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IMPLEMENTATION COMPLETION REPORT

CZECH REPUBLIC

TECHNICAL SUPPORT AND INVESTMENT PROJECT FOR THE

PHASEOUT OF OZONE DEPLETING SUBSTANCES

GEF GRANT NUMBER 28661

August 27, 1998

WEIGHTS AND MEASURES

Metric System

CZECH REPUBLIC'S FISCAL YEAR (FY)

January 1 - December 31

CURRENCY EQUIVALENTS

(as of February 4, 1998)

Currency Unit	=	Czech Crown (CZK)
US$1	=	34.773 CZK

AVERAGE EXCHANGE RATES

Czech Crown per US$

1994	1995	1996	1997	1998
28.285	26.545	27.135	31.71	34.43

Vice President:	Johannes Linn, ECAVP
Country Director:	Roger Grawe, ECC07
Sector Director:	Kevin Cleaver, ECSSD
Sector Leader, Environment:	Michele E. De Nevers, ECSSD
Responsible Staff:	Krisztina Kiss, Program Team Leader (ECCHU)
	Gottfried Ablasser, Portfolio Manager (ECSSD)

ABBREVIATIONS AND ACRONYMS

BHL	-	Bratři Horákové, s.r.o.(Ltd.)
CEE	-	Central and Eastern Europe
CFC	-	Chlorofluorocarbon
CKD-C	-	CKD Compressors
CK	-	Czech Koruna
CR	-	Czech Republic
CSFR	-	Czech and Slovak Federal Republic
CTC	-	Carbon tetrachloride, a regulated substance
DOU	-	Document of Understanding
GEF	-	Global Environment Facility
GET	-	Global Environment Trust
GWP		Global Warming Potential
FI	-	Financial Intermediary
FSU	-	Former Soviet Union
HCFC	-	Hydrochlorofluorocarbon
HFC	-	Hydrofluorocarbon
IBRD	-	International Bank for Reconstruction and Development
IDA	-	International Development Association
ICB	-	International Competitive Bidding
IPB	-	Investicní a Postovní Banka
IS	-	International Shopping
LCB	-	Local Competitive Bidding
LS	-	Local Shopping Procedures
LCB	-	Local Competitive Bidding
LS	-	Local Shopping
MFMP	-	Multilateral Fund for the Implementation of the Montreal Protocol
MOE	-	Czech Ministry of Environment
MOF	-	Czech Ministry of Finance
MP	-	Montreal Protocol on Substances that Deplete the Ozone Layer
MW	-	Megawatt
NBF	-	Not Bank-Financed
ODP	-	Ozone Depleting Potential
ODS	-	Ozone Depleting Substances
PAA	-	Project Administration Agreement
PCE	-	Perchloroethylene
PIM	-	Project Implementation Manual
PIU	-	Project Implementation Unit
PU	-	Polyurethane
SOE	-	Statement of Expenditures
STAP	-	Scientific and Technical Advisory Panel
TAG	-	Technical Advisory Group
UNEP	-	Untied Nations Environment Program
3R	-	Recovery, Reclamation and Recycling

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PREFACE

This is the Implementation Completion Report (ICR) for the Technical Support and Investment Project for the Phaseout of Ozone Depleting Substances in the Czech Republic, for which GEF Grant Number 28661, Code CZ-GE 8377 of 1994 in the amount of SDR 1,700,000 equivalent was approved on August 23, 1994 and made effective on December 15, 1994.

The grant was closed on March 31, 1998 instead of June 30, 1996 the original closing date. 98.3% of the grant was disbursed and SDR 29,395 remained undisbursed and unutilized. The last disbursement date was April 16, 1998.

The ICR was prepared by Krisztina Kiss, Program Team Leader, from the Europe and Central Asia Region ECSSD, and Mr. David Gibson, Consultant. It was reviewed by Ms. Michele de Nevers, Sector Leader for Environment, ECSSD, Mr. Gottfried Ablasser, Portfolio Manager, ECSSD and Mr. Mahesh Sharma, Senior Regional Coordinator, ENVGC.

Preparation of this ICR was begun during the Bank's final supervision and project completion mission, which took place from March 8-12, 1998. It is based on material in the project file and discussions with the Director of the Project Implementation Unit, officials of the Ministry of Environment and other relevant entities involved in project implementation. The recipient participated in the preparation of the ICR by contributing their own project completion report.

EVALUATION SUMMARY

INTRODUCTION

i. The Czech Republic was one of the first countries eligible for Global Environment Facility (GEF) grant funds to launch a comprehensive Ozone Depleting Substances (ODS) phaseout program. In 1992, the Government of the Czech Republic requested World Bank assistance in the preparation of a GEF funded ODS Phaseout Project. When the project closed in early 1998, it was one of the first successful ODS phaseout projects worldwide. GEF support provided an incentive for the Czech Republic's early adoption of ODS phase-out activities, which yielded environmental and economic benefits.

Project Objectives

ii. The principal objective of the Project was to assist the Czech Republic in the cost-effective phaseout of ODS production and consumption by 1996, as mandated by the Montreal Protocol. Specific objectives included: a) the progressive phase-out of chloroflurocarbon (CFC) production in the Czech Republic; b) the establishment of a Czech network for refrigerant recovery, reclamation and recycling (3R); and c) supporting applied engineering efforts to use ODS substitutes in manufactured goods, thereby reducing immediate and future needs for regulated substances. Subprojects addressed each of the project objectives (equipment manufacturing, 3R, CFC phase out).

Implementation Experience and Results

iii. Overall, the objectives of the project were fully achieved. ODS production and use of primary CFCs were phased out through the implementation of the sub-projects and enactment of the Act of the Czech Republic on the Protection of the Ozone Layer. In addition to meeting some of the incremental costs of phaseout, this GEF funded project enabled appropriate Western technologies to be identified and introduced into the country.

iv. *Project time frame.* The project closing date was extended twice, due to a number of reasons: 1) technical and procurement problems; 2) the change of sub-project designs; and 3) difficulties regarding the introduction and operation of the 3R scheme. All legal covenants were met on time, although delays continue on the introduction of incentives to make the 3R scheme work as intended.

v. *Investment Components.* The equipment manufacturing projects at Thermo King Czech Republic (formerly Frigera) and CKD Kompresory (CKD) are considered successful. Implementation at Thermo King Czech Republic proceeded smoothly and results matched expectations. The production of new transport cooling systems was converted to non-ODS refrigerants, and methodologies developed were developed to retrofit existing CFC-12 based equipment in the field to non-ODS refrigerants. Implementation at CKD experienced initial

difficulties when the choice of equipment for which retrofit methodologies were being developed proved inappropriate. The problem was rectified when a new management team re-focussed the project on more widely used equipment.

vi. The refrigeration equipment retrofit methodologies developed by Thermo King and CKD are generally applicable to similar systems made by different manufacturers. Their dissemination via manuals in Czech, Russian and English will promote the retrofitting of a wide range of cooling equipment in CIS and Eastern European countries.

vii. The use of CFCs in the manufacturing of foamed panels and cooling systems has been curtailed along with the production of CFC-12 and CFC-11. Bratři Horákové (BHL), a foamed panel company, established a foam testing laboratory. This has proved invaluable in solving technical problems caused by the foaming agents used so far, and is likely to be well used in the future as new developments such as HFC-245a are tried.

viii. *The 3R Scheme.* The performance of the 3R component of the project has not been satisfactory. Although some 200 tons of refrigerants per year are being generated, only a small amount is being reclaimed. The problem seems to stem from legislation adopted in 1993 to artificially increase the price of CFC-12 by imposing a high excise duty on it. Because the two reclaim centers are offering only a fraction of the street value of CFC-12, contaminated refrigerants are being re-used directly. The result may be a heavy hidden cost on the Czech economy in the form of higher refrigeration equipment failure rates. Legislation in this regard will be difficult to enforce in the short term. Improving the redemption price of recovered refrigerants will have more effect. A significant amount of CFC-11 (about 80 tons) has been recovered and stored by the reclaim centers. Only about 20 tons have been reclaimed and there seems to be no market for the remaining 60 tons.

ix. As the operator of one of the two refrigerant reclaim centers, Spolek is also likely to benefit if the problems of the 3R scheme are resolved. (See section D below.)

x. From a commercial point of view, three project participants are now in a stronger position than they were when the Project started. BHL has increased its market share from about 10 percent to 30 percent and is now the largest foamed panel maker in the Czech Republic. Thermo King Frigera has concluded a Joint Venture partnership with Thermo King US making them the lead designers of a new bus air conditioning system that Thermo King will market worldwide. Ekotez, one of the two partners in the 3R scheme, has carved out a significant share of the refrigerant recovery machine market in Western Europe with a machine originally designed for local use. The refrigeration division of CKD will find new business in retrofitting industrial systems that they originally installed, and will be well positioned to survive the future restructuring of the CKD engineering empire.

Summary of Findings, Future Operation, and Key Lessons Learned

xi. The Czech ODS project was the first of its kind to be designed and implemented in Central Europe. The lessons learned from this project will be invaluable to future projects of its kind. They include:

xii. *Legal and Regulatory Framework.* The establishment and improvement of the proper legal and regulatory framework, and the institutional system were essential for the positive outcome of the project. The 1995 Czech law made manufacturing, importing and exporting CFCs, including products containing regulated substances, illegal from January 1, 1996 in accordance with MP commitments. In addition, in January 1, 1997, a ban was imposed on the production of HCFCs and use of these substances in propellants. This legislation has been instrumental in ensuring that zero ODS and not transitional (i.e. HCFC based) substances are employed in new products manufactured in the Czech Republic. Additional legislation enforcement and regulatory reforms may be considered in order to ensure that Reclaim Centers in the 3R scheme are put to use.

xiii. Until recovered refrigerants are reclaimed instead of simply being re-used after recovery, the 3R scheme cannot be considered successful. The reclaim and refrigerant testing equipment provided may, unless this problem is solved, turn out to be redundant. However, this will not affect the amount of refrigerants recovered, a factor which is driven by the high market value of recoverable refrigerants. As long as the value of CFC-12 remains higher than a mechanic's daily wage, it can safely be assumed that refrigerants will continue to be recovered at the high rates, making this scheme one of the most effective in the world in terms of reducing refrigerant consumption. Specific lessons learned for the 3R which include: a) financial incentives are the most important factors in encouraging compliance with the scheme; b) duty levels should be easily variable enabling the redemption price of recovered refrigerants to be "fine tuned" as conditions change; and c) the commercial refrigeration sector, rather than the domestic sector should be targeted as the primary source of recoverable refrigerants.

xiv. *Major Factors Affecting the Project:* The Czech ODS project was the first of its kind to be designed and implemented in Central Europe. To some degree all sub projects experienced a learning curve as ideas and technologies imported from the West proved less mature than they appeared. The feasibility study on CFC-12 and CFC-11 production conversion at Spolek became redundant shortly after the Project start-up, when it became obvious without carrying out a study that there was no room in the World for another HFC refrigerant producer. BHL (a foamed panel manufacturer) found that the use of HCFC-141b as a foaming agent belied its description as a simple "drop-in" replacement for CFC-11 and was obliged to solve technical problems with little outside help.

xv. Legislation adopted in 1993 to encourage the recovery of refrigerants by imposing a heavy excise duty on CFCs backfired to some degree. The proportion of refrigerants recovered from service operations is possibly the highest in the world, yet the scheme does not work as designed and may be imposing a heavy unseen cost on the Czech economy in the form of higher

refrigeration equipment failure rates. The origin of this problem lies in the high duty that was originally imposed to promote CFC refrigerant recovery by artificially increasing its value .

xvi. *Recipient Participation.* Many of the Project's achievements were due to the exemplary cooperation of the sub-project participants in successfully tackling the challenges that emerged during implementation. CKD Kompressori, BHL, Thermo King, Ekotez and Spolek all adapted quickly to these challenges. CKD Kompressori changed the equipment for which retrofit methodologies were to be developed in mid-project, BHL persisted in solving the problems that beset their foam project, and Thermo King changed their approach to retrofitting their own refrigerated truck testing facility.

xvii. *Bank Performance.* The Bank's performance in preparation, appraisal and implementation was satisfactory, despite three changes in task manager during the project cycle. The Bank's missions were staffed with highly qualified professionals in financial, environmental and technical fields. The priorities both of the Czech Republic and GEF were appropriately addressed to implement the Montreal Protocol and its related amendments. The project was innovative and pioneering, but could have been simpler. More operational support could have been provided during implementation, especially in the start-up phase, and particularly on training in procurement and project accounting.

