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PROJECT PROPOSALS: CHINA

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and

Technical Evaluation for China ODS Reduction First Investment Project

PROJECT SUMMARY

COUNTRY:	China
PROJECT TITLE:	Tianjin CFC Conversion to LPG
SECTOR COVERED:	Aerosols
ODS CONSUMPTION IN SECTOR:	9,420 tons CFC-12 in 1991
PROJECT DURATION:	2 years
PROJECT IMPACT:	Phase out 7,080 tons CFC-12
TOTAL PROJECT COST:	$6,855,000
PROPOSED ODS GRANT:	$3,360,000
IMPLEMENTING AGENCY:	Tianjin First Daily Use Chemical Factory
NATIONAL COORDINATING AGENCY:	Ministry of Light Industry

Project Summary

The subproject aims at phasing out CFC consumption in aerosols for the Tianjin area by creating a local supplier of purified LPG, "Hydrocarbon Aerosol Propellants" (HAPs), and by establishing a centralized filling station that will serve both its own products and those of small aerosol producers. Larger enterprises in the area will convert their filling operations to HAPs while smaller manufacturers, representing about 50 percent of CFC use, will discontinue filling operations and contract with the centralized filling station. The Tianjin area accounts for about one-third of CFC consumption in China's aerosol industry.

Project Objectives

The subproject objectives are to: (i) produce locally sufficient quantities of HAPs to replace CFC-12 in aerosols; (ii) demonstrate feasibility of substituting HAPS for CFC-12 in aerosols and use of a centralized filling station for small manufacturers; and (iii) expand project scope to eliminate existing and new uses of CFC-12 in aerosols in the greater Tianjin area.

Sector Background

The aerosol sector is characterized by high growth. 1989 consumption was 2,000 tonnes. This figure jumped to 4,790 in 1990. In 1991, aerosol consumption of CFCs reached 9,410 tonnes or 19 percent of China's ODS consumption. Of this 9,410 tonnes, about 3,300 tonnes were consumed in the Tianjin area. If uncontrolled, consumption is projected to reach 23,500 tonnes or 27 percent of estimated ODS consumption in China in 1996.

Project Description

Conversion of China's rapidly expanding aerosol industry from CFC to LPG propellants is the most commercially proven, cost effective option for rapidly reducing and eliminating CFC use in this sector. About one-third of China's aerosol products are produced in greater Tianjin. Most of these manufacturers are within fifty kilometers of Tianjin. No manufacturers are more then 150 kilometers away. For this subproject, the Tianjin First Daily Use Chemical Factory, a state enterprise, will establish a LPG purification plant and a centralized filling station. The availability of HAPs and a central filling station in Tianjin will lead to the elimination of one-third of China's CFC use in aerosols or about 7,000 tonnesper year in 1995.

The Tianjin Factory's development of an LPG purification plant and an HAPs centralized filling station will allow the immediate replacement of CFCs by both small and large manufacturers in the Tianjin area. Small manufacturers, for which it is not cost effective to install safety equipment needed to handle filling of flammable propellants, will discontinue their CFC filling operations and contract with the Tianjin Factory to fill its cans. Use of HAPs is expected to reduce aerosol production costs by 2-8 percent. A portion of this cost savings will be passed on to small manufacturers to encourage conversion to HAPs and to offset transportation costs to the Tianjin filling station. Larger manufacturers will convert their filling lines for use with HAPs which they will purchase from the Tianjin Factory. Imported HAPs can be used by the filling station and large manufacturers until the purification plant is on line.

This subproject includes four activities to ensure the successful development and operation of the purification plant and filling station: (i) establishment of a quality assurance laboratory, (ii) development of a safety monitoring program for the filling and purification plants, (iii) overseas and local training programs in handling of flammable products, product reformulation and use of other propellant alternatives; and (iv) lab tests and trial runs.

Project Costs

Incremental Costs	Project Costs		
	Local	Foreign	Total
to be calculated	$3,495,000	$3,360,000	$6,855,000

Financial and Economic Analysis (to be added in preappraisal mission)

[FRR and ERR of project
Financial and economic viability of enterprise
Calculation of ODS phase out incremental cost
Unit Abatement Cost:]

Financing Plan (to be added during preappraisal mission)

[Including all sources of financing, amount of grant funding (and how determined), terms and conditions of all financing.]

Project Implementation

The Ministry of Light Industry will be responsible for overseeing the successful completion of this subproject. It will be executed by the Tianjin First Daily Use Chemical Factory. The Engineering Institute of Tianjin Light Industry Bureau will provide engineering and design services for this subproject.

Quarter	Q0	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
Design and equipment procurement	xxxxxxxxxxxx								
Construction			xxxxxxxxxxxx						
Installation					xxxxxxxxxxxx				

[procurement, disbursements and audits. to be added]

Results

This project will remove 7,080 tonnes of CFC-12 in 1995 or the first year of full operation. This project employs cost effective, commercially available technology in a rapidly growing CFC use sector. Previous country study investigations have identified this as a high priority phase-out project. The China CP is under preparation and is scheduled to be completed by end September 1992.

PROJECT SUMMARY

COUNTRY:	China
PROJECT TITLE:	Shanghai CFC Conversion to LPG
SECTOR COVERED:	Aerosols
ODS CONSUMPTION IN SECTOR:	9,420 tons CFC-12 in 1991
PROJECT DURATION:	2 years
PROJECT IMPACT:	Phase out 7,880 tons CFC-12
TOTAL PROJECT COST:	$5,209,000
PROPOSED ODS GRANT:	$3,440,000
IMPLEMENTING AGENCY:	Shanghai Daily Chemical Corporation
NATIONAL COORDINATING AGENCY:	Ministry of Light Industry

Project Summary

The subproject aims at phasing out CFC consumption in aerosols for the Shanghai area by creating a local supplier of purified LPG, "Hydrocarbon Aerosol Propellants" (HAPs), and by establishing a centralized filling station that will serve its own products and those of small aerosol producers. Larger enterprises will convert their filling operations to HAPs while smaller manufacturers, representing about 50 percent of CFC use, will discontinue filling operations and contract with the centralized filling station. The Shanghai area accounts for about one-third of CFC consumption in China's aerosol industry.

Project Objectives

The subproject objectives are to: (i) produce locally sufficient quantities of HAPs to replace CFC-12 in aerosols; (ii) demonstrate feasibility of substituting HAPS for CFC-12 in aerosols and use of centralized filling stations for small manufacturers; and (iii) expand project scope to eliminate existing and new uses of CFC-12 in aerosols in the greater Shangai area.

Sector Background

The aerosol sector is characterized by high growth. 1989 consumption was 2,000 tonnes. This figure jumped to 4,790 in 1990. In 1991, aerosol consumption of CFCs reached 9,410

tonnes or 19 percent of China's ODS consumption. Of this 9,410 tonnes, about 2,300 tonnes were consumed in the Shanghai area. If uncontrolled, consumption is projected to reach 23,500 tonnes or 27 percent of estimated ODS consumption in China in 1996.

Project Description

Conversion of China's rapidly expanding aerosol industry from CFC to LPG propellants is the most proven, cost effective option for rapidly reducing and eliminating CFC use in this sector. About one-third of China's aerosol products are produced in and around Shanghai. Most are manufactured within fifty kilometers of Shanghai's business center. No manufacturers are more than 200 kilometers outside Shanghai. For this subproject, the Shanghai Daily Chemical Corporation, a state enterprise, will establish a LPG purification plant and a centralized filling station. The availability of HAPS and a central filling station in Shanghai will lead to the elimination of one-third of China's CFC use in aerosols or about 5,700 tonnes in 1995. In 1996, this could increase to 7,880 as the majority of manufacturers in Fujian begin to use the Shanghai filling station.

The Shanghai Corporation's development of an LPG purification plant and an HAPs centralized filling station will allow for the immediate replacement of CFCs by both small and large manufacturers in the Shanghai area. Small manufacturers, for which it is not cost effective to install safety equipment needed to handle filling of flammable propellants, will discontinue their CFC filling operations and contract with the Shanghai Corporation to fill its cans. HAPs are typically four times cheaper than CFCs by weight. A portion of this cost savings will be passed on to small manufacturers to encourage conversion to HAPs and to offset transportation costs to the Shanghai filling station. Larger manufacturers will convert their filling lines for use with HAPs which they will purchase from the Shanghai Corporation. Imported HAPs can be used by the filling station and large manufacturers until the purification plant is on line.

This subproject includes four activities to ensure the successful development and operation of the purification plant and filling station: (i) establishment of a quality assurance laboratory, (ii) development of a safety monitoring program for the filling and purification plants, (iii) overseas and local training programs in handling of flammable products, product reformulation and use of other propellant alternatives; and (iv) lab tests and trial runs.

Project Costs

Incremental Costs	Project Costs		
	Local	Foreign	Total
to be added	$1,769,000	$3,440,000	$5,209,000

Financial and Economic Analysis (to be added in preappraisal mission)

[FRR and ERR of project
Financial and economic viability of enterprise
Calculation of ODS phase out incremental cost

Unit Abatement Cost:]

Financing Plan (to be added during preappraisal mission)

[Including all sources of financing, amount of grant funding (and how determined), terms and conditions of all financing.]

Project Implementation

The Ministry of Light Industry will be responsible for overseeing the successful completion of this subproject. It will be executed by the Shanghai Daily Chemical Corporation. The Engineering Institute of Shanghai Light Industry Bureau will provide engineering and design services for this subproject.

Quarter	Q0	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
Design and equipment procurement	xxxxxxxxxxxx								
Construction			xxxxxxxxxxxx						
Installation					xxxxxxxxxxxx				

[procurement, disbursements and audits. ,to be added]

Results

This project will remove 5,700 tonnes of CFC-12 in 1995 or the first year of full operation. In 1996 CFC removal could increase to 7,880 tonnes as the majority of manufacturers in Fujian begin to use the Shanghai filling station. This project employs cost effective commercially available technology in a rapidly growing CFC use sector. Previous country study investigations have identified this as a high priority phase-out project. The China CP is under preparation and is scheduled to be completed by end September 1992.

PROJECT SUMMARY

COUNTRY:	China
PROJECT TITLE:	Beijing ABC Powder Production
SECTOR COVERED:	Fire Protection (halon)
ODS CONSUMPTION IN SECTOR:	4,400 tons Halon 1211 and 660 tons Halon 1301 in 1991
CONSUMPTION WEIGHTED WITH ODP VALUE:	17,600 weighted tons Halon 1211 and 10,600 weighted tons Halon 1301 IN 1991
PROJECT DURATION:	1 year
PROJECT IMPACT:	Phase out 500 tons Halon 1211 (2,000 weighted tons)
TOTAL PROJECT COST:	$615,000
PROPOSED ODS GRANT:	$500,000
IMPLEMENTING AGENCY:	Beijing Fire Protection Equipment Factory
NATIONAL COORDINATING AGENCY:	The Ministry of Public Security

Project Summary

This project WILL develop 3,000 tons of ammophos dry powder chemical (ABC powder) production capacity in China and increase production of sodium acid carbonate dry powder (BC powder) by 1000 tons. These two types of dry powder are effective halon substitutes on a weight for weight basis for many applications in which halons are commonly applied in China. Chinese production of ammophos dry powder, a basic fire fighting agent in industrialized countries, is very limited because China lacks appropriate production technology. Quality is unstable and the price is forbidding. Lacking such basic fire fighting agents as ABC powder, China has resorted to halons for many applications that could be protected with non-halon agents or other fire protection measures. By importing modern ammophos dry powder technology, the Beijing Fire Protection Equipment Factory will be able to produce a high quality agent at a reasonable cost. With the assistance of the central fire protection bureau under the Ministry of Public Security (MPS), the ABC and BC powders will be channeled to applications where halons were previously applied.

Project Objectives

The objectives of this subproject are to: (i) successfully transfer the technology to manufacture 3,000 tons annually of ammophos dry powder chemical to China; (2) increase production of sodium acid carbonate dry powder by 1,000 tons; and (3) ensure that new powder production is used to replace halons in new extinguishers and other applications.

Sector Background

China's halon consumption continues to pose the greatest threat to the ozone layer if the weighted ODP value of the ODS consumed in China is considered. With the availability of local Halon 1211 supplies, its use grew rapidly in the late 1980's. Due to China's recent recession, use remained stable at between 4,000 and 5,000 tonnes between 1989-91 (16,000 to 20,000 tonnes if weighted with and ODP value of four). About seventy percent, 3,100 tons, of Halon 1211 consumption went to fill new fire extinguishers in 1991. 130 tons were used to fill fixed systems and the remainder was used for testing and to service existing equipment. If uncontrolled, use is expected to increase at an annual rate of 10 percent in the future, however, as China's economy re-heats.

Halon 1301 use is harder to quantify. Most Halon 1301, which is used exclusively in fixed systems, is imported into China as part of fire protection systems. These systems often enter China as part of foreign investment projects and do not require MPS approval. Domestic production is only about 20-30 tons annually.

Halons are perhaps the strongest candidate for early reduction efforts and the Chinese government has made halon reductions a high priority. Not only do halons pose the greatest threat to the ozone, but they are mostly used in applications for which alternatives are well known. Moreover, up to 20 percent of installed halons leak annually.

Project Description

For this subproject the Beijing Fire Protection Equipment Factory will import technology to manufacture ammophos dry powder and will expand its production of sodium acid carbonate powder. The Ministry of Public Security will adopt measures to channel new supplies of these two powders to applications that used halons in the past. The Beijing Factory will import a package of technology including manufacturing process techniques, major production equipment (i.e., grinding machines, weighing and transferring systems, mixing and drying equipment, and screening and packaging systems), and training of Chinese technicians in installation, production, and maintenance practices. The Beijing Factory is in contact with three potential ammophos dry chemical suppliers, Ansul (USA), Asahi Glass (Japan), and Totalit (Germany) to determine which foreign company can provide a technology package that best suits the project's requirements.

Beijing Factory engineers will install the ammophos powder production capacity at a

building site they have already equipped with appropriate test instruments [this should be confirmed]. Beijing Factory engineers and technicians are well qualified to engage in ammophos powder production. They developed and installed the sodium acid carbonate production system currently in operation at the plant and they have also done preliminary research in the development of ammophos powder production. China has abundant production of industrial ammophos, the primary component in ammophos dry powder. Quality of domestic industrial ammophos is expected to improve and the price is high, but is dropping. [effect of price and quality of ammophos on project success should be investigated]

Project Costs (to be confirmed)

Incremental Costs	Project Costs		
	Local	Foreign	Total
	$115,000	$500,000	$615,000

Financial and Economic Analysis (to be determined in appraisal)

FRR and ERR of project
Financial and economic viability of enterprise
Calculation of ODS phase out incremental cost
Calculation of unit abatement cost

Financing Plan (to be determined in appraisal)

Including all sources of financing, amount of grant funding (and how determined), terms and conditions of all financing

Project Implementation

MPS will oversee successful implementation of this subproject. The Beijing Fire Equipment Factory and the selected foreign supplier will be responsible for the transfer of ammophos dry powder production technology to the Beijing Factory. The Beijing Factory will execute the expansion of its sodium acid carbonate powder production. MPS will ensure that new powder production will be channeled to appropriate uses for which halons were applied in the past.

Transfer of Ammophos Dry Powder Production Technology Time Schedule

	Q0	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
Investigation & negotiation	xxxxx								
Design & equipment procurement		xxxxx							
Training		xxxxx							
Installation			xxxxxxxxxx						
Test Runs				xxxxx					
Full scale production					xx→				

[implementation, schedules, procurement, disbursements and audits. to be determined]

Results

This project will remove 2,000 ODP weighted tons of ODS (500 tonnes of Halon 1211) in 1994 or the first year of full operation. This project employs cost effective commercially available technology as a halon replacement in one of China's largest ODS consuming sectors when the ODP weighted value is considered. China CP is under preparation and is scheduled to be completed by end September 1992.

PROJECT SUMMARY

COUNTRY: China

PROJECT TITLE: Zhejiang Halon Extinguisher Conversion

SECTOR COVERED: Fire Protection (halon)

ODS CONSUMPTION IN SECTOR: 4,400 tons Halon 1211 and 660 tons Halon 1301 in 1991

CONSUMPTION WEIGHTED WITH ODP VALUE: 17,600 weighted ODP tons (Halon 1211) and 10,600 weighted ODP tons (Halon 1301)

PROJECT DURATION: 1 year 6 months

PROJECT IMPACT: Phase out 500 tons Halon 1211 (2,000 tons ODP)

TOTAL PROJECT COST: $1,215,000

PROPOSED ODS GRANT: $ 720,000 (to be confirmed)

IMPLEMENTING AGENCY: Zhejiang Fire-Fighting Equipment Factory

NATIONAL COORDINATING AGENCY: Ministry of Public Security

Project Summary

This subproject will phase-out halon use at China's largest halon extinguisher manufacturer, the Zhejiang Fire-Fighting Equipment Factory, by converting its extinguisher lines to production of ABC dry chemical and light-water foam extinguishers and by converting its halon fixed system to production of CO_2 fire protection and water sprinkler system production. Halon has been the preferred agent in China, because its hazards were unknown and because it leaves no residue, it has been perceived as the most modern and therefore the most desirable extinguishing agent. However, many non-halon alternatives exist for applications in which halons are commonly applied in China. In certain applications, ABC powder is more effective than halons on a weight for weight basis. Light foam is superior to halon in extinguishing class A fires and can also be applied to class B fires. In addition, Water and CO_2 systems can be used instead of halon systems for certain applications in which halon systems are currently employed. Conversion of this factory will coincide with education campaigns encouraging the use of non-halon alternatives for appropriate applications. Production capacity at the Zhejiang Factory will be increased from 100,000 extinguishers to 250,000 extinguishers to maintain factory revenue. MPS expects that conversion of this prominent halon extinguisher factory will motivate other halon extinguisher manufacturers to follow its model. This project will directly

reduce consumption of Halon 1211 by 500 tons.

Project Objectives

The objectives of this subproject are to: (i) convert the halon fire extinguisher production line at the Zhejiang Factory to production of ABC dry chemical and light foam extinguishers; (ii) expand the plant's extinguisher capacity from 100,000 units to 250,000 units; and (iii) convert fixed halon system production to CO_2 and water fire protection systems by developing design and manufacturing capabilities at the plant.

Sector Background

China's halon consumption continues to pose the greatest threat to the ozone layer if the weighted ODP value of the ODS consumed in China is considered. With the availability of local suppliers, Halon 1211 use grew rapidly in the late 1980's. Due to China's recent recession, use remained stable at between 4,000 and 5,000 tonnes between 1989-91 (16,000 to 20,000 tonnes if weighted with and ODP value of four). About seventy percent, 3,100 tons, of Halon 1211 consumption went to fill new fire extinguishers in 1991. 130 tons were used to fill fixed systems and the remainder was used for testing and to service existing equipment. If uncontrolled, use is expected to increase at an annual rate of 10 percent in the future, however, as China's economy grows. Most Halon 1301, which is used exclusively in fixed systems, is imported into China as part of fire protection systems. These systems often enter China as part of foreign investment projects and do not require MPS approval. Domestic production is only about 20-30 tons annually. About 20 percent of installed halons leak annually. Halons are mostly used in applications for which alternatives are well known and are a strong candidate for early reduction action.

Project Description

The Zhejiang Fire-Fighting Equipment Factory plans to convert its halon extinguisher production line to the production of ABC dry powder and light foam extinguishers. In addition, the factory plans to develop CO_2 and water system design and production capabilities. The Zhejiang factory is already proficient in ABC dry powder extinguisher production and produces 30,000 units annually. However, to convert the halon line and scale up production to 250,000 units, the factory will acquire some additional production and testing equipment including, a new assembly line, powder filling equipment, pressure and leak testing equipment, a siphon valve assembly machine and other items.

Some equipment used to produce ABC extinguishers can be used in the production of light-water foam units. Additional technology requirements for light-water foam extinguisher production include light-water foam agent testing and corrosion resistance for the internal walls of cylinders. The technology to protect cylinder walls will be imported from abroad.

The plant's halon fixed system production line will require few modifications as the components of fixed CO_2 fire protection systems are similar to those use to build halon systems However, because the CO_2 systems operate under higher pressures, the factory will acquire some

additional testing and manufacturing equipment including, a boost pump for filling CO_2, a pressure test pump for CO_2 canisters, and a CO_2 leak detector (??).

Zhejiang Factory engineers have been developing water sprinkler design and production capabilities at the plant since 1990. The factory intends to manufacture sprinklers and valves on site. It will sub-contract the production of other components. Systems will be assembled and tested at the Zhejiang plant. To produce sprinklers the factory will procure a precision casting line and construct a new building. To test water sprinklers in accordance with the GB5135 standard, the factory will acquire a test facility including water tank and pump.

Project Costs

Incremental Costs	Project Costs		
	Local	Foreign	Total
to be determined	$495,000	$720,000	$1,215,000

Financial and Economic Analysis (to be completed in appraisal)

FRR and ERR of project
Financial and economic viability of enterprise
Calculation of ODS phase out incremental cost
Calculation of unit abatement cost

Financing Plan (to be completed in appraisal)

Including all sources of financing, amount of grant funding (and how determined), terms and conditions of all financing

Project Implementation

The Ministry of Public Security (MPS) will oversee the completion of this subproject. The Zhejiang Fire-Fighting Equipment Factory will execute the phase-out of halons in its production of extinguishers and fixed systems. Three departments, the Fire Institute, the Production Department and the Equipment Department will be involved in the project. MPS will be responsible for education campaigns to promote the use and non-halon alternatives and will also control the use of halons in applications for which effective alternatives are available.

Conversion of Halon Line to ABC Extinguisher Production

TASK	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
Procure general equipment	xxxx	xxxx	xxxx	xx				
Design and build special equipment	xxxx	xxxx	xxxx	xx				
Design and make testing and inspection systems	xxxx	xxxx	xxx					
Install equipment, do trail runs and train staff					xxxx	xxxx	xxxx	xx
Check and adjust testing and inspection systems						x	xxxx	xx

Conversion of Halon Line to Light-Water Foam Extinguisher Production

TASK	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
Design production line	xxxx	xxxx						
Design technology		x	xxxx	xx				
Design and make tools			xx	xxxx	xxxx	x		
Identify foreign supplier, negotiate and procure special equipment	x	xxxx	xxxx	xxxx	xx			
Install special equipment, test and train staff					x	xxx		
Conduct trail runs and make adjustments						xxxx	xxxx	xxx

Conversion of Halon Line to CO_2 System Production

TASK	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
Procure general equipment and test instruments	xx	xxxx	xxx					
Design technology	x	xxxx	xxxx					
Design and make tools			xx	xxxx	xxxx	x		
Install and test equipment and test instruments			x	xxx				
Train staff				x	xxx			
Conduct trail runs and make adjustments				x	xxxx	xxxx	xxxx	

Conversion of Halon Line to Sprinkler System Production

TASK	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8

[implementation, schedules, procurement, disbursements and audits to be completed in appraisal.]

Results

This project will remove 2,000 ODP weighted tons of ODS (500 tonnes of Halon 1211) in 1994 or the first year of full operation. This project employs cost effective commercially available technologies as halon replacement in one of China's largest ODS consuming sectors when the ODP weighted value is considered. China CP is under preparation and is scheduled to be completed by end September 1992.

PROJECT SUMMARY

COUNTRY:	China
PROJECT TITLE:	Fifty Percent Reduced CFC Foam
SECTOR COVERED:	Rigid Foam
ODS CONSUMPTION IN SECTOR:	16,500 tons CFC-11 in 1991
CONSUMPTION WEIGHTED WITH ODP VALUE:	16,500 weighted ODP tons CFC-11
PROJECT DURATION:	2 years
PROJECT IMPACT:	Phase out 2,200 tons CFC-11 (2,200 tons ODP)
TOTAL PROJECT COST:	$4,320,000 (to be confirmed)
PROPOSED ODS GRANT:	$4,316,000 (to be confirmed)
IMPLEMENTING AGENCIES:	Yantai Synthetic Plastic Factory Liming Research Institute 510 Research Institute of MAA Wuxi Foam Material Factory Tianjin PU Plastic Factory Wuxi City Foam Material Factory Shanghai No. 6 Plastic Factory Shen Yan Petrochemical Plant Four refrigerator factories Three panel factories Beijing Household Electric Appliances Research Institute
NATIONAL COORDINATING AGENCY:	Ministry of Light Industry

Project Summary

This subproject will demonstrate the applicability of 50% reduced foam technology in certain PU foam insulation applications by converting seven refrigerator and three panel manufacturers. In addition the project will adapt several domestic polyol suppliers and China's only MDI producer to production of materials compatible with the reduced CFC formulation. The reduced CFC foam formulation will be phased-in at the seven manufacturers over two years resulting in a phase-out of 2,200 tons of CFC-11. Reduced CFC foam formulations have been applied commercially in Europe and other areas as short-

term CFC reduction measures.

Project Objectives

The objectives of the subproject are to: (i) adopt a reduced CFC foam formulation at three typical panel factories and four representative refrigerator manufacturers to demonstrate the applicability of wide-spread adoption of low CFC formulations as an interim CFC phase-out measure for China's rigid PU insulation applications; (ii) convert four domestic polyol manufacturers to production of a polyol compatible with the reduced CFC formulation; (iii) up-grade China's MDI manufacturer to production of a material suitable for use with the reduced CFC formulation; and (iv) establish technical evaluation and support centers to assist factories and promote new technology.

Sector Background

Consumption of CFC-11 in rigid PU insulation applications was about 16,500 tonnes in 1991. Half of consumption went to rigid PU panel production, thirty percent to household refrigerators, ten percent to other refrigeration equipment, six percent for in-situ spraying and four percent to pipe sleeves. (Pipe sleeve use may be underestimated. The largest consumer of pipe insulation is the China National Petroleum Corporation (CNPC). CNPC was, however, not interviewed for this report.) MLI predicts that consumption of CFC-11 in household refrigerators will show the highest growth in the rigid PU sector. Consumption is expected to grow at 12 percent annually to reach 8,500 tonnes in 1996. Consumption of CFC-11 in other refrigeration equipment, according to MOC, will reach 2,200 tonnes of CFC-11 in 1996. According to MLI's growth scenario, consumption of CFC-11 in 1996 for panels, in-situ spraying and pipes will be 11,200, 1,400 and 1,000, respectively.

Project Description

Use of reduced CFC foam formulation is impeded by a lack of domestic raw material suppliers, concerns about long-term foam stability and by higher price. This subproject will overcome these barriers by demonstrating the new technology at several manufacturers and by converting domestic materials producers to production of compatible materials.

The Liming Research Institute and the 510 Research Institute of MAA have developed polyols compatible with reduced CFC foam. As one component of this subproject, these institutes will be involved in the transfer their new polyol technology to the Tianjin PU Plastic Factory, Wuxi City Foam Material Factory, Shanghai No.6 Plastic Products Factory, and the Shen Yan Petrochemical Plant. About 75 percent of the polyether polyols used in China are produced locally, however none of these producers can yet produce a polyol compatible with a 50 percent reduced CFC formula.

The second subproject component, the Yantai Synthetic Plastic Factory, will up-grade its MDI production facilities and techniques to manufacture materials compatible with reduced CFC foam formulation. The MDI produced at China's sole producer has a high acid and hydrolysis chlorine content that may create special problems when the MDI is used

in conjunction with reduced CFC foam formulations.

Four refrigerator plants and three panel manufacturers will be selected to adopt the reduced foam formulation as demonstrations. Conversion will include trail runs to optimize the formula and blowing technique, batch production and full scale conversion. Factories will use domestic raw materials to demonstrate their performance. The new foam formulation will be used with existing foam blowing equipment.

China's National Testing Center, the Beijing Household Electric Appliances Research Institute (BHEARI), will serve as a testing, evaluation and promotion center for reduced CFC technology. ICI has equipped the center with foam testing and demonstration equipment. This project will provide further technical training to BHEARI engineers and supplementary equipment as required. The center will conduct performance tests to ensure product quality, set appropriate standards, provided technical assistance to factories and promote results among all refrigerator manufacturers.

Project Costs (to be confirmed in appraisal)

Project Component	Incremental Costs	Project Costs		
		Local	Foreign	Total
Liming			$515,000	$513,000
510			$300,000	$300,000
Yantai			$800,000	$800,000
Tianjin			$100,000	$100,000
Wuxi			$230,000	$230,000
Shanghai			$400,000	$400,000
Shen Yan			$100,000	$100,000
Refrig-4			$700,000	$700,000
Panel-3			$525,000	$525,000
BHEARI			$650,000	$648,000

Financial and Economic Analysis (to be completed in appraisal)

[FRR and ERR of project
Financial and economic viability of enterprise

Calculation of ODS phase out incremental cost

Unit Abatement Cost:]

Financing Plan (to be determined in appraisal)

[Including all sources of financing, amount of grant funding (and how determined), terms and conditions of all financing.]

Project Implementation

This subproject will be coordinated by the Ministry of Light Industry (MLI). Fifteen factories and institutes from five ministries, MLI, the Ministry of Aerospace and Aeronautics (MAA), the Ministry of Chemical Industry (MCI), the Ministry of Commerce (MOC), and the Ministry of Machines and Electronics Industry (MMEI)), will participate this subproject. The ministry responsible for the institutes and factories falling under its jurisdiction will oversee their activities.

The Liming Research Institute and the 501 Research Institute of MAA will transfer their low CFC compatible polyol technology to four polyol manufacturers

[names of refrigerator and panel manufactures and who will supply with chemical]

[time schedule including time required to resolve time effect issue]

[procurement, disbursements and audits. to be completed in appraisal]

Results

This project will remove 2,200 tons of CFC-11 in 1994, or at the end of the second year of project implementation. This project employs commercially available technology in a China's largest CFC use sector. Previous country study investigations have identified this as a high priority phase-out project.

PROJECT SUMMARY

COUNTRY:	China
PROJECT TITLE:	Zhejiang Conversion to Butane
SECTOR COVERED:	Polystyrene & Polyethylene Extruded Foam
ODS CONSUMPTION IN SECTOR:	2,400 tons CFC-12 in 1991
PROJECT DURATION:	2 years
PROJECT IMPACT:	Phase out 500 tons CFC-12
TOTAL PROJECT COST:	$1.910,000
PROPOSED ODS GRANT:	$ 960,000 (to be confirmed)
IMPLEMENTING AGENCY:	Zhejiang Plastics Pilot Plant
NATIONAL COORDINATING AGENCY:	Ministry of Light Industry

Project Summary

The subproject will phase out CFC consumption at the Zhejiang Plastics Pilot Plant by replacing CFC-12 with butane in its PS/PE extruded foam sheet operations. Butane technology is well non-known and is used commercially in Korea and Europe. The Zhejiang plant will adopt a safety program to control potential hazards of using a flammable blowing agent. Butane technology is appropriate for about half of China's PS/PE operations. The Zhejiang conversion will phase-out about 20 percent of CFCs used in PS/PE applications and will demonstrate the applicability of butane technology as a CFC-12 replacement for China's PS/PE industry. Factories that are located in densely populated areas, or that are involved in other types of production that would present a hazard if butane were incorporated into factory operations, about half of China's producers, will have to wait for the development of other replacements.

Project Objectives

The subproject objectives are to replace CFC-12 with butane for the PS/PE extruded foam sheet application at the Zhejiang Plastics Pilot Plant and to demonstrate the applicability of using butane in other Chinese PS/PE applications.

Sector Background

China's PS/PE industries have grown up very rapidly to meet packaging needs for food, instruments, household appliances and handicrafts. Consumption reached 2,400 tons in 1991.

In that year, China's 30 imported production lines were operating at two-thirds capacity. Consumption is expected to rise to 3,000 tons in 1993 AND to over 4,000 tons in 1996.

Project Description

The Zhejiang Plastic Pilot Plant will cooperate with a foreign supplier to convert its PS/PE extruded sheet foam operations to the use of butane as its blowing agent (a Korean firm has been cooperating with Zhejiang to develop this project). To date, butane is the only commercialized substitute available to phase-out CFC-12 in PS/PE extruded sheet foaming applications. Because butane, a flammable substance, is being used to replace a non-flammable agent, the Zhejiang plant will adopt special measures to ensure plant safety. This subproject includes plant design, equipment procurement, development of a safety program, trail runs and full scale operations. Training in chemical handling and safe practices will be conducted on site at plant that has been converted to butane with follow-up sessions in China at the Zhejiang plant.

Project Costs (to be confirmed)

Incremental Costs	Project Costs		
	Local	Foreign	Total
	$950,000	$960,000	$1,910,000

Financial and Economic Analysis (to be completed in appraisal)

FRR and ERR of project
Financial and economic viability of enterprise
Calculation of ODS phase out incremental cost
Calculation of unit abatement cost

Financing Plan (to be completed in appraisal)

Project Implementation (to be completed in appraisal)

The Ministry of Light Industry will be responsible for overseeing the completion of this project. It will be executed by the Zhejiang Plastics Pilot Plant. [implementation, schedules, procurement, disbursements and audits. to be added]

Results

This project will remove 500 tonnes of CFC-12 in 1994, or the first year of full operation. This project employs cost effective commercially available technology in a rapidly growing CFC use sector. The China CP is under preparation and is scheduled to be completed by end September 1992.

PROJECT SUMMARY

COUNTRY:	China
PROJECT TITLE:	Dalian Precision Parts Aqueous Cleaning Line
SECTOR COVERED:	Electronics and Metal Cleaning
ODS CONSUMPTION IN SECTOR:	1,300 tons CFC-113 and 600 tons methylchloroform in 1991
CONSUMPTION WEIGHTED WITH ODP VALUE:	1,400 weighted tons of CFC-113 60 weighted tons of methylchloroform
PROJECT DURATION:	2 years
PROJECT IMPACT:	Phase-out 130 tons of CFC-113 (140 tons ODP)
TOTAL PROJECT COST:	$580,000
PROPOSED ODS GRANT:	$450,000
IMPLEMENTING AGENCY:	Dalian Picture Tube Factory
NATIONAL COORDINATING AGENCY:	The Ministry of Machines and Electronic Industry

Project Summary

This subproject aims to demonstrate the feasibility of a non-CFC process for "electronic gun" cleaning by converting the country's largest precision metal parts producer, Dalian Picture Tube Factory, to an aqueous or other appropriate non-CFC cleaning system. The Dalian factory will first work with ICOLP, and its production line and cleaning system suppliers, Matsushita and Toshiba, to identify an appropriate non-CFC cleaning system. After verifying the substitute technology at the No. 2 Electronics Cleaning Process Research Institute of MMEI, the Dalian factory will procure and install the new system as a demonstration project for other precision metal parts producers in China. There are about 10 picture tube and oscilloscope manufacturers in China and an additional 10 producers of large electrical instruments. The Dalian factory was selected as a demonstration site because "electronic guns" require the most thorough cleaning of all precision metal parts that are manufactured in China. The Dalian factory is also one of the largest CFC-113 consumers.

The China Electronics Engineering Design Institute of the Ministry of Machines and Electronics Industry (MMEI) is responsible for overall planning and execution of the phase-out

of ODS in China's electronics industries. The Institute expects that the Dalian factory demonstration project will lead to the rapid conversion of other precision metal parts producers at minimal cost of $20,000 of MP funds per plant.

Project Objectives

The objectives of this subproject are to: (i) identify appropriate non-CFC cleaning system for "electronic gun" parts production; (ii) demonstrate the feasibility of the non-CFC cleaning system by convert the Dalian Picture Tube Factory to its use; (iii) promote the new system among other precision metal parts manufacturers in China.

Sector Background

China's electronics industry is nascent but expanding rapidly. Consuming 1,200 tons of CFC-113 in 1991, electronics and metal parts cleaning is one of China's smallest ODS use sectors. The rapid growth expected in the sector, however, merits special attention. Cost effective non-CFC cleaning processes are commercially available., but these substitute technologies are unknown in China. If chlorinated solvent growth is unrestricted, MMEI predicts that CFC-113 use will climb to 3,400 tons in 1996 and methylchloroform use will reach 1,600 tons.

Project Description

For this subproject the Dalian Picture Tube Factory will work with ICOLP and the suppliers of its picture tube production lines, Toshiba and Matsushita, to identify an appropriate non-CFC cleaning system for its "electronic gun" production. The Dalian factory will also work with the No. 2 Electronics Cleaning Process Research Institute of MMEI to identify appropriate alternative technology by testing and appraising various cleaning options. After a suitable substitute cleaning system has been identified and the technology verified, the Dalian Factory will be used as a demonstration site for the new non-CFC system. Dalian will use the new technology to replace its CFC-113 system reducing CFC-113 consumption by 130 tons annually.

After the new technology is installed and operating at Dalian, the China Electronics Engineering Design Institute will oversee the transfer of the non-CFC cleaning technology to China's 20 other precision metal parts manufacturers. This transfer will include the training of engineers and technicians of the other plants and reproduction of the new cleaning system. Finally, the new cleaning technology will be transferred to China's 200 electro-vacuum and semiconductor components manufacturers. The conversion of subsequent factories will require $20,000 in MP funds per factory.

The Dalian factory together with the No. 2 and No. 46 research institutes have already collected technical information related to cleaning processes for "electronic guns". The factory has also engaged in some preliminary experimental work. Preliminary investigations by Dalian indicate that a water spraying process employing both a surface active agent and DI water will be a more effective replacement for "electronic gun" cleaning than use of a surface active agent or DI water.

Project Costs

Incremental Costs	Project Costs		
	Local	Foreign	Total
	$130,000	$450,000	$580,000

Financial and Economic Analysis (to be added in preappraisal mission)

FRR and ERR of project
Financial and economic viability of enterprise
Calculation of ODS phase out incremental cost
Calculation of unit abatement cost

Financing Plan (to be added in preappraisal mission)

Including all sources of financing, amount of grant funding (and how determined), terms and conditions of all financing

Project Implementation

The Environmental Protection Office and the Science and Technology Department of the ministry of Machines and Electronic Industry (MMEI) will be responsible for the successful completion of this subproject. The Dalian Picture Tube Factory will execute this CFC-113 replacement subproject at its factory. The China Electronics Engineering Design Institute of MMEI (CEEDI) is in charge of planning and executing the ODS phase-out in China's electronics and metal parts cleaning industries. CEEDI will oversee the demonstration of non-CFC cleaning technology at the Dalian Picture Tube Factory and will coordinate the transfer of the new technology to other CFC-113 and methylchloroform users. Two design institutes, No. 2 and No. 46 will provide technical support to the Dalian factory.

Schedule for Project Activities

TASK QUARTER	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
Technology investigation	■							
technology		■→	→•	→•	→•	→■		
Procurement of equipment		■→	→■					
Training abroad				■				
Install equipment and do trail runs			■→	→•	→■			
Training for project replication					■→	→•	→•	→97
Full operation						■→	→•	→•

[procurement, disbursements and audits, to be added]

Results

This project will remove 130 tons of CFC-113 in 1994 or the first year of full operation. This project employs cost effective commercially available technology in a rapidly growing CFC use sector. Previous country study investigations have identified this as a high priority project. The China CP is under preparation and is scheduled to be completed by end September 1992.

PROJECT SUMMARY

COUNTRY:	China
PROJECT TITLE:	Dandong Electronic Tuner Aqueous Cleaning Line
SECTOR COVERED:	Electronics and Metal Cleaning
ODS CONSUMPTION IN SECTOR:	1,300 tons CFC-113 and 600 tons methylchloroform in 1991
CONSUMPTION WEIGHTED WITH ODP VALUE:	1,400 weighted tons of CFC-113 60 weighted tons of methylchloroform
PROJECT DURATION:	2 years
PROJECT IMPACT:	Phase-out 25 tons CFC-113 (30 tons ODP)
TOTAL PROJECT COST:	$640,000
PROPOSED ODS GRANT:	$470,000
IMPLEMENTING AGENCY:	Dandong Tuner Factory
NATIONAL COORDINATING AGENCY:	The Ministry of Machines and Electronic Industry

Project Summary

This subproject aims to demonstrate the feasibility of an aqueous process as a subsubstitute to cholrinated solvents for electronic tuner cleaning by converting the Dandong Tuner Factory to its use. The Dandong Factory will first work with ICOLP, Matsushita and Toshiba to identify appropriate aqueous cleaning technology and water soluble fluxes. After verifying the substitute technology at the No. 2 Electronics Cleaning Process Research Institute of MMEI, the Dandong factory will procure and install the new technology as a demonstration project for other electronic tuner producers in China. There are 10-20 large scale tuner manufacturers in China and about 300 factories produce electronic components for broadcasting and communications equipment. The Dandong Factory has been investigating aqueous systems for its cleaning operations and is well positioned to demonstrate a non-CFC cleaning technology.

The China Electronics Engineering Design Institute of the Ministry of Machines and Electronics Industry (MMEI) is responsible for overall planning and execution of the phase-out of ODS in China's electronics industries. The Institute expects that the Dandong demonstration project will lead to the rapid conversion of other electronic tuner producers to non-CFC cleaning

processes for the minimal cost of $20,000 in MP funds per plant.

Project Objectives

The objectives of this subproject are to: (i) identify an appropriate aqueous cleaning system and water soluble flux for electronic tuner production; (ii) demonstrate the feasibility of the aqueous cleaning technology by converting the Dandong Tuner Factory to its use; (iii) promote the new system among other electronic tuner manufacturers in China.

Sector Background

China's electronics industry is nascent but expanding rapidly. Consuming 1,200 tons of CFC-113 in 1991, electronics and metal parts cleaning is one of China's smallest ODS use sectors. The rapid growth expected in the sector, however, merits special attention. Cost effective non-CFC cleaning processes are commercially available., but these substitute technologies are unknown in China. If chlorinated solvent growth is unrestricted, MMEI predicts that CFC-113 use will climb to 3,400 tons in 1996 and methylchloroform use will reach 1,600 tons.

Project Description

For this subproject the Dandong Tuner Factory will work with ICOLP, Toshiba and Matsushita to identify an appropriate aqueous cleaning system and water soluble fluxes for its electronic tuner production. The Dandong factory will also work with the No. 2 Electronics Cleaning Process Research Institute of MMEI to identify appropriate alternative technology by testing and appraising various cleaning options. After a suitable substitute cleaning system has been identified and the technology verified, the Dandong Factory will be used as a demonstration site for the new aqueous cleaning technology. Dandong will use the new technology to replace its CFC-113 system reducing CFC-113 consumption by 25 tons annually.

After the substitute technology is installed and operating at the Dandong Factory, the China Electronics Engineering Design Institute will oversee its transfer to China's 10-20 other electronic tuner manufacturers. This transfer will include the training of engineers and technicians of the other plants and reproduction of the new cleaning system. Finally, the new cleaning technology will be transferred to China's 300 broadcasting and communications electronic components manufacturers. The conversion of subsequent factories will require $20,000 in MP funds per factory.

The Dandong Factory together with the No. 2 and No. 46 research institutes have already collected technical information on aqueous cleaning technologies for electronic tuner production. The factory has determined that "no-clean" processes would not meet specifications for the UHF electronic tuners and so it intends to replace its CFC cleaning system with a DI water system in conjunction with commercialized water soluble fluxes. The aqueous cleaning system will include a drying unit, a DI water production facility and appropriate test instruments.

Project Costs

Incremental Costs	Project Costs		
	Local	Foreign	Total
	$170,000	$470,000	$640,000

Financial and Economic Analysis (to be added in preappraisal mission)

FRR and ERR of project
Financial and economic viability of enterprise
Calculation of ODS phase out incremental cost
Calculation of unit abatement cost

Financing Plan (to be added in preappraisal mission)

Including all sources of financing, amount of grant funding (and how determined), terms and conditions of all financing

Project Implementation

The Environmental Protection Office and the Science and Technology Department of the ministry of Machines and Electronic Industry (MMEI) will be responsible for the successful completion of this subproject. The Dandong Tuner Factory will execute this CFC-113 replacement subproject at its factory. The China Electronics Engineering Design Institute of MMEI (CEEDI) is in charge of planning and executing the ODS phase-out in China's electronics and metal parts cleaning industries. CEEDI will oversee the demonstration of non-CFC cleaning technology at the Dandong Tuner Factory and will coordinate the transfer of the new technology to other CFC-113 and methylchloroform users. Two design institutes, No. 2 and No. 46 will provide technical support to the Dandong Factory.

Schedule for Project Activities

TASK QUARTER	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
Technology investigation	■							
Verification of technology		■→	→	→	→	→	→■	
Procurement of equipment		■→	→■					
Training abroad				■				
Install equipment and do trail runs			■→	→	→■			
Training for project replication						■→	→	→97
Full operation						■→	→	→

[procurement, disbursements and audits, to be added]

Results

This project will remove 25 tons of CFC-113 in 1994 or the first year of full operation. This project employs cost effective commercially available technology in a rapidly growing CFC use sector. Previous country study investigations have identified this as a high priority project. The China CP is under preparation and is scheduled to be completed by end September 1992.

Technical Evaluation for
China ODS Reduction First Investment Project

Reviewer: Dr. Stephen O. Andersen, Director Technology Transfer and Industry Programs, Global Change Division, United States Environmental Protection Agency.

Since 1987 China has been evaluating technology to replace substances controlled by the Montreal Protocol, attending international technology meetings, conducting study tours, organizing domestic research, and even converting factories from CFCs. The government is well informed and organized to take good advantage of Interim Multilateral Fund financing, particularly in refrigerator, foam, aerosol, fire protection and solvent sectors. U.S. EPA is assisting in halons and refrigeration areas.

Most of the priority projects listed in the First Investment Project category are ready for immediate investment.

Aerosol Sector

1- Tianjin CFC Conversion to LPG, US$ 6,855,000
2- Shanghai CFC Conversion to LPG, US$ 5,210,000

These subprojects envision a central cooperative facility to replace the filling operations of many small CFC aerosol product manufacturers. It can be expected that the savings from LPG propellant could repay the investment cost within several years. There will be additional savings in ingredients, cans, and valves because a modern central filling facility will have a much lower defect rate. Facility laboratory services and bulk purchase may also be an advantage.

There is little, if any, uncertainty about the economic advantage of the technology, but the factories must be safely designed and operated. Experts from the Mexico Safe Aerosol project should advise this investment and training.

The development of a hydrocarbon industry does not assure that the CFC products leave the market. It has been the experience of developed and developing countries that access to hydrocarbon technology is not sufficient to eliminate CFC filling. In Mexico, Egypt, and elsewhere it has been necessary to regulate and negotiate voluntary phase-out agreements. The phase-out has been further assisted by public information campaigns and product labeling. This project must have a plan to manage the facility so that the existing and potential small CFC fillers have an advantage of participation.

RECOMMENDATION:

> Approve only if constructed and operated to international safety standards and only if the project includes government regulatory and public information programs to discourage the manufacture and use of CFC products.

Rigid Foam Sector

1- Reduced CFC Rigid Insulation Foam, US$ 4,320,000

China has modern refrigerator foam filling technology that is generally will suited to a reduced CFC formulation. ICI chemical has established a foam testing and demonstration laboratory at the Beijing Household Electrical Appliance Research Institute (BHEARI) and has already converted several Chinese plants to the low CFC formulation.

It is important that China structure the project to achieve reductions in CFC while maintaining the insulation value of the foam. It is technically and environmentally preferable to set energy performance goals or CFC/volume goals rather than 50% reduction goals. The ICI/BHEARI laboratory can accomplish this work.

It is also important to anticipate the non-CFC foam technology that will be available in the near-future to assure that equipment investment will be compatible with it. Flexibility can be built into new systems by adopting multiple-head and valve mixing assemblies, expandable control systems, explosion-proof electrical components and plant placement, and consideration of possibly longer foam filling cycles (necessitating additional filling stations to maintain assembly line speed).

RECOMMENDATION:

Approve on the condition that energy efficiency is maintained and that equipment redesign anticipate near-future non-CFC foam blowing alternatives.

PS/PE Extruded Foam Sector

1-Zhejiang Conversion to Butane, US$ 1,910,000

Butane technology has been successfully adopted in Europe to replace CFCs in blowing extruded polystyrene and polyethylene sheets. It can be expected that the savings from butane blowing agent could repay the investment cost within several years. The economic viability of this project is favorable, but the factory must be safely designed and operated. Special provisions should be made to train operators in the safe storing and application of butane. Development of a safety program with regular monitoring and inspections should be a high priority.

RECOMMENDATION:

Approve only if constructed and operated to international safety standards.

Commercial Refrigeration Sector

1- Nanjing Conversion to HCFC-22 Compressors, US$ 3,150,000

Until recently China has relied on domestic technology designed exclusively for low pressure applications to produce commercial refrigeration and air-conditioning equipment. Chinese compressor technology is designed for relatively low pressure applications (CFC-11, CFC-12). Over the last few years, a few manufacturers have imported modern technology that is compatible with high pressure systems, but most factories still rely on old designs. Retrofitting Chinese compressor technology for use in high pressure HCFC-22 systems will require substantial modifications including new bearing and motor technology.

It is unadvisable to invest in low-ODP technologies in the refrigeration sector as superior non-ODS technologies may be available in the near-term. It is strongly recommended that of this project be postponed until issues about using low-ODP chemicals as interim CFC substitutes are resolved. New non-ODS technical options for commercial refrigeration applications may soon be available which would allow the Nanjing factory to implement a superior compressor design that is more environmentally sound. The costs of licensing this technology should be investigated and compared to the costs of development during project appraisal if it goes forward.

RECOMMENDATIONS:

Postpone investment in HCFC-22 technology until issues and options are resolved.

Fire Protection Sector

1- Beijing ABC Powder Production, US$ 615,000
2- Zhejiang Halon Extinguisher Conversion, US$ 1,215,000

The international fire protection community is rapidly employing existing technology to eliminate halon in virtually all applications with important exceptions in explosion suppression (e.g. petroleum pipelines, chemical facilities) and limited military applications. China is a leader among developing countries in this cooperative work. China has sponsored international conferences on halon elimination, has sent experts on study tours and to European, Asian, and North American conferences, and has conducted original research on new chemical alternatives in cooperation with the United States Military and the U.S. EPA.

Because the world is rapidly eliminating the need for halon and halon-like chemical extinguishing agents, China has placed priority on replacing halon factories with dry-powder technology. Dry powder can replace halon in all the high-volume applications in China including fire protection for hallways and stairways, trucks and cars, and most electronic and communication facilities. To be effective as halon substitutes in fire protection applications, dry powder products must be of high quality. Both the Beijing and Zhejiang dry powder subprojects should include training components to support the development of quality assurance programs

for dry powder manufacturing, transport, storage and filling.

In addition to quality assurance programs, the availability of high quality reasonably priced feedstocks will be critical to production of high quality dry powder. During appraisal of this project potential feedstock suppliers should be carefully evaluated.

The development of a modern dry powder industry in China does not assure that halon products will leave the market. Constructing a modern dry chemical plant and converting a halon extinguisher plant to the production of dry chemical extinguishers are necessary but not sufficient conditions for reduction and elimination of halon. It is important to link the establishment of the dry chemical powder plant and the permanent closing of halon production facilities. The Beijing ABC Powder Production subproject should include a time schedules both for project implementation and simultaneous dismantling of halon production facilities.

RECOMMENDATIONS:

> Approve projects to replace halon factories with dry chemical technology, but only if the halon factories are actually dismantled and the government prohibits construction of additional halon facilities. This is necessary to assure that the investment replaces halon, not just augments fire protection.

Electronic and Metal Cleaning Sector

1- Dalian Precision Parts Aqueous Cleaning Line, US$ 580,000
2- Dandong Electronic Tuner Aqueous Cleaning Line, US $640,000

Excellent technology is available to replace CFC and methyl chloroform as solvents. The Industry Cooperative for Ozone Layer Protection (ICOLP) is a consortium of Canadian, Japanese, Mexican, Russian, Swedish, United Kingdom, and United States companies, government agencies, and research institutes that are dedicated to the rapid elimination of ozone-depleting solvents. ICOLP sponsors publications, conferences, workshops, internships, "OZONET" computerized data-base, and hands-on projects. ICOLP has offered to organize teams of experts to advise developing country companies on technology to replace CFC and methyl chloroform, charging only for management, travel, and lodging but providing the experts without consulting charges of wages.

Cost effective CFC and methyl chloroform replacement technologies are available on a commercial basis. Funding needs for implementation of the Dalian and Dandong demonstration subprojects should be based on licensing fees and other costs required to adapt Chinese manufacturing processes to commercially available technology.

RECOMMENDATIONS:

> Approve funding to select and implement substitute technology using ICOLP services emphasizing no-clean and other manufacturing processes that are

inherently environmentally acceptable or that have engineering systems to protect worker safety and the environment.