spendings, related to the cleaning portion, caused by the contracting of a new aqueous cleaning/chemical paint machine.

Incremental operating costs/savings (see Annex 2):

If the project were not undertaken, the annual operating cost, exclusive of tax, would be US$ 198,964 . If the project is implemented, the annual operating cost will be US$ 172,906 , resulting in an annual operating savings of US$ 26,058 . Given an equipment lifetime of 10 years and a discount rate of 10 per cent, the net present value of the first four years of incremental operating savings is US$ 82,600 . a more detailed breakdown of operating costs is provided in Annex 2.

Revenues:

This project will not provide the company with any incremental revenue.

Local ownership ratio:

A local ownership fraction of 100 per cent was considered to determine the amount of eligible MF grant financing. Since the total project incremental cost should be multiplied by the fraction of local ownership to determine the proposed grant amount, total proposed MF financing is US$ 180,527 .

Contingencies:

As equipment has been already contracted no contingencies have been included in the total investment costs.

Breakdown of total project costs

The breakdown of total project costs is given in Exhibit 4 . Although the economic life of the project is 10 years, the incremental operating costs/savings are calculated for a period of 4 years.

Exhibit 4 . Breakdown of total project costs

Description of cost	10 year period, US$	First four years, US$
Investment (capital) costs	263,127	263,127
NPV of incremental operating savings	160,115	82,600
NPV of incremental operating revenues	0	0
Total costs	103,012	180,527

Proposed MF Grant:

The proposed MF grant for this project is US$ 180,527 and has been calculated by multiplying the total project cost by 100 % local ownership fraction.

Unit Abatement Cost (UAC) and Cost Efficiency Factor:

As shown in Annex 3, the UAC for this project is US$ 2.61 per ODP-weighted kilogram of ODS phased out per year. In the same annex is demonstrated that the cost efficiency factor is US$ 28.02 per ODP-weighted kilogram of ODS phased out in the first year. These numbers are derived from an annualized incremental cost of capital of US$ 263,127 , first year incremental annual operating savings of US$ 26,058 , phasing out 6.4 MT (ODP-weighted) of ODS per year and a total MF grant of US$ 180,527 .

6. Project Implementation

Management

The Interministerial Ozone Working Group (PROZON) will oversee the successful implementation of this project, which will be carried by the enterprise. UNIDO will also provide technical assistance to the project during its implementation.

Procurement

Project procurement will comply with the UNIDO procurement procedures. These are described in the related UNIDO documents.

Disbursements

Fund disbursements will comply with UNIDO financial procedures. These guidelines are described in the related UNIDO documents. The schedule for disbursements will be decided upon at the beginning of project implementation.

Audits

For auditing, UNIDO's project evaluation procedures and project financial management data will be used.

Schedule of activities

The project road map is given in Exhibit 5.

Exhibit 5 . Project road map

	Activity	Description	Responsible	Timing
1	Select technology	Prepare the list and specifications of equipment and materials	TEPERMAN	1995 (done)
2	Carry out reliability and performance tests	Evaluate the effectiveness of alternative products/processes	TEPERMAN	1995 (done)
3	Contract equipment	Prepare bidding documents, invite bids and hold commercial negotiations based on the selected technology, selected equipment and sign the contact(s).	TEPERMAN	1995 (done)
4	Contract modifications and acessories for the equipment	Prepare bidding documents, invite bids and hold commercial negotiationst and sign the contract(s).	TEPERMAN	3Q 96
5	Design modifications of the site and facilities	Engineering design of utilities (water and electricity), piping and civil engineering.	TEPERMAN	3Q 96
6	Prepare facilities	Engineering and construction	TEPERMAN	4Q
7	Acceptance test, installation and commissioning of equipment		TEPERMAN	4Q
8	Start utilizing new cleaning processes		TEPERMAN	4Q
9	Evaluate the processes		UNIDO, TEPERMAN	4Q
10	Evaluate the project		UNIDO	4Q

7. Required Regulatory Actions

No regulatory actions, other than routine permitting, are required to implement this project. Under the existing agreement with the UNDP, equipment and machinery imported as part of this project will be exempt from import duties levied by the Government of Brazil.

8. Results

Direct and indirect impacts

The project will eliminate annually 6.4 MT of ODSs (ODP-weighted) at TEPERMAN . as far as the indirect effect such as transfer of technology to other enterprises in subsequent projects is concerned, this project will have a big impact. The project has

been designed to maximize this impact. Particularly, the involvement of PROZON will ensure the successful repetition of ODS phase-out projects in the Brazil engineering industry.

9. Environmental Assessment

Since the utilization of alkaline detergents will adversely affect the environment, mainly because of some components and additives like surfactants, there is a need to threat all the effluents from this process. The other chemicals used in the process are easily treated (when dissolved in water) with addition of calcium hydroxide and a polymer (JWT 300-508). As TEPERMANN has currently a water treatment facility able to carry (technically and in volume) all the effluent generated during this process (and with certification by local authorities) no extra money was placed in the project.

Annex 1. Breakdown of Investment (Capital) Costs

	Description of cost item	Unit	Unit cost, US$	Qty	Total cost, US$
A	Aqueous batch cleaning machine, 2 tanks for washing and 4 for rinsing, with pumps, heating, spay nozzles and agitators, tank individual capacity of 3,000 liters. (67% of total contacted value)	1	250,000	0.67	166,667
B	Traveling crane modification				17,000
C	Electrical, piping and civil modifications				14,000
D	Exhaust and ventilation				24,000
E	DI water generation system (25% of total cost)	1	85,000	0.25	21,250
F	Installation, testing, qualification and certification				12,700
G	Training				1,500
H	UNIDO mission				6,000
	TOTAL INVESTMENT COSTS				**263,127**

Annex 2. Breakdown of Incremental Operating Costs/Savings

	Description of cost item	Unit	Unit cost, US$	Qty	Pre-project total cost, US$	Post-project total cost, US$
A	Solvent media					
A.1	1,1,1 Triclhoroethane	Kg	2.7	64,430	173,691	
A.2	Alkaline detergent (2 types)	Kg	3.5	29,000		101,500
	Sub-total				173,691	101,500
B	Electricity					
B.1	Current vapor degreaser (40 kW, 18 hours/day, 5 days/week)	kWh	0.11	187,200	20,592	
B.2	New aqueous lyne (95 kW, 18 hours/day, 5 days/week)	kWh	0.11	444,600		48,906
	Sub-total				20,592	48,906
C	Water					
C.1	Current vapor degreaser	m^3	3.1	1,568	4,681	
C.2	New aqueous machine	m^3	3.1	4,500		13,950
C.3	Water treatment	m^3	1.9	4,500		8,550
	Sub-total				4,681	22,500

TOTAL PRE-PROJECT COSTS/YEAR	**198,964**
TOTAL POST-PROJECT COSTS/YEAR	**172,906**
TOTAL INCREMENTAL SAVINGS/YEAR	**26,058**
NPV OF 4 YEARS INCREMENTAL SAVINGS @ 10%/YEAR	**82,600**

Annex 3. Calculation of unit abatement cost and cost efficiency factor

A	ODS phase out		
A1	Average use of 1,1,1 trichloroethane	Kg	64,430
A2	ODP of 1,1,1-trichloroethane		0.1
A3	ODP-weighted 1,1,1-trichloroethane phase out	Kg	6,443
B	Annualized capital costs		
B1	Total investment cost (from annex 1)	US$	263,127
B2	Equipment economic life	Year	10
B3	Discount rate	%	10
B4	Annualized capital cost (10 years @ 10%0	US$	42,823
C	Annual operating savings (from annex 2)	US$	(26,058)
D	Unit abatement cost		
D1	Annualized capital cost per kg ODS phased out	US$/kg	6.65
D2	Annual incremental operating savings per kg ODS phased out	US$/kg	(4.04)
D3	**UNIT ABATEMENT COST (D1 + D2)**	**US$/kg**	**2.61**

E	MF grant	US$	180,527
F	ODP-weighted 1,1,1-trichloroethane phase out	MT	6,443
G	**COST EFFICIENCY FACTOR (E/F)**	**US$/kg**	**28.02**