xviii. *Implementation Structure.* It is felt that the Project would have progressed more smoothly had the status of the PIU and its manager been higher. The PIU manager was only able to advise the parties concerned when disputes arose between the three ministries involved in the project; a more proactive role could have facilitated project operation.

xix. *Commercial Motivation.* Overall, performance was best in sub-projects in which participants had a real commercial interest in the project. The smoothest project implementation took place at BHL, Ekotez and Thermo King. Difficulties at Spolek and CKD were partly due to the fact that the project activities related to only a small part of their business.

xx. *Sustainability and Future Applications.* The principal challenge for the future is to make the entire 3R scheme operation reach its anticipated capacity. Ideas have been taken from neighboring countries, such as the "Green Card " from the Hungarian 3R scheme. An awareness raising campaign has been launched that will make end users demand this card from refrigeration technicians. The Mission recommended that money from the Czech Environmental Fund be used to subsidize the redemption price of new refrigerants and "pump prime" at the reclaim facility. With a reasonable throughput, the operating costs of the reclaim center should be much lower than their operators estimate, and it should be possible to permanently offer a better price for recovered refrigerants. A redemption price 80 percent of the current value of CFC-12 would give an ample margin to cover reclaim center running costs, and would likely be sufficient for service technicians to choose to sell the center recovered refrigerant rather than re-use it directly.

xxi. None of the three implemented sub projects runs a significant risk of premature failure. The technologies introduced in compressor and cooling system manufacturing are based on HFC refrigerants, a technology that has become standard practice in the rest of the world. Whilst HFCs possess zero Ozone Depleting Potential (ODP), they have a significant Global Warming

Potential (GWP). A variety of low GWP refrigerants will doubtless emerge over the next decade as this environmental issue is tackled.

xxii. The enduring value of the sub project lies not so much in the development of a particular equipment modification or retrofit methodology for specific refrigerants, but rather in the support given to the enterprises concerned in solving these kinds of problems. Before the Ozone layer became a concern, refrigeration engineering was largely a static industry, so the consequences of using different fluids as refrigerants would never have been investigated by a commercial company. The experience of participating in this project will enable CKD and Thermo King to solve similar engineering problems in the future for another generation of refrigeration engineers.

xxiii. *Demonstration Value and Replicabiliy.* The BHL foam project has developed techniques of using both low ODS (HCFC-141b) and zero ODS (HFC-134a & CO2) that are already being copied by other foamed panel makers in the Czech Republic. Willingness to share their experiences in using ODS foaming agent substitutes was an implied condition of project participation for all enterprises. BHL has hosted a number of workshops attended by other Czech manufacturers in which their experiences in using new foaming agents are shared. Furthermore, although the foam test laboratory supplied under the project is located on BHL's premises, it is accessible to other foam users for test and development work.

xxiv. *Global significance.* The project has a significant regional and potentially global impact. Lessons learned from the Czech 3R project are important for the development of future projects worldwide. Thermo King and CKD export extensively throughout the former Soviet bloc, consequently, the cooling system retrofit methodologies developed, will have a positive impact on CFC phaseout in these countries. Retrofit manuals have been produced in Russian, Czech and English to maximize the project impact.

PART I.

PROJECT IMPLEMENTATION ASSESSMENT

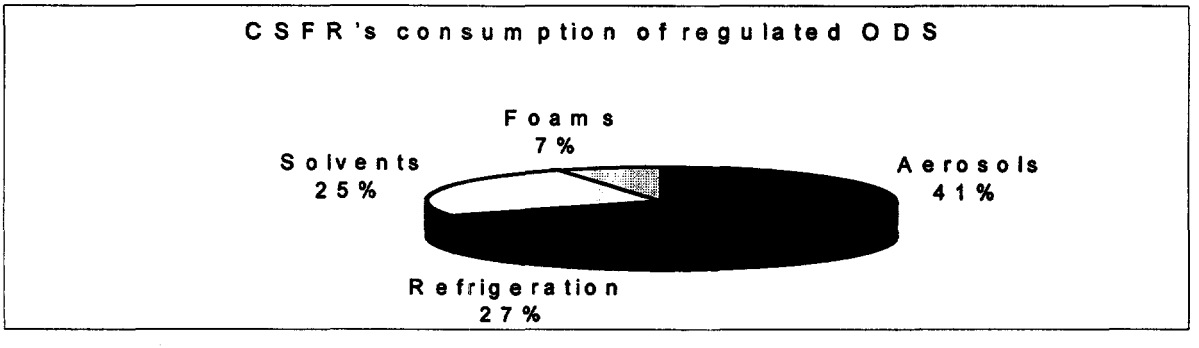
A. PROJECT CONTEXT AND OBJECTIVES

Project Context

1. The Vienna Convention for the Protection of the Ozone Layer (1985) and the Montreal Protocol on Substances that Deplete the Ozone Layer (MP), signed in 1987, are international environmental agreements which call for the phaseout of substances that deplete the stratospheric ozone layer (hereafter "regulated substances"). More than 160 countries representing over 95 percent world consumption of these regulated substances have ratified the MP and Vienna Convention. As of Januray 1, 1996 the MP with its amendments and adjustments mandates the complete phaseout of production and consumption of a number of ozone depleting substances (ODS) in developed countries. All industrialized countries have undertaken comprehensive national programs to develop cost-effective strategies to phase-out the use of these substances in the various end-user sectors. The largest family of ODS is chlorofluorocarbons (CFCs) which are widely used in various industrial applications including domestic, commercial and industrial refrigeration and air conditioning, flexible and rigid insulation foam, and in numerous other applications such as aerosol propellants, and solvents.

2. The Czech Republic (CR), was the largest producer and an important consumer of the regulated substances in Central and Eastern Europe (CEE) until 1995. In 1992 a comprehensive Country Program study for the Phaseout of ODS in the former Czech and Slovak Federal Republic (CSFR) was completed with Bank support. The study served as the basis for establishing priorities for the Czech Government and for identifying key policy and regulatory measures which would support a cost effective phaseout, and minimize disruptions to the industrial sectors which utilize ODS. The activities funded under this Project are included in priority activities identified in the Country Program.

3. In 1991, the former CSFR's consumption of regulated ODS was 3935 metric tons (t) (equivalent to 3759 ODP weighted tons), which amounts to a per-capita consumption of 0.22 kg. The Czech Republic accounted for 60 percent of the total consumption in the former CSFR. The percentage breakdowns for ODS consumption in the former CSFR are outlined in the chart below:



4. The Czech Republic was one of the first countries eligible for grant funding from the Global Environment Facility (GEF) to launch a comprehensive Ozone Depleting Substances (ODS) phaseout program. In 1992, the Government of the Czech Republic requested World Bank assistance in the preparation of a GEF funded ODS Phaseout Project. Project preparation and implementation took place simultaneously with the economic transition and industrial restructuring of the country. The financial viability of enterprises selected for Project participation had therefore been subject to prior investigation.

5. *Rationale for GEF Involvement.* The project was developed and structured based on specific ODS phaseout requirements in the Czech Republic as outlined in the Country Program and the general project eligibility criteria guidelines of the GEF Scientific and Technical Advisory Panel (STAP). GEF funding was obtained on the basis of the Czech Republic's eligibility for GEF assistance, i.e. its classification as a developing country, and ineligibility for funding from the Multilateral Fund for the Implementation of the Montreal Protocol. The government completed a Country Program to succeed the former CSFR's ratification of the Vienna Convention and Montreal Protocol.

Project Objectives

6. The principal objective of the Project was to assist the Czech Republic in the phaseout of ODS production and consumption in a cost effective manner by the year 1996, as mandated by the Montreal Protocol, its amendments and adjustments. Specifically the Project was to assist the Czech Republic to: (a) initiate the phaseout of the production of CFCs; (b) phase-in the operation of a national network for refrigerant (CFC-11 and CFC-12) recovery/reclamation/recycling (3R); and (c) support applied engineering efforts to use ODS substitutes in manufactured goods (mainly refrigeration and commercial/industrial cooling applications), thereby reducing both the immediate and future needs for regulated substances. GEF support provided an incentive for the early adoption of ODS phaseout activities and captured additional environmental and economic benefits which otherwise would have been lost or delayed.

Evaluation of Objectives

7. The above objectives proved to be correct and the strategy employed to achieve the overall project objective of assisting the phase out of CFC use in the Czech Republic played an important role in the outcome of the project.

8. The tactics employed to provide this strategic support were the introduction of non-ODS technologies at key enterprises where maximum demonstration value could be gained. This entailed a secondary objective in line with more general GEF objectives, namely to provide technical innovation that would benefit the country concerned and realize global environmental benefits. The project scope and basic design did not need to be and was not changed.

9. Project milestones for the primary objective were clear since implementation of the project took place within the defining framework of the Czech Environmental Law. The framework established dates for the ending of CFC use in all applications and HCFCs in new equipment (see para. 14. below).

10. Evidence that secondary objectives were being attained would be harder to discern, given that the country went through an economic transition during the project preparation and implementation period. As a result there was much less stability in the legal/regulatory, ownership and market frameworks. The actual success factors or objectives indicators of the post-project business position of the project enterprises, would depend largely on the degree of adoption of technologies developed under the project.

B. ACHIEVEMENT OF OBJECTIVES

11. The objectives of the Project were fully achieved. All ODS production and use of new CFCs was phased out through the implementation of the sub-projects and enactment of relevant legislation. The project suffered some bureaucratic delays (mainly due to some delays in the setting-up and full operation of the PIU) and was finally initiated in February 1995. On January 1 1996, a ban on ODS production and import was imposed in accordance with Montreal Protocol commitments (see Project-wide Elements below). When the project closed in early 1998, it was one of the first successfully completed ODS phaseout projects in the world.

12. In line with the more general GEF objectives, the secondary project objective was realized through the introduction of three different types of technology: a) refrigerant recovery and reclaim; b) retrofit of existing refrigeration equipment with non-ODS refrigerants; and, c) non-ODS foaming agents for coldroom panel manufacturing. All this technology was innovative as it introduced established Western practices to the Czech Republic.

13. The retrofit project consisted essentially of validating techniques developed in Western countries on Czech equipment and documenting an approved methodology for end users. In the case of the foam project, the established western technology was not immediately suitable, and required considerable development before an acceptable product could be made.

14. *Project-wide Factors.* A legislative framework was created to support Project implementation. The elements relating to this Project are:

i) 1993 – imposition of an excise duty on the import and production of CFCs;
ii) 1995 – Ban on the import, export and production of CFCs (as of January 1, 1996) and production and use of HCFCs in new equipment (as of January 1, 1997), although its use for service will be allowed until 2015.

This framework was vital to the Project's success by making CFC phaseout mandatory. The standards imposed by HCFC legislation exceed both EU and MP requirements. This has ensured that zero ODS solutions have been found for new refrigeration equipment and for the manufacturing of foamed panels.

15. *Sub-project 1.* This sub-project involved funding a feasibility study to enable the chemical producer Spolek to change CFC-12 and CFC-11 production to new refrigerants. Cursory investigations into the world market potential for HFC-134a showed that the establishment of production facilities for this refrigerant at Spolek would not be a sound

policy. Similar conclusions were quickly drawn regarding HCFC-22 production. Money destined for these activities was subsequently used for sub-project 2, Refrigeration Recovery and Reclamation (3R).

16. *Sub-project 2.* With the Refrigerant Recovery and Recycling (3R) Scheme, difficulties were experienced in using both imported technology and implementing western concepts of how such a scheme should be organized. Refrigerant reclaim equipment supplied by a western manufacturer failed to perform to acceptable standards. Implementing the accepted western model of 3R scheme organization was equally challenging. Globally, the demonstration value of this project has been very high, but ironically in a negative sense. Groups organizing 3R schemes in Poland, Slovenia and Hungary have learnt from the understandable mistakes made with the Czech scheme and consultants preparing regional 3R schemes in Russia have studied the Czech experience carefully.

17. This sub-project involved setting up a refrigerant recovery scheme based on a refrigerant reclaim facility that would convert refrigerants to new product standards and enable them to be re-used without damaging refrigeration equipment. A long-term training and re-training program managed by the Association of Refrigeration Engineers supported the 3R scheme. More than 2000 refrigeration technicians were trained. Advanced methodology, techniques, equipment, relevant legislation and regulations were introduced and applied by refrigeration service technicians for home and industrial appliances. During the first year of operation (1993-94), there was a significant decrease in the consumption of new CFC-12 refrigerants. Six tons of CFC-12 were used from the installed reclaim facility capacity of at least 150 tons[1], a dramatic 42 percent reduction. Although this result made the scheme one of the most successful worldwide, there was an economic cost. Technicians collecting the refrigerants have bypassed the reclaim facility and directly re-used contaminated refrigerants. The use of these contaminated refrigerants is believed to have increased the frequency of refrigeration equipment failures, especially in small hermetic systems[2].

18. The Czech 3R scheme suffered from being the first in Eastern and Central Europe, and from being implemented more or less simultaneously with schemes in Western countries. Mistakes were made, given limited experience on which to draw from.

19. Technology transfer has not been solely from West to East. A participant in the 3R scheme (Ekotez), manufactures portable Recovery Machines that were originally designed for the Czech market. These machines have since become the best selling Recovery Machines in Western Europe under different brand names of which the "Baby R" is the most sought after.

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1 20 tons of CFC-11 have been reclaimed. This entails the obvious cost of repairing the failed equipment, and a less obvious cost related to food losses resulting from the failure of small commercial systems. These are potentially much greater.

d and another 60 tons have been offered. There is no market for this. Recommendations are made (see Section D) that might identify a market.

2 This entails the obvious cost of repairing the failed equipment, and a less obvious cost related to food losses resulting from the failure of small commercial systems. These are potentially much greater.

20. *Sub project 3.* Equipment retrofit projects were carried out at two enterprises, CKD an industrial compressor manufacturer, and Thermo King Czech Republic (originally Frigera), a manufacturer of transport refrigeration systems. Both companies formerly exported equipment all over the Soviet bloc. The documentation of retrofit techniques developed by these companies for their equipment will enable users of their equipment to retrofit to non-ODS refrigerants as CFC use is phased out in CIS countries. Retrofit manuals have been produced in English, Russian and Czech.

21. All new equipment produced by these companies is now specified for HFC refrigerants[3].

22. Small amounts of HCFC-22, the major component in the MP-66[4] (R-401b) retrofit fluid used in the associated refrigeration equipment, will continue to be used at the Thermo King Czech Republic truck testing station. Emissions will be negligible. After retrofit, the refrigeration equipment has shown an improvement in energy efficiency of some 8 percent, thereby reducing the Global Warming impact of the Project.

23. The CKD element of the sub project had originally been based on the retrofit of a district heating heat pump. This was changed in mid-project because there was limited demonstration value of a large screw compressor retrofit. The compressor types finally chosen were the KBP range (300-600 kW) and the CJ range (50-150 kW). The available "park" of refrigerants present in this equipment in the Czech Republic has been estimated at 280 tons and 100 tons of CFC-12 respectively, which will eventually become available to the 3R scheme.

24. *Sub project 4.* Techniques for foaming Polyurethane insulation used in coldroom panels were developed at BHL. Significant problems were experienced in using what was thought to be a straightforward "drop-in" replacement for CFC-11. Foaming temperatures were higher than predicted and two foaming tables became warped. In response, a low ODS transitional replacement (HCFC-141b) was used, and the zero ODS mixture (an HFC-134a/CO2 blend) currently in use was developed by BHL with the help of laboratory facilities supplied under the project. Nevertheless, problems are ongoing and the laboratory continues to be used intensively. BHL has shared its findings with other panel manufacturers via a series of foam workshops. The laboratory facilities are located on BHL's premises but are accessible to other panel makers and foam users.

25. The HFC-134a/CO2 blend allows a serviceable product to be made at a reasonable cost using a zero ODS blowing agent. The conductivity of the insulating foam being used is about 8 percent greater than the original CFC-11 blown foam. The foamed panels have had to be made thicker to offset increased energy consumption.

26. Project implementation has improved foaming techniques and reduced amounts lost in offcuts from 25 percent to a few percent.

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[3] Use of HCFC refrigerants in new equipment has been banned since January 1997 under the Czech Environmental Law, although its use for service will be allowed until 2015.

[4] A drop-in replacement refrigerants for CFC-12 based on HCFC-22 which is manufactured by Dupont (US).

27. *Global Benefits.* The global impact of the project is considerable. Lessons learnt from the Czech 3R project will inform the development of similar projects worldwide. The cooling system retrofit methodologies will benefit end users of Thermo King and CKD equipment all over the former Soviet bloc, and will help reduce the economic impact of phasing out CFC refrigerants in these countries (see below "Demonstration Value").

28. *Innovation..* Western practice in ODS substitution was introduced into the Czech Republic. In some cases the transfer of technology was relatively painless (as with Sub project 3 – Retrofit), in others it proved to be more challenging (as with Sub project 4 – foaming). In the case of the 3R project, the technology was appropriate but the concept of scheme organization was not. A way of making the scheme function properly has yet to be found.

29. Most technologies on which the Project was based on are the "technologies of choice". BHL is the exception, as their current zero ODS foaming agent (HFC-134a & CO2 blend) represents a somewhat esoteric choice.

30. *Demonstration Value and Replicabiliy.* The BHL foam project has developed techniques of using both low ODS (HCFC-141b) and zero ODS (HFC-134a & CO2) that are copied by other foamed panel makers in the Czech Republic. Willingness to share their experiences in using ODS foaming agent substitutes was an implied condition of project participation for all enterprises, although only BHL was required to share technical information with potential competitors. BHL have hosted a number of workshops attended by other Czech manufacturers where they shared their experiences of using new foaming agents. The foam test laboratory supplied under the project is located on BHL's premises but is accessible to other foam users for test and development work.

31. The refrigeration equipment retrofit methodologies developed by Thermo King and CKD for their own equipment are generally applicable to similar systems from different manufacturers. Their dissemination via manuals in Czech, Russian and English will promote the retrofit of a wide range of cooling equipment in CIS and Eastern European countries.

C. MAJOR FACTORS AFFECTING THE PROJECT

32. The project was the first of its kind to be designed in Central Europe. Work started in 1992 at a time when there was little experience in the effectiveness of regulatory measures on ODS phaseout. Many different technologies were also being discussed at the time but there was little experience in their practical implementation.

33. Each sub-project participant experienced a learning curve. Sub-project 1 was literally overtaken by events when it became obvious that the conversion of Spolek's CFC-12 production to HFC-134a would be counter-productive. BHL found that the use of HCFC-141b as a foaming agent (a transitional now abandoned) belied its description as a simple "drop-in" replacement for CFC-11. Considerable test work was required before a reliable product could be developed. It was initially not anticipated how important the foam test laboratory supplied under the project would turn out to be.

34. The legislation adopted in 1993 to impose an excise duty on refrigerants reflected the wisdom of the time. No one could have predicted that this could actually be too high. On the one hand, the measure succeeded by reducing refrigerant service consumption by 20 percent, but on the other, failed by making refrigerants so expensive that only a small amount was taken to the Reclaim Centers funded under the project. Subsequent legislation raised this level still further. 3R schemes developed later were able to learn from the Czech experience. The Hungarian scheme was designed to be less dependent on central refrigerant processing, a modification that would be difficult to make at this stage to the Czech scheme.

35. The flexible attitude demonstrated by the sub-project participants was a major factor in their success in tackling the challenges that emerged during implementation. CKD (sub-project 3) changed the subject of their demonstration retrofit to cooling systems that had been used widely in the former Czechoslovakia and exported in large numbers. Thermo King accepted a consultant's advice and revised their method of retrofitting their truck testing facility. BHL solved the challenges of HCFC-141b foaming and continue to solve the problems caused by the C02/HFC-134a blend.

36. The 3R scheme is the only sub-project that has not fully been successful as far as reclamation is concerned. The largest factor affecting this scheme is the current value of refrigerants. The present high value of $22/kg is not the result of the government excise duty, the original cause of its price rise. It reflects world prices, and has exacerbated the problem of making the 3R scheme work as intended. A number of approaches are being taken (see Section D below). Advice has been sought from a UK firm which successfully operates a refrigerant reclaim operation. Hungary's experience with technician certification and public awareness raising has been tapped.

D. PROJECT SUSTAINABILITY

37. The sustainability of this project will depend on the sub-project enterprises' continued use of non-ODS technologies in the future. This is ensured by the fact that importing into or manufacturing ODS in the Czech Republic is forbidden by law. Ideally the project should have achieved this without compromising economic performance. Second, the new technologies introduced under the project constitute long term options that will not need to be changed in order for enterprises to stay competitive. Moreover, these technologies should not exhibit other negative environmental effects such as increased GWP which would require further technology changes as these issues are addressed.

38. From a business point of view, three project participants are now stronger than when the Project started. Despite technical difficulties, BHL have increased their market share from approximately 10 percent to 30 percent. Thermo King Frigera concluded a Joint Venture partnership with Thermo King US. They are now the lead designers of a new bus air conditioning system based on HFCs that will be marketed world wide. Ekotez, one of the two partners in the 3R scheme has carved out a significant share of the refrigerant recovery machine market in Western countries. The refrigeration division of CKD will find new business in retrofitting industrial systems originally installed by them, and will be well positioned to survive the future restructuring of the CKD engineering empire.

39. These positive developments are related to the exposure enterprises received from the new zero ODS technologies. Spolek is the only company that has yet to gain from Project participation. However, if the problems of the 3R scheme are resolved, this may change since Spolek is an operator of one of the two refrigerant reclaim centers. From a technical standpoint, the facilities provided are satisfactory for the purposes required[5] and are likely to remain so in the medium term. Sustainability of this sub-project is threatened by the current non-performance of the scheme as designed. Unless a way is found (e.g. incentives for redemption prices and a change in the regulatory framework) to encourage technicians to sell recovered refrigerants to the reclaim centers instead of re-using them directly, SPOLEK sub-project enterprise, one of the reclaim center operators, will eventually lose interest and the equipment provided will gather dust on their premises. The proposal of both reclaim centers to offer available reclaim capacity to neighboring countries could be taken into consideration.

40. The impact of the Czech 3R scheme on replicability is somewhat ironic. Neighboring countries have shown special interest to the Czech experience, yet schemes around the World are urged not to repeat the understandable mistakes made in the Czech Republic.

41. With respect to equipment Retrofit at Thermo King and CKD, Sub-project 3, technologies developed for the production of new equipment based on HFC refrigerants are the technologies of choice world-wide for CFC-12 retrofit. These are unlikely to need replacing in the medium term. Technologies developed under this sub-project have been integrated into the new commercial activities developed with the US JV partner.

42. The retrofit technologies developed by these companies will be used throughout the Czech Republic and also in much of the former USSR where both companies, especially the former Frigera company, exported their equipment.

43. The foaming technology currently used by BHL in Sub-project 4 may not be the last one to be used. For cost reasons BHL chose to use a non-flammable substance for an application where Cyclopentane (CP) is frequently used. Other developments are likely to be available in 1-2 years (e.g. HFC-245a). These may offer a better final product than the current HFC-134a/CO2 mixture without introducing flammability concerns. The most important criterion would be the performance of the foam as a heat insulator, given that other factors such as metal adhesion and tensile strength are unchanged. Making panels thicker and thus more expensive has not adversely affected BHL's business performance.

44. The CO2/HFC-134a mixture employed by BHL is an established technology, but sourced locally. Its demonstration value has been communicated to other companies by a series or workshops, and by the testing facility established at BHL.

45. Whether or not the HFC-134a/C02 technology is itself sustainable depends on the success BHL have in solving their latest technical problems and the performance of new foaming systems such as HFC-245a.. Changes made to equipment are relevant for any new foaming system as they enable the foaming procedure itself to be carried out more

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[5] With the exception of the first reclaim machine purchased. This will reclaim refrigerants to the standard required, but only after the refrigerants have made several passes through the machine

effectively[6]. That, in conjunction with the testing facilities provided under the project, put BHL (and the Czech PU foaming industry generally) in a good position to assimilate new foaming technologies.

46. The current zero ODS choice is not the last. The test facilities at BHL will enable appropriate solutions to be identified and successfully implemented as new foaming technologies are developed world wide. These should result in improvements in insulation efficiency leading to lower energy consumption of cooling (and possibly heating) equipment with a reduction in indirect Global Warming. The already significant global benefits of this project will therefore continue to be reaped for an indefinite period into the future.

E. BANK PERFORMANCE

47. The working relationships of the groups involved in the Project, namely the Bank, the grant Recipient institutions, the MOE, the IPB Bank, and the five enterprises in receipt of grants were excellent. Spot checks during supervision missions were all that was required to establish that rules regarding GEF eligibility criteria, and procurement and financial reporting guidelines, were being followed. Bank missions provided useful guidance on technical issues, project management, and institutional strengthening advice to the PIU, the financial intermediary and the grant recipient enterprises.

48. The Bank's performance in preparation, appraisal and implementation was satisfactory despite the task manager being changed three times throughout the project cycle. The Bank's missions were staffed with professionals well qualified in environmental, financial, economic and technical fields. Both the country's and GEF's priorities were properly addressed to implement the Montreal Protocol and its related amendments. The project was innovative and pioneering but its design however could have been simpler. Supervision was intensive and most missions were staffed with ODS phaseout and environmental specialists. More operational support could have been provided during implementation, especially in the start-up phase and particularly on training in procurement and project accounting.

F. RECIPIENT PERFORMANCE

49. The Recipient's performance was satisfactory throughout the whole project cycle. Performance during implementation progressively improved, thanks to the professionalism and commitment of the PIU director and his staff, who provided effective project management and coordination between sub projects. All main legal covenants were met in a timely fashion, given that the project closing date was extended twice. The extensions were required because of technical and procurement problems, the change of sub-project designs, and difficulties regarding the introduction and operation of the 3R scheme. Delays continue on the introduction of legislation and incentives to make the 3R scheme work as intended.

50. All Czech agencies involved with the Project have performed in an exemplary fashion. It remains to be seen whether the institutional set-up for the 3R scheme will enable

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[6] These equipment modifications involve the ability to obtain good foam distribution and control foaming temperatures closely during the foaming process

the private sector to carry out refrigerant reclaim efficiently and economically. The performance of the PIU, particularly of the Head of the PIU, was outstanding throughout the whole three and a half years of the implementation period. Project implementation and financial management was punctual and efficient.

G. ASSESSMENT OF OUTCOME

51. Overall performance of the project was satisfactory. The principle objective of phasing out ODS emissions in the Czech Republic was achieved by eliminating their use in equipment manufacturing, curtailing production at the country's only producer, and encouraging the re-use of ODS used for the servicing of refrigeration equipment. Consumption of new CFCs in the Czech Republic has been reduced to zero. Very high levels of existing CFCs are being re-used during the course of service work.

52. Had the Czech government simply enacted legislation to ban ODS import and production, these results would have been eventually achieved. However it can be reliably asserted that had GEF funding for these sub-projects not been available, the costs incurred by the industries concerned would have been considerable. GEF funding facilitated the timely introduction of non-ODS technologies in key CFC user areas. Technical assistance supplied under the Project enabled best international practice to be identified and contacts to be made with suitable equipment and chemical suppliers world-wide, and with world class technical advisors. The technologies demonstrated on these sub-projects will be adopted throughout the country, and in the case of sub-project 3, throughout the former Eastern Bloc. Their assimilation by other companies should be relatively painless thanks to their prior implementation under this project.

53. The performance of the 3R scheme cannot be considered satisfactory. About 200 ton of CFC-12 are being re-used annually, but it may become an additional cost to the users of refrigeration equipment in the future. The mistakes made are understandable and due largely to the pioneering nature of the 3R project.

H. FUTURE OPERATION

54. No future GEF/Bank operations in support of ODS phaseout are envisaged. However the Government needs to address the issues impending the implementation of the 3R scheme as recommended in this chapter. Future activities will largely be devoted to finding ways of making the 3R scheme work as designed. The example of the Hungarian 3R scheme has been used to identify activities that should help turn this around, including the idea of the "Green Card" scheme[7] from the Hungarian 3R scheme. It is hoped that awareness raising schemes will make refrigeration system owners demand this qualification of technicians who repair their equipment.

55. An awareness raising scheme among commercial and industrial users has been carried out in Prague under the auspices of the Ministry of the Environment. One of the failings of the Czech 3R scheme was to target the domestic sector rather than the commercial and

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[7] This identifies the holder as having been formerly trained in recovery and retrofit techniques.

industrial sectors which are the most important and largest suppliers of used refrigerants for reclamation.

56. In order for this sub-project to be salvaged, attention has to be given to ways of achieving compliance with the scheme. The most important lever is financial incentive. Currently the price being offered for recovered refrigerants is $US6/kg, however the street value is $US18-22/kg. Based on foreign models, operating costs should not exceed $US2/kg. A buy price substantially closer to the street price should be tried. It is known from an anonymous survey that technicians on average collect 100 kg of refrigerants per year, which translates to extra earnings of approximately $US1,000 to $US2,000[8]. Unless this black revenue is compensated it is clear that the practice will continue. Recommendations to facilitate this are made below.

57. *Recommendations.* Funds should be provided to cover the full operating costs of the reclaim centers for a limited period. Offering a redemption price equal to the current selling price of CFC-12 would increase the amount of refrigerants presented for reclaim and would enable the reclaim scheme proprietors to know their true running costs. Foreign examples suggest these should not exceed $US2/kg. A competitive situation should develop between the two centers to allow the real price of recovered refrigerants to emerge. It is understood that the Czech Environmental Fund could in principle provide these funds.

58. The Reclaim Center operators are wary of the planned awareness campaign to foster recovery in the commercial sector, fearing that large amounts of CFC-11 will be presented for which there is currently no market. Only CFC-11, CFC-12 and R-502 should initially be solicited.

59. Proposals by the MOE to incinerate CFC-11 in a facility planned at Spolek should be re-considered. A market may exist in the Czech Republic and neighboring countries among the operators of older industrial equipment not capable of economic retrofit to CFC substitutes. To find alternative solutions to expensive incineration, the PIUs recommended an informal survey of the region to determine whether such an opportunity for CFC-11 re-use exists.

60. BHL will continue development work to solve their problems with use of their new zero-ODS foaming agent.

I. KEY LESSONS LEARNED

61. All projects except the 3R project and Spolek's original project to make HFC-134a proceeded according to plan. Important technical lessons were learnt along the way, particularly by BHL. First, the warranty of foaming chemical suppliers on the performance of their foams, could not fully be accepted and second, a testing facility was necessary to verify performance of new foaming alternatives.

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[8] 500 technicians participated. Extrapolated for the number of technicians in the country, this figure matches the amount of refrigerants that macro statistics suggest is being recovered and re-used.

62. The major lessons learned relate to the partial failure of the 3R scheme. These can be summarized as follows:

i) Financial incentive to technicians is far and away the most important factor in encouraging compliance;
ii) Duty levels should be easily variable (e.g. by ministerial decree), enabling the price of CFC refrigerant to be controlled, considering proper prices with respect to other refrigerants and
iii) The domestic sector was targeted rather than the commercial/industrial sector.

63. Planning was a vital element in the success of the Project. When the Project was designed in 1992, the technologies were largely untried in the West. Sufficient flexibility was incorporated into the original project design to enable changes to be made without great disruption. A marketing study on the demand and use of CFC-11 and CFC-12, and a feasibility study on the introduction and operation of the 3R scheme at preparation stage should have been prepared. This could have prevented many of the scheme.'s problems that were encountered. It was fortunate that a comprehensive testing laboratory had been built into the original design of sub-project 4 (BHL). Its value has proved much greater than anticipated. Funds were re-directed from the Spolek production study when it became obvious that the subject of the study was no longer relevant. A covered storage facility was financed by re-allocated project funds when new Czech legislation required its use for refrigerant storage. The shape of the CKD component changed significantly as the result of new thinking on the project impact.

64. The Project would have progressed more smoothly if the PIU had been fully operational by the time of effectiveness, and had the status of the PIU and its manager been higher. Bureaucratic and legislative problems could have been resolved earlier and more effectively had the PIU manager enjoyed the rank of Director of a ministerial department. Responsibilities for legislation were split between three ministries (Ministry of the Environment, Ministry of Finance and Ministry of Justice) and co-ordination between these would have been improved. The PIU manager can only advise and recommend actions to these ministries. Ideally the PIU head would possess sufficient rank to enforce legislation and to actively promote co-ordination between ministries.

65. Significantly better performance was seen from sub-projects participants who had a real interest in the project. The smoothest project implementation took place at BHL, Ekotez and Thermo-King. Difficulties at Spolek and CKD were at least partly due to the fact that the project activities related to only a small part of their business. The ideal sub-project host enterprise is a company where the sub-project activity constitutes a major part of their business activities and where key individuals can be identified. CKD's contribution appeared in doubt until a new managing director was appointed who took a fresh look at their contribution.

PART II.

STATISTICAL TABLES

Table 1: Summary of Assessments

A. Achievement of Objectives	Substantial (✓)	Partial (✓)	Negligible (✓)	Not applicable (✓)
Macro Policies	☐	☐	☐	✓
Sector Policies	✓	☐	☐	☐
Financial Objectives	☐	☐	✓	☐
Institutional Development	☐	✓	☐	☐
Physical Objectives	☐	✓	☐	☐
Poverty Reduction	☐	☐	☐	✓
Gender Issues	☐	☐	☐	✓
Other Social Objectives	☐	☐	☐	✓
Environmental Objectives	✓	☐	☐	☐
Public Sector Management	☐	✓	☐	☐
Private Sector Development	☐	✓	☐	☐
GEF Objectives	✓	☐	☐	☐

B. Project Sustainability	Likely (✓)	Unlikely (✓)	Uncertain (✓)
	✓	☐	☐

(Continued)

C. Bank Performance	Highly Satisfactory (✓)	Satisfactory (✓)	Deficient (✓)
Identification	☐	✓	☐
Preparation Assistance	☐	✓	☐
Appraisal	☐	✓	☐
Supervision	✓	☐	☐

Highly

D. Recipient Performahce	Satisfactory (✓)	Satisfactory (✓)	Deficient (✓)
Preparation	☐	✓	☐
Implementation	☐	✓	☐
Covenant Compliance	✓	☐	☐
Operation (ODS Phaseout)	☐	✓	☐

E. Assessment of Outcome	Highly Satisfactory (✓)	Satisfactory (✓)	Unsatisfactory (✓)	Highly unsatisfactory (✓)
	☐	✓	☐	☐

Table 2: Related Bank Loans/Credits

Loan/credit/grant/study title	Purpose	Year of approval	Status
Preceding operations			
1.GEF Biodiversity Protection Project	Forestry/biodiversity protection	FY93	Completed
Following operations			
1. Kyjov Waste Heat Utilization Project	GHG emissions reduction and energy generation	FY99	Implementation under way for future retroactive financing
2. EU Accession Environment Study	Least cost planning for wastewater treatment	FY99	Study under preparation

Table 3: Project Timetable

Steps in Project Cycle	Date Planned	Date Actual/ Latest Estimate
Identification (Executive Project Summary)	11/91	03/92
Preparation	10/92	10/92
Appraisal	08/93	10/93
Negotiations	07/94	07/94
Board Presentation	08/94	08/94
Signing	09/94	10/94
Effectiveness	10/94	12/94
Project Completion	06/96	03/98
Grant Closing	06/96	03/98

Table 4: Loan/Credit/Grant Disbursements: Cumulative Estimated and Actual
(US$ million)

	FY94	FY95	FY96	FY97	FY98
Appraisal estimate	0.20	1.70	2.30	2.30	2.453*
Actual		0.53	1.30	2.01	2.412**
Actual as % of estimate		31	57	87	98,3
Date of final disbursement					23/4/98

* total grant proceeds including foreign exchange gains

** US$ 41,000 remained undisbursed, unutilized

Table 5: Key Indicators for Project Implementation

ODS Phased out in tons

	Estimated in FY					Actual in FY					
	'94	'95	'96	'97	'98	'94	'95	'96	'97	'98	Total
Sub-project 1			2 000	2 000	2 000		377	2 493	2 149	2 020	7 039
Sub-project 2		200	200	200	200	757	374	781	270	22	2 204
Sub-project 3		110	110	110	110		5	2	1		8
Sub-project 4		80	80	80	80		82	31	31	4	148
Total		390	2 390	2 390	2 390	757	838	3 307	2 451	2 046	9 399

Table 6: Key Indicators for Project Operation

No operation indicators were defined in the project document

Table 7: Studies and Workshops Included in Project

Study	Purpose as defined at appraisal/redefined	Status	Impact of study
12/95/OZONE J.Petrák CR	Sub-project 3 CKD Component Develop retrofit techniques	Implemented	Technical assistance to CKD to modify sub-project to overcome difficulty in implementing the original project concept
13/95/Ozone V.Řeháček CR	GEF Vienna Conference Technical & advisory support to the Czech delegation	Implemented	Compliance of the CR with the Montreal Protocol and its Amendments, consequent impacts on the Project
TA/GEF/JP E+E Consulting CR	GEF Projects Services for the organization of the seminar	Implemented	Environmental policy coordination program in the field of air protection and ozone layer
TA/PIR/11/96 V.Řeháček CR	ODS Phase-out Project Technical assistance to the participating enterprises	Implemented	Review of the implementation progress of individual sub-projects, preparation of sub-projects' progress reports
TA/ODS/12/97 Refrigerant Product UK	Technical assistance to sub-project 2 (recovery, recycling, reclamation)	Implemented	Improvement of the 3R scheme
TA/ODS/O2/98 Dewpoint Consultants UK	Technical assistance to MoE/PMU	Implemented	Preparation of ICR, consultancy services to the international workshop

Project/Sub-project	Workshop Activity	Date	Venue
Sub-project 2	Up-dated technology for ODS handling, regulatory framework	May 1996 International workshop	Kostelec nad Orlicí
Sub-project 4	ODS free technology in the manufacturing of could room panels and insulation foams	October 1997 International Workshop	Prague Lužec nad Vltavou
ODS Phase-out Project	Environmental policy coordination program/air & ozone layer protection	March 1997 International workshop	Luhacovice
ODS Phase-out Project	Czech ODS Project	March 1998 International workshop	Prague
ODS Phase-out Project	Czech ODS Project	March 1998 Local seminar	Prague

Table 8A: Project Costs

	Appraisal estimate ($ thousand)			Actual ($ thousand)		
Item	Local costs	Foreign costs	Total	Local costs	Foreign costs	Total
Sub-project 1 Spolek	0	80	80	50		50
Sub-project 2 Spolek EKOTEZ	300 150 150	1040 230 810	1340 380 960	114 18 96	963 212 751	1.077 230 847
Sub-project 3 Thermo King ČKD	0	464 210 254	464 210 254	143 121 22	349 143 206	492 264 228
Sub-project 4 BHL	1548	363	1911	1264	554	1.818
PMU (including financial intermediary)	0	353	353	138	546	684
Total	1848	2 300	4148	1709	2412	4.121

Table 8B: Project Financing

	Appraisal estimate (US$ million)			Actual (US$ million)		
Item	Local costs	Foreign costs	Total	Local costs	Foreign costs	Total
1. GEF Grant	1.456	0.844	2.300	1,245	1.167	2.412
2. Counterpart funds (how much form enterprises,	1,848		1.848	1.571		1.571
3 Amount from the Czech Gov.				0.138		0.138
Total	3.304	0.844	4.148	2.954	1.167	4.121

Table 9: Economic Costs and Benefits

No economic analysis of project was estimated at appraisal

Table 10: Status of Legal Covenants
Czech Republic
ODS Phaseout

Agreement	Section	Covenant Type	Present Status	Original Fulfillment Date	Revised Fulfillment Date	Description of Covenant	Comments
Grant							
Grant	4.01. (a),(b),(c)	1, 2	C	Yearly		Accounting and Auditing Program	In compliance
Grant	6.01 (a),(b)	8	C	12/26/94		Effectiveness	In compliance

Covenant types:

1. = Accounts/audits
2. = Financial performance/revenue generation from beneficiaries
3. = Flow and utilization of project funds
4. = Counterpart funding
5. = Management aspects of the project or executing agency
6. = Environmental covenants
7. = Involuntary resettlement
8.= Effectiveness

Present Status:

C = covenant complied with
CD = complied with after delay
CP = complied with partially
NC = not complied with

Table 11: Compliance with Operational Manual Statements

Statement number and title	Describe and comment on lack of compliance
	No lack of compliance was observed.

Table 12: Bank Resources: Staff Inputs

Stage of project cycle	Planned		Revised		Actual	
	Weeks	US$	Weeks	US$	Weeks	US$
Preparation to appraisal	0	0	0	0	3.9	12,400
Appraisal	0	0	0	0	4.0	15,000
Negotiations through Board approval	0	0	0	0	3.0	10,500
Supervision	34.0	131,800	44.7	120,000	52.7	118,000
Completion	0	0	12.0	20,100	0	0
Total	34.0	131,800	56.7	140,100	63.6	155,900

Table 13: Bank Resources: Missions

Stage of project cycle	Month/ Year	No. of Persons	Days in Field	Specialization[1]	Performance Rating[2] Implem. Status	Performance Rating[2] Developm. objectives	Types of Problems[3]
Through Appraisal							
Appraisal through Board Approval							
Board Approval through effectiveness							
Supervision 1.	10/94	2	3	E, T	1	1	P
Supervision 2.	08/95	1	2	E	1	1	
Supervision 3.	12/95	2	8	E, T	2	1	D
Supervision 4.	04/96	2	3	E, F	2	1	D
Supervision 5.	09/96	1	4	F	1	1	
Supervision 6.	02/97	3	5	E, F, T	1	1	
Supervision 7.	09/97	2	3	E, F	1	1	
Supervision 8. & Completion	03/98	2	5	E, T	1	1	
Total			65		1	1	

1 - Key to Specialized staff skills:

F = Financial Analyst
E = Environmental Economist
N = Engineer
T = Technical Specialist
P = Procurment Specialist

2 - Key to Performance Ratings:

1 = Minor or No Problems
2 = Moderate Problems
HS = Highly Satisfactory
S = Satisfactory

3 – Key to Types of Problems:

P = PIU understaffed
D = Disbursement behind schedule

Appendix A.

SUPERVISION AND COMPLETION MISSION

March 6-12, 1998

AIDE-MÉMOIRE

I. Introduction

1. A World Bank mission[9] visited the Czech Republic on March 6-12 1998 to carry out the supervision and completion mission of the ODS Phase-out Project financed by the Global Environment Facility (GEF). The mission was connected to the third regional ODS Phase-out workshop with the involvement of nine countries, with about 70 participants, held in Prague on March 4-6 1998. The workshop was very well organized by Mr. Jaroslav Koubal, Head of the Ozone Project Implementation Unit (PIU). The mission worked closely with Mr. Jaroslav Koubal, Head of the PIU and met with Mr. Dobiasovski, of the Air Protection Department of the Ministry of Environment, and representatives of Investicni And Postovni Banka (IPB, the financial agency), BHL, Spolek, Ekotez, CKD Compressors and Thermo King (participating enterprises). The list of people contacted is in Attachment 1. The mission visited three sub-project sites. The mission wishes to extend its appreciation and gratitude to all individuals met, the Ministry of Environment (MOE) and the PIU for their hospitality and assistance and congratulates the PIU for the thoughtful and professional organization of the regional workshop (paragraph 7. of this Aide Memoire). The mission's findings and recommendations were discussed with Mr. Dobiasovski of the MOE and are summarized in this draft Aide-Mémoire, which is subject to confirmation by World Bank management.

II. Overall Status of Project Implementation

Project Closing Date Extension

2. Based on the request of MOE, the Bank provided a six months extension of the project closing date from September 30, 1997 to March 31, 1998 to allow completion of project activities. As Mr. Jiri I. Skalicky, Minister of Environment was notified by the Bank in January 1998, further disbursements from the grant after the March 31 1998 grant closing date, can only be made if withdrawal applications for expenditures made before the closing date (March 31, 1998) are received at the Bank's Headquarters by close of business on July 31, 1998, i.e. payments made or payments due for goods, works and services that have been provided/done prior to the closing date. Proceeds of the grant remaining unwithdrawn after disbursements made in respect of these withdrawal applications will be canceled.

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[9] The mission included Ms. Krisztina Kiss, Team Leader (ECSSD, Hungary Office) and Mr. David Gibson, Consultant.

Use of Remaining Funds

3. Of the original grant of 1.7 million SDR (US$ 2.3 million at that time), about US$ 107,000 (5% of the grant) not including the Special Account, remain undisbursed today. The Special Account includes about US$ 20,000 currently. The remaining funds altogether about US$ 127,000 would be used for the following components:

i) Project Management: about US$ 10,000 for the PIU and local consultants; US$ 2,200 for the Financial Intermediary; about US$ 8,000 for training, the organization and all arrangements for the regional ODS Phaseout Workshop; about US$ 4,000 for foreign consultant services; about US$ 19,000 for local workshop for Public Awareness Raising regarding ODS Phaseout;
ii) Recovery, Reclamation and Recycling (3R) scheme (implemented by Ekotez and Spolek): about US$ 24,000 for Ekotez' marketing of reclamation and Public Awareness Raising Campaign at the Prague Refrigeration Fair March 3-6 1998; about US$ 22,800 for forklift equipment for handling the refrigerant storage tanks for Ekotez;
iii) Non-ODS Insulation Technology implemented by BHL; about US$ 37,000 for improving their heating system for moulds and auxiliary equipment for their laboratory.

Project Implementation, Financial Intermediary Operation

4. The PIU's management of the project and the management of the Special Account by IPB continue to be excellent. Since the last supervision in September 1998, significant progress has been made. The MOE and IPB made amendments to their agreement taking into account the proposed changes proposed in the September 1997 Aide Memoire. The PIU handed over the Audit Report of the Grant Accounts for FY 1997, prepared by Auditors HZ Praha, dated February 16, 1998 to the mission.

ODS Phaseout Implementation

5. The Project objective was fully achieved, since all ODS production and all chlorfluorocarbons (CFCs) use was phased out through the implementation of the sub-projects and enactment of relevant legislation. Current ODS Consumption, Exports and Imports Monitoring, Information and Licensing System is managed by the MOE. The MOE also issued environmental and safety statements for all sub-project companies. For all the completed sub-projects, relevant local governments issued the operational licenses.

Series of Regional Workshops for knowledge dissemination, exchange of experience, good practices, transfer of know-how and replicability of project results.

6. The Bank has launched a series of regional workshops for the GEF grant recipient countries in the region for the exchange of experience and good practices for the phaseout of ODS. The first workshop for the PIUs and company representatives of the refrigeration and fire protection sub-sectors of the Czech, Slovenian and Hungarian Projects was held in Budapest in May 1997. The workshop was considered to be very useful and successful. The relevant

counterparts of the Czech and the Slovenian ODS Phaseout Projects have adopted in practice what was learnt at the workshop. The second workshop on alternative technologies in the solvents sub-sector and on project management was held by the Slovenian EcoFund and the PIU in Bled and Ljubljana in October, 1997, this time also with the involvement of the relevant Polish counterparts. The third regional workshop on ODS phase-out was held in Prague on March 4-6, 1998, opened by Mr. Erik Geuss, Deputy Minister of the Ministry of Environment, under the excellent organization of Mr. Koubal, Head of the PIU, with the participation of the PIU and representatives of MOE, Ekotez, BHL, Thermo King, CKD Compressors and Spolek of the Czech Republic. The workshop dealt with the 3R scheme, refrigerants in the commercial, industrial and refrigerated transport sectors, and on preparation of the recipient's contribution to the ICR, and on project completion and outcome evaluation. Since the Czech project will be the first one to be completed, five other countries receiving GEF grants for ODS phaseout purposes were also involved (Slovenia, Hungary, Poland, Belarus and Russia). Lecturers from the UK, Austria and Belgium were invited to present their 3R schemes. The fourth workshop, most likely on Public Awareness Raising will be held in Warsaw, Poland. In addition, ODS Phase-out in October 1998, if possible will be connected to the Nuremberg refrigeration fair. The fifth will be held in Moscow or Kiev. Further workshop venues and topics will be identified in due course.

II. Implementation and Completion of Investment Sub-projects

Sub-project 1.: Engineering Assistance for ODS Production Phaseout at Spolchemie (Spolek).

7. Original plans at Spolek involved the termination of CFC production including the conversion of their existing CFC-11 and CFC-12 production to HFC-134a and HCFC-22 production. The sub-project consisted of a feasibility study to a) determine whether this was technically viable and to identify a potential technology supplier; and b) to establish whether such a strategy made business sense. Before the study had been commissioned. it became obvious that excess production capacity of HFC-134a existed world-wide and thus converting Splochemie's production made no sense. Similar conclusions were quickly drawn regarding HCFC-22 production. In addition, it was found that existing HFC-134a producers were unwilling to license their technology. Thus a decision was taken to curtail the project and transfer all funds from this activity to Sub-project 2.

Sub-project 2.: Establishment and Operation of a CFC Refrigerant Recovery and Reclamation Scheme

8. This sub-project comprised activities with two participating enterprises, Spolchemie and Ekotez. Activities consisted of i) conversion of CFC-11 and CFC-12 production facilities at Spolchemie to a reclaim plant and acquisition and installation of 2 other dedicated proprietary reclaim machines (one at Spolchemie, the other at EKOTEZ); ii) provision of associated laboratory testing equipment at both sites; iii) purchase and distribution of recovery machines and cylinders to service technicians; and iv) training of refrigeration technicians. The sub-project was supported by legislation which imposed a US$ 6/kg duty on CFC refrigerant. Despite these actions having been carried out, the scheme has not functioned as designed. The generally

perceived reason for this is that the prevailing value of refrigerants makes them unattractive for service technicians to sell recovered refrigerant to the reclaim centers. The high value of refrigerants was originally a result of the duty levied, but now reflects prevailing World prices of around US$18/kg. Statistical information indicates that approximately 200 tons of recovered CFC-12 are being re-used annually. This amount was supported by the results of an anonymous questionnaire which showed that on average 100 kgs of refrigerants are being recovered and re-used by each service technician. Since all technical facilities for reclaim are now in place, the problem of how to make the scheme work, lies in devising the right incentive to encourage service technicians to sell their recovered refrigerants to the reclaim cente,r rather than re-useing it directly. No obvious solution to this problem exists. Discussions on how to create an appropriate incentive scheme are ongoing. It is acknowledged that the current redemption price of US$6/kg is inadequate given the prevailing US$ 18/kg price of CFC-12. There is evidence that the re-use of unprocessed recovered refrigerants is increasing the rate of refrigeration equipment failures. It is clear that finding a way of making the 3R scheme work properly is a matter of urgency. Due to the lack of enforcement capacity and weak regulatory framework, it is difficult to demand that service technicians use the Spolek or EKOTEZ reclaim centers.

9. The Bank recommends that an estimated amount of CZK 500-600 thousand of central funds should be provided to cover the full operating costs of the reclaim centers for a limited period. This would enable them to offer a redemption price equal to the current selling price of CFC-12 (including other refrigerants) and would enable the reclaim scheme proprietors to know their true running costs. Foreign examples suggest that their current estimates are very high. The reclaim centers would claim running costs up to a certain value retrospectively against demonstrable running costs. Thereafter a competitive situation should develop between the two centers and a real price for recovered refrigerants should emerge from this process. An awareness campaign to encourage technicians will also be useful. It is understood that the reclaim center principals are wary of this because they fear large amounts of CFC-11 will be presented (for which there is no market) but little CFC-12. It is recommended that this campaign be carried out, but that *only* CFC-12, HCFC-22 and R-502 be solicited. It is known that large amounts of CFC-11 (up to 80 tons) are available.

10. The Ministry of Environment currently proposes to incinerate CFC-11 in an incineration facility which is planned at Spolek. An exercise is recommended before this takes place that may obviate this inherently expensive process. It may be that a number of CFC-11 plants are in operation in the Czech Republic and neighboring countries. Many of these may not be capable of economic retrofit but still have a significant service life left. These are all industrial type plants with a service life of around 25 years. A 15 year old semi-hermetic centrifugal compressor plant would be very costly to retrofit with HCFC-123 (the only alternative for these machines) and replacement would be very expensive. Thus if these could be operated normally until the end of their service life, both the expense of premature retirement and the cost of incineration would be avoided. Such machines properly managed use only about 5% of their system charge (of between 0.5 to 2 tons) per year. Thus the 80 tons of CFC-11 thought to be available could theoretically be used to give about 1800 extra machine years of operation merely for the cost of processing the refrigerant. Montreal Protocol rules allow trade with other countries in reclaimed CFC material. Thus neighboring countries (Poland, Slovenia, Hungary,

Slovak) are a potential market for reclaimed CFC-11. It is recommended therefore that both the Czech Ministry of the Environment and the PIU's in these countries be asked to conduct a survey of these plants with a view to establishing whether a potential market for reclaimed CFC-11 exists as described above.

Sub-project 3.: Introduction of non-ODS Refrigerant in the Commercial, Industrial and Refrigerated Transport Sectors.

11. This sub-project essentially involved the development of retrofit methodologies for industrial and transport refrigeration equipment. This was carried out at two enterprises, Thermo King Czech Republic and CKD Kompressory. Retrofit methodologies were developed for standard Frigera transport units produced by the former and widely sold in the former USSR, and two widely used industrial cooling units produced by the latter. These methodologies were verified in the field and the procedures published in technical manuals. The transport refrigeration manual was translated into Russian to facilitate retrofit in the countries of the former USSR. In both cases existing compressors produced by each enterprise were modified for HFC-134a, tested and rated for this refrigerant. The sub-project has proceeded satisfactorily and all actions and disbursements were completed by July 1997.

Sub-project 4.: Introduction of non-ODS Insulation Technology in Coldroom Panel Manufacture.

12. The participating enterprise in this sub-project, Bratri Horakove Ltd. (BHL) is the largest manufacturer of modular coldroom panels in the Czech Republic. During the course of the project, several transitional technologies were used before the present zero ODS HFC-134a/CO2 blowing agent was adopted. Interim technologies employed were the use of a 50% CFC-11 foaming system and the use of HCFC-141b as a blowing agent. The use of HCFC-141b presented some technical problems related to higher foaming temperatures and the need to keep these within a critical range. The higher temperatures caused three foaming plates to buckle and two of these were replaced using spare funds from the project. In addition to the modification of existing production equipment and the purchase of new equipment, a full foam testing workshop was established. A condition of the project was that experience gained in using new foaming agents and the facilities of the test lab were made available to other foaming companies. Good relations have been established with other companies and a seminar held attended by these companies and the major polyurethane foam system and equipment manufacturers. Application of the HFC-134a/CO2 technology continues to present some problems. BHL is requesting support from project funds to finance the solution of this problem, including special testing equipment purchase. Apart from the mould heating equipment required to solve this problem, the investment portion of this project has been completed. Procurement is under way and the sub-project will be successfully completed before the grant closing date.

III. Implementation Completion Report, Recipient's Evaluation of Project Implementation.

13. Five companies who completed the implementation of their respective sub-project have already prepared a draft sub-project completion reports. The World Bank reviewed these reports and found them satisfactory both in meeting the requirements of the ICR and in the way they raised interesting issues related to shifting to and using new ozone-friendly technologies. Bank Guidelines and Directives for the preparation of the Recipient's Contribution to the Implementation Completion Report (ICR) were discussed with the PIU. The Recipient's responsibilities in the preparation of the ICR are indicated in the Bank's Operational Manual Statement and Good Practices (GP) for ICR Preparation. Copies of all relevant parts of the BP and GP were given earlier to the Grant Recipient. As indicated in BP 13.55 and GP 13.55, the Recipient's ICR should include a summary not exceeding 10 pages, together with the supporting background information and annexes.

14. Project Cost and Financing Plan: To enable a comparison of appraisal and actual project costs and financing plans, the Recipient should update the relevant tables of Schedule A, B, C, D and Technical Annex 1. Summary Table of the Project Document.

15. To enable the Bank to complete the draft of Part I of the ICR, it was agreed that the recipient would ensure that information in relation to the grant and technical assistance components indicated in Attachment 2. of this Aide Memoire is sent to the Bank together with the updated ODS phaseout, project costs and financing tables. The Terms of References of the Consultant to assist the PIU and the Bank in the technical, and project objective evaluation is in Attachment 3. of this Aide Memoire.

16. Outputs and schedule: To enable the timely submission of the final ICR, including both the Borrower's and the Bank's parts to the Bank's Board of Directors by September 30, 1998, as required, it was agreed that the following timetable would be followed: the PIU to send the Bank by April 31, 1998 the background information on sub-project components, the updated ODS, project cost and financing tables, the implementation / disbursement schedule, and the summary table of all technical assistance and consultancy components.

17. Coordination of ICR Preparation. The following persons would coordinate the preparation of the Recipient's and the Bank's preparation of the ICR:

For the Recipient: Mr. Jaroslav Koubal, Head of the Project Implementation Unit of the Ministry of Environment
For the World Bank: Ms. Krisztina Kiss

Prague, March 12, 1998.
Krisztina Kiss, Program Team Leader

Attachment 1.

SUPERVISION AND COMPLETION MISSION

March 1998

LIST OF PERSONS CONTACTED

Government of the Czech Republic
Mr. Erik Geuss, Deputy Minister of the Ministry of Environment
Mr. Jiri Dobiasovsky, of the Air Protection Department of the Ministry of Environment,
Mr. Jaroslav Koubal, Head of the Project Implementation Unit

IPB Bank
Mr. Kiril Janatchkov, Head of Branch Office

EKOTEZ
Mr. Frantisek Janda, Director
Dr. Miroslav Benes, Engineer

SPOLEK
Mr. Milos Vanek, Chemical Engineer
Mr. Martin Holub, Marketing Specialist
Mr. Josef Solc, Chemical Engineer

THERMOKING
Mr. Zdenek Kaiser, Director
Mr. Antonin Ryska, Civil Engineer

BHL
Mr. Klement Horak, Owner
Mr. Vaclav Vetrovsky, Civil Engineer

CKD Compressors
Mr. Petr Snapek, Civil Engineer

EKOTRON
Mr. Vaclav Kmoch, Owner

Attachment 2.

Relevant Tables from the Implementation Completion Report

Table 5: Key Indicator for Project Implementation Ozone Depleting Substances Phased Out in Metric Tons (as defined in the Project Document)

Sub-Project	Estimated in FY					Actual in FY					
	'94	'95	'96	'97	'98	'94	'95	'96	'97	'98	Total
1. Engineering Assistance for ODS Production Phaseout											
2. Design and Operation of a 3R Scheme											
3. Thermoking											
4. BHL											
Total:											

Table 7: Studies Included in Project

Study	Purpose as defined at appraisal/redefined	Status	Impact of study
1.			
2.			
3.			
4.			
5.			
6.			

Table 8A: Project Costs

Item	Appraisal estimate (US$ million)			Actual/latest estimates (US$ million)		
	Local costs	Foreign costs	Total	Local costs	Foreign costs	Total
1. Engineering Assistance for ODS Production Phaseout						
2. Design and Operation of a 3R Scheme						
3. Thermoking						
4. BHL						
5. PIU						
6. Others, Financial Intermediary						
Total:						

Table 8B: Project Financing

Item	Appraisal estimate (US$ million)			Actual/latest estimates (US$ million)		
	Local costs	Foreign costs	Total	Local costs	Foreign costs	Total
1. Engineering Assistance for ODS Production Phaseout						
2. Design and Operation of a 3R Scheme						
3. Thermoking						
4. BHL						
5. Others, Financial Intermediary						
Total:						

Attachment 3.

SUPERVISION AND COMPLETION MISSION

March 1998

Preparation of the Implementation Completion Report
Terms of References for
Mr. David Gibson, technical expert for ODS phase-out projects

Since Mr. Gibson (Consultant) was involved in the technical design of the project his services would be used to assist in the preparation of the ICRs.

Introduction:

1. The Czech Republic received SDR 1.7 million grants from the Global Environment Facility for the phaseout of ODS production and consumption in a cost effective manner as mandated by the Montreal Protocol, its amendments and adjustments. An Implementation Completion Report for the Project will need to be prepared within six months from grant closing (closing dates mentioned above, respectively) that assesses the achievements and experiences under the grants and to what extent the project's objectives were met. The Bank would engage the Consultant's services as qualified, experienced, independent consultant to assist in the preparation of the assessments and report preparation.

2. Specific Terms of References (TORs) for the consultant's work are provided below.

Objective:

3. The consultant is expected to assist the Project Implementation Unit (PIU), the participating intermediary bank and the Bank to make a realistic assessment of the environmental impact of the project by means of evaluating the subprojects with the assistance of the PIUs and to prepare all the technical parts of the reports.

Main Tasks:

4. The consultant with the assistance of the PIU will review the subprojects from the aspects of implementation record and performance, technical innovation, use of alternative technologies, benefits, key lessons, problems, ownership characteristics, good practices, what major factors affected the project, project outcome, etc.

5. The consultant with the assistance of the PIUs should collect and analyze data with respect to the evaluation of achieving the project's objectives for each subproject, the whole Project and assess how the project fit in the country program. Wherever possible, cross-checking should be done to ensure that the information provided for project benefits and performance are realistic and consistent.

Outputs and Schedule:

6. The consultant's draft report including all the analysis as above should be submitted to the PIU and the Bank by end of April, 1998. The final report would be prepared after comments by the PIU and the Bank by end of May, 1998.

7. The consultant should make sure that the Bank's Guidelines regarding the preparation of ICRs and the so called ICR and Montreal Protocol macros are all properly taken into account throughout the work.

Appendix B.

Grant recipient's contribution to the Implementation Completion Report
Program Management Unit
Ministry of the Environment of the Czech Republic

Technical Support and Investment Project for the Phaseout of Ozone Depleting Substances [GEF GRANT 28661]

April 1998

CURRENCY EQUIVALENTS
(as of February 4, 1998)

Currency Unit
CZK 34,773 = USD 1

AVERAGE EXCHANGE RATES
Czech Crown per US dollar

1994	1995	1996	1997	1998
28,285	26,545	27,135	31,71	34,43

WEIGHTS AND MEASURES
1 ton (ton)=1,000 kilograms 1 kilowatt-hour=1,000 hours

FISCAL YEAR OF BORROWER
January 1 - December 31

ABBREVIATIONS AND ACRONYMS

BHL	Brothers Horákové
CFC	chlorofluorocarbonated refrigerants
CFC 11	trichlorofluoromethane
CFC 12	dichlorofluromethane
CFC 113	trichlorotrifluoroethane
CKD	Ceskomoravská Kolben Danek a.s., a Czech manufacturer of cooling equipment, participating enterprise
CR	the Czech Republic
CSFR	the Czechoslovak Federal Republic
CSN	Czech State Standard
DIN	German State Standard
EKOTEZ	a Czech manufacturer of recycling equipment, participating enterprise
HCFC	hydrogenchlorofluorocarbonated refrigerants
HFC	hydrogenchlorofluorocarbonated refrigerants
HCFC 22	chlorodifluoromethane
IPB	Investment and Post Bank
MoE	Ministry of the Environment
ODS	ozone depleting substances
PCB	polychlorinated biphenyl
SCHKT	The Refrigeration and Air-conditioning Technology Association
SFZP	the State Environmental Fund of the Czech Republic
Spolek	the firm in charge of the sub-project implementation
IPB	Investment and Post Bank

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Preface

This is the Implementation Completion Report (ICR) prepared by the Recipient for the Technical Support and Investment Project for the Phaseout of Ozone Depleting Substances in the Czech Republic, for which grant GEF GRANT 28661 in the amount of SDR 1,7 million equivalent was approved in April 1994 and made effective on 28 October 1994. The Project was carried out through the Recipient's Ministry of Environment. The Beneficiaries were five participating enterprises in the Project, respectively Spolek Ltd., EKOTEZ, Thermo King CR Ltd., CKD Compressors Ltd. and Brothers Horákové. The implementation of the Project was carried out in parallel with the ongoing transformation process of the national economy and privatization scheme. It was successfully completed irrespective of these circumstances.

The grant was closed on 31 March 1998, almost two years after the original closing date. The project itself begun about six months after the signing the grant agreement due to administration procedures on the side of Recipient. The other delay was the cause of required modification of retrofit sub-project in CKD Compressors and, of lagged behind two other investment sub-projects at EKOTEZ and BHL due to longer time required for the introduction of new non-ODS technology. The GEF original grant amount was unchanged and it was fully disbursed by the end of March 1998. The whole Project was completed when all planned activities were accomplished and individual sub-projects became operational. The scope of co-financing for the project was rather limited and provided by the participating enterprises themselves.

The ICR was prepared by Mr. Jaroslav Koubal, Project Manager of the Program Management Unit/Ministry of the Environment, and reviewed by Ms. Alexandra Orlíková, Director of the External Relations Department of the Ministry.

This Recipient's ICR was drafted after the closing date of the Project. It is based on material in the project file. The Recipient's ICR is based on his own evaluation of the project's execution, views reflecting the implementation progress including legal and environmental requirements of the Czech Republic and international commitments of the country .

Evaluation Summary

1. Introduction

The fundamental objective of the State Environmental Policy was systematically improvement the quality of the environment in the Czech Republic and thus contribute towards the solution of global environmental problems. The main objective of the Country Program was to limit health and environmental hazards and, inter alia, incorporate environmental costs into production processes and begin integrating the principles of environmental protection into social and economic activities.

The process of economic transformation contributed, by the removal of the centrally planned economy, to the ongoing process of the revival of market economy, to the restructuring of industrial sectors towards production processes which were less demanding on energy and natural resources, and to the improving of the environment. The GEF grant linked external support and the internal objectives of the State Environmental Policy to help meeting international commitments of the country to protect ozone layer of the Earth.

2. Project Objectives

This Project was the first comprehensive and planned ODS phase-out program which was launched in the Central and Eastern Europe. The objective of the Project was structured based on specific ODS phase out requirements in the Czech Republic and according to the Country Program. The main objective of the Project was to support the Czech Republic's effort in the phasing out the production and consumption of ozone depleting substances in a cost effective manner by the year 1996 as mandated by the Montreal Protocol. Further, the Project expected to contribute to the national objective to reduce ODS consumption, and during the implementation of 3R scheme in the refrigeration sector. The Project would reduce emissions that originate during servicing the refrigeration and air conditioning equipment in the commercial, industrial and transport sectors. The Project consisted of four investment sub-projects that aimed at introducing the environmentally friendly technologies while using substitutes for CFCs.

3. Achievement of Objectives

In the most crucial areas important achievements were obtained. The basic legal and economical infrastructure was put in place. In 1995, in compliance with the Montreal Protocol and Copenhagen Amendments, the Czech Republic passed the new law to protect ozone layer of the Earth. The production of CFCs was terminated as at January 1, 1996 in the largest chemical plant at Spolek. Thanks to the Project new non-ODS technologies were successfully introduced as envisaged through individual sub-projects.

Refrigerant and reclaim scheme was established and recovery network put in place. The training program for technicians, addressing updated techniques of refrigerant recovery and retrofit was substantially carried out. Tens of courses took place and more than 2000 refrigeration technicians were trained and re-trained. The course content is incorporated in the

syllabus of the apprenticeship school. The new retrofit methodology for chilling compressors was developed and verified in practice. The retrofit carried out for transport refrigeration equipment successfully replaced the existing CFC refrigerants with HCFC refrigerants. On the other hand, the results were blended due to unsatisfactory operation of the national network for recovery/recycling /reclamation (the 3R scheme), were larger amount of waste refrigerants was originally expected to be reclaimed.

4. Major Factors Affecting the Project

The rehabilitation of the environment and ongoing transformation process of the national economy were the positive factors in the course of the Project implementation. Market economy was the driving force and the challenge for the participating enterprises to survive and thus major factor for successful participation in the Project. New regulatory framework adopted by the government to protect ozone layer following the Montreal Protocol provisions played a decisive role. On the other hand lack of enforcement capacity and undeveloped supervision system and monitoring with respect to the waste refrigerants market on the both sides of SCHKT and SFZP led to the situation that the 3R scheme is not yet functioning properly.

5. Project Sustainability and Future Operation

The investment activities and achieved objectives led to the establishment of a long-term technologically advanced background to phase out CFCs in refrigeration equipment which would likely remain in operation for another 5-10 years, at least. With respect to the 3R scheme the up-dated technology will continue to be used to handle, recover and reclaim current substitute substances (HCFCs) in the future. In addition, requirements for the improvement of environment supported by regulatory framework will provide favorable conditions for the broader utilization of advanced technology introduced under the Project. Commitments of participating enterprises are well known. Some enterprises are strongly motivated to demonstrate the success of the Project because of ownership interests as long as the advanced technology and experience gained remain competitive. However, due to the orientation of Spolek on the production of chemicals in large scope, likely more critical is the commitment of the company to maintain the 3R scheme in operation for a longer term if only limited amount of waste refrigerants will be recovered in the future. This part of sub-project will depend, to some extend, on the profitability of the purification of waste refrigerants. Additionally, future decision on financial incentives from the state budget to support the construction and operation of a new CFC incineration plant will play important role.

6. The Bank and Recipient Performance

The Bank's performance in all aspect of the project cycle was excellent. There were no deviations in Bank policy or procedures in the course of project implementation. The supervision was adequate to the project size. The Bank team was successful in providing technical assistance to the grant Recipient and participating enterprises to coordinate the project activities and utilize the proceeds in the cost effective manner. The overall performance of the

Recipient and in particular Program Management Unit concerned was satisfactory and appropriate in all phases of the project cycle.

7. Assessment of Outcomes

The original project was designed as an investment program for a period of two years, 1994-1996. About 85% of the total USD 2,3 million program was intended to support the introduction of non-ODS technology in the manufacturing programs and phasing out production of CFCs. The actual grant program financed expenditures at five participating enterprises to procure variety of equipment and advanced technologies, to develop new techniques of refrigeration both in the industrial and commercial sectors, and a small amount to technical assistance. The investment expenditures at the participating enterprises improved the optimization of technological processes and contributed to substitute ODS in the manufacturing of products through technology transfers. In addition, minor savings of CO2 and energy were achieved through the higher level while utilizing of propylene used as the raw material for the production of PCE and CTC. Further, the specific training program was developed and applied in practice focusing on the use of ODS advanced equipment and techniques to eliminate ODS emissions during the servicing of refrigeration and air-conditioning systems.

The actual costs did not exceed the planned budget due to the strict procurement procedures and fair implementation. However, due to some difficulties, e.g. privatization process and unclear property rights, needs for the long-term testing of new technologies and requirements for the successful completion of some sub-projects, resulted in several short-term extensions of the Project.

Newly established market economy was the driving force to achieve the planned objective of the project. The consequence of increasing competition squeeze led to rise the awareness of the participating firms to comply with the new requirements of the domestic market. The achievement of targeted objectives of the Project paved the way keep pace with the local and foreign competitors.

However, certain shortcomings affected the implementation of the project. In particular, the 3R scheme is concerned when existing legal and regulatory framework including enforcement capacity lag behind the expectations of the reclamation centers and the Recipient to prevent some unfair marketing of waste refrigerants.

Successful implementation of the Project resulted in a series of workshops organized by participating enterprises (EKOTEZ, BHL, Spolek) in co-operation with MoE. It appeared that there was an enormous interest among producers and users of CFCs and CFCs substitutes in participating in these workshops. Therefore, majority of workshops were held as international ones. At the end of the Project the MoE organized two workshops. An international workshop in particular for Slovenia, Poland, Hungary and Belarus, which are currently implementing ODS projects under GEF assistance, to extend experience of the Czech Project. A local seminar to present the results of the Project in a broader scope, and to promote public awareness with respect to the protection of the ozone layer.

8. Key Lessons Learnt

Based on the experience gained during the implementation of the Project the key lessons learnt are:

(i) more attention should be given to the regulatory framework in the refrigeration sector including the tools of enforcement
(ii) legal/regulatory framework and economic stimuli should be taken into account to ensure an appropriate coordination of environmental activities
(iii) as an alternative of the 3R centralized scheme a mobile equipment for the purification of used refrigerants could be used
(iv) public awareness will be increasingly the most decisive factor for the satisfactory completion of a project while ensuring the support of the lay and professional public to support project implementation

Part I: Project Implementation Assessment

A Achievements of Objectives - Sub-projects Description

In fact the Project was a 3 year program the principal objective of which was to assist the Czech Republic in the phasing out of ODS production and consumption in a cost effective manner. The original project design assumed to phase out 2000t/y of ODS production while terminating the manufacture of CFCs. In addition, 190 t/y of ODS were to be reduced due to the introduction of new non-ODS technology at manufacturing programs. The Project included following components:

a) Engineering assistance for ODS production phase out
b) Establishment of 3R scheme and collection system plus Establishment of training scheme for servicemen
c) Introduction of non-ODS refrigeration technologies in the industrial, commercial and transport sectors
d) Introduction of non-ODS insulation technologies in cold room panel manufacturing

B. Achievements of Objectives - Sub-projects Description

a) Sub-project 1: Engineering Assistance to Spolek
(Spolek pro chemickou a hutní výrobu, 400 32 Ústí nad Labem, Revolucní 86)

Spolek produced CFC-12, 11 and 113 from CTC, which is itself a by-product of a percloroethylene and epichlorhidrine manufacturing process that is a component in the manufacture of epoxide resins. Originally Spolek had planned to convert their CFC-12 and CFC-11 production to HFC-134a and/or HCFC-22. A study was proposed under the project that would carry out a marketing and feasibility study to determine whether this was a sound business

decision and to identify a potential technology supplier for HFC-134a production. It became obvious before any work was carried out that there was excess HFC-134a production capacity world-wide, and that Spolek's original plan was no longer sound. Funds intended for this study were thus diverted to sub-project 2, in which Spolek also participated.

Spolek is in the process of implementing plans to convert the CFC-113 production process as planned. CTC production has been cut from 2,000 to 500 tons per year as a feedstock for chloroform production. This is the minimum economical production level for this material.

b) Sub-project 2: Refrigerant Recovery and Reclaim Scheme
(EKOTEZ, 133 00 Praha 3, Konevova 47)

This project was based at Spolek (above) and EKOTEZ, a distributor of imported refrigeration components and manufacturer of refrigerant recovery machines. It involved i) the conversion of part of Splek's CFC-12 and CFC-11 production facilities to a reclaim plant and the acquisition of two dedicated reclaim machines ii) the establishing of testing facilities at both enterprises for reclaimed refrigerant, iii) the purchase of 2,000 recovery machines and cylinders for refrigeration technicians and iv) the organization of a training course for refrigeration technicians. Successful participants on this course are issued with a so-called "green card" stating they are qualified to carry out refrigerant recovery and handle new refrigerants. Though there is currently no legal requirement for a technician to hold this certificate, it is anticipated that such a regulation may form part of a future technician licensing scheme.

Some technical difficulties were encountered with this project. Gas Chromatograph equipment supplied as part of the testing equipment was found to be very sensitive to adjacent chemical and sewage emissions and an air conditioned clean room had to be constructed to house this equipment. The operation of the first dedicated reclaim machine was not satisfactory. Repeated operation of the cleaning cycle were required to achieve required purity levels, and the filters were observed to have a very short life - factors that would negatively affect the reclaim center running costs. A different reclaim machine has been procured for the second reclaim center at Ekotez' premises and performance of this appears to be satisfactory.

The principal problem with the 3R scheme is non-compliance by refrigeration technicians. Only about 6 tones has been recovered to date, yet macro statistics suggest that about 200 tones per year is being recovered and directly re-used. An anonymous questionnaire showed that an average of 100 kgs. being collected per year by each technician. It is assumed that this refrigerant is short-circuiting the reclaim facility. The reason is thought to be the high value this refrigerant has acquired. This was originally the result of a refrigerant tax imposed to encourage the recycling of refrigerant, but is now reflects the high prevailing world price of around $US 18/kg. Larger amounts of CFC-11 have been presented for reclaim (about 20 tons) and it is known that at least a further 60 tones can be easily obtained. Unfortunately there is no immediate market for reclaimed CFC-11.

c) Sub-project 3: Introduction of Non-ODS Refrigerants in the Commercial, Industrial and Refrigerated Transport Sectors
(Thermo King Czech Republic, 150 00 Praha 5, Ostrovského 34)
(CKD DUKLA, 190 02 Praha 9, Klecákova 1947)

This sub-project comprised activities at two companies, namely Thermo King (originally the Czechoslovak company Frigera), and CKD. The former makes truck refrigeration units and operates an environmental test chamber for commercial vehicles; the latter makes industrial compressors. Both enterprises exported their products to the USSR in former times.

Both projects involved the development of retrofit methodologies for retrofitting their cooling equipment to non-ODS substitute refrigerants. Thermo King test chamber was retrofitted using a "drop-in" CFC-12 replacement that though not a CFC as such, possesses a small ODP. There are no plans to eventually replace this transitional HCFC fluid (MP-66 from Dupont US) which was used to avoid the considerable cost that retrofitting to HFC-134a would have entailed owing to the age of the equipment and complicated circuitry involved.

Thermo King developed HFC-134a retrofit methodologies for their truck refrigeration units which were widely exported to the former USSR. These have been tested and verified in the field. Instructions for carrying out retrofit have been published in a manual available in Russian as well as Czech and English. The impact of this project will likely extend to GEF funded service sector projects in other countries such as Bolarus, Ukraine and the Russian Federation. The Thermo King component proceeded very much as planned.

The CKD component was changed during implementation, however. They had planned to retrofit two large utility heat pumps. This was changed when the ownership of these facilities changed and a new management team at CKD changed and took a fresh look at the sub-project. As a result retrofit methodologies were developed for their popular KBP (300-600 kW) and CJ (509-150 kW) reciprocating cooling units. The impact of the sub-project will be greater than with the original plan because many examples of this equipment are in use in the Czech Republic as well as other Eastern Bloc countries. Retrofits of both equipment types were verified in the field using a data logger purchased under the project. In the Czech Republic alone the "park" of refrigerant contained in these systems is estimated at 280 and 100 tons of CFC-12 respectively. These amounts will eventually become available for recovery.

d) Sub-project 4: Introduction of non-ODS Insulation Technologies in Cold Room Panel Manufacturing
(Bratri Horákové, 277 06 Luzec nad Vltavou, Melnická 150

This sub-project was based at Bratri Horákové Ltd. (BHL), at he largest manufacturer of modular panels for cold room construction in the Czech Republic. The original project design was modified somewhat as implementation progressed. The ultimate phase out solution had not been identified in the original project design as it was recognized that future technical developments were likely to invalidate any choice made at that time. It was proposed initially

that 50% CFC-11 foaming technology be introduced first, followed by the transitional foaming agent HCFC-141b, to be followed in turn by an appropriate zero ODS foaming technology. The project involved acquisition of High Pressure foaming equipment, equipping molds with heaters and the setting up of a comprehensive foamed panel testing laboratory that would be available for use by other foaming companies.

The 50% CFC-11 process was successfully introduced, but its replacement with HCFC-141b technology entailed some technical problems related to the higher temperatures reached during the foaming process by comparison with CFC-11 processes. Three foaming beds warped as a result of exposure to these higher temperatures; two of these were replaced with spare funds from the project. BHL have selected a blend of HFC-134a and CO2 as the final choice of zero ODS foaming agent. This is a proven technology for panel foaming. BHL use polyols supplied by the principal European manufacturers such as BASF and Enichem for this purpose, and source the blowing agent locally from Tannex, a Czech company.

Problems have been encountered in maintaining temperatures within a critical range in all parts of molds during foaming. More funds have been requested for equipment to control this effectively. The conductivity of the foam produced using the HFC-134a/CO2 blend is about 8% higher than that of the original CFC-11 blown foam. This means that the panels have to be made correspondingly thicker to offset an increase in the energy consumption of cold room equipment. The extra thickness has led to an increase in the price of the panels.

The original CFC-11 foaming procedure was very wasteful of foam. About 25% of the foam used was wasted because molds had to be overfilled to ensure even distribution. Greater attention paid to foaming techniques with the adoption of the new technologies has led to a considerable reduction in this wastage. Disposal of these foam off cuts, especially those left over from CFC-11 foaming, is a problem. It is anticipated that these can be disposed of at a domestic refrigerator disposal facility that will be funded by the MoE.

C. Assessment of Outcomes

CFC's used as refrigerants and polyurethane foam blowing agents were phased out at three enterprises. A refrigerant recovery and reclaim (3R) scheme was organized at two other enterprises with a view to recycling as much refrigerant as possible and thereby reduce the demand for new refrigerant. An account of each sub-project is given below.

One project (sub-project 1) comprised a feasibility and engineering study to assist the country's only CFC producer (Spolek) to convert its CFC-12 and CFC-11 production to HFC-134a and HCFC-22. It became obvious before the study was commissioned that such a strategy did not make business sense because of the over-production of these refrigerants world-wide and the fact that no HFC producer was willing to license their technology to Spolek. Thus this sub-project was canceled and funds re-allocated to the 3R scheme (sub-project 2).

In general the remaining projects have been successfully completed, with the exception of the 3R scheme which is not yet functioning properly. In one sense, the objective of this project

has been met. During the first year of operation, the net demand for new CFC-12 dropped by about 200 tonnes, nearly 30% of the country's consumption for refrigeration purposes. This is an exceptional reduction by world standards. Unfortunately this refrigerant is not being processed through the reclaim centers set up to restore this refrigerant to its original specification. It appears that refrigeration technicians are directly re-using the refrigerant they collect. It is thought that this practice is causing an increase in the frequency of refrigerant equipment failures and imposing an unnecessary economic cost on the country. The reason of this practice is thought to the high value CFC-12 has acquired by comparison with a the price offered for recovered refrigerant by the reclaim centers. The current value of CFC-12 has reached $US 22 (including VAT) while the reclaim centers are currently offering only $ 6/kg.

Small amounts of HCFC-22 will continue to be used at the truck testing facility at Thermo King Czech Republic in the form of the major component of a proprietary blend (MP-66 from Dupont). This is not a CFC as such, but does possess small ODP of about 0.03. It was decided to use this option because the refrigeration system in question was fairly old. Use of a zero ODS refrigerant such as HFC-134a would have required the whole system to be disassembled and thoroughly cleaned, and this would have been expensive. Conversion using this so-called "drop-in" refrigerant was achieved at far less expense. The capacity and energy efficiency of this system were found to have improved by about 8% following conversion.

The retrofitting of this equipment was a small part of sub-project 3 which was primarily concerned with developing and testing retrofit methodologies for i) transport refrigeration equipment (at Thermo King) and, ii) for industrial cooling equipment at a compressor manufacturer, CKD. These both components proceeded according to plan and were successfully concluded in July 1997.

Substitution of CFC-11 used as a blowing agent at Bratri Horovace Ltd. (BHL - sub-project 4) encountered some technical difficulties that complicated somewhat the original sub-project design. This project is now complete though the inferior thermal performance of the new insulating foam by comparison with the original CFC-11 blown foam has required the insulating panels to be made thicker, with an attendant cost increase.

D. Key Lessons Learnt from the Project

Some technical lessons were leant in sub-project 4. New processes were found generally to be more difficult than the original CFC-11 foaming procedure. It was also found that a polyol supplier's word could not be trusted with regard to the structural and thermal performance of foam made with his product. Careful testing was found to be vital in maintaining the quality of foamed panels. All sub-projects are considered to have been successfully implemented with the exception of sub-project 2, the 3R scheme.

The non-compliance of refrigeration service technicians with this scheme is thought to be due to the high value acquired by CFC-12 and the relatively low price paid for contaminated CFC-12 by the reclaim centers. This encourages technicians to re-use the refrigerant directly and keep a high proportion of its value for themselves. CFC-12 refrigerant originally acquired a

relatively high value when the government imposed duty raised its price from about $US 2/kg to $US 8/kg. The high reduction in overall refrigerant use dates from this period. Had it been possible to vary this duty easily, a level might have been found which both encouraged technicians to recover refrigerant and sell it to the reclaim centers.

Lessons learned can be summarized as follows:

i) Financial incentive is far and away the most important factor in encouraging compliance. It should be noted that large amounts of CFC-11 have been reclaimed to date for which there is no apparent market. About 20 tones have been reclaimed and a further 60 tones have been offered to the reclaim centers who have refused this refrigerant which is used only in large centrifugal cooling machines.
ii) Duty levels should be easily variable (e.g. by ministerial decree) enabling the price of CFC refrigerant to be controlled with respect to other refrigerants. Successive duty changes in the Czech Republic required approval by Parliament making it impossible to "fine tune" in response to prevailing conditions.

E. Recommendations

It is recommended that funds be provided to cover the full operating costs of the reclaim centers for a limited period. This would enable the centers to offer a price at or near the current market price for new CFC-12. Foreign examples suggest that the true operating costs of the centers when operating normally should be a maximum of $US 2/kg only-. Once in full operation, the centers' proprietors should be able to know their true costs and be able to offer a redemption price for recovered refrigerant far closer to its true value than at present. This should be carried out in conjunction with a campaign aimed at technicians, advertising the new rates paid but soliciting only CFC-12, R-502 and HCFC-22. Thereafter the fact that two reclaim centers will be competing for recovered refrigerant should enable a competitive price to emerge for recovered refrigerant. The operation of the reclaim centers should then become self-sustaining.

The problem of what to do with CFC-11 has no obvious solution other than eventual incineration at an appropriate incineration facility. The building of such a facility at Spolek is currently proposed, financed with money from the SFZP. Incineration, in some respect, could be viewed wasteful. Before this is carried out, it should be determined that no market for CFC-11in fact exists. If there are elderly CFC-11 centrifugal plants still in operation in the Czech Republic, the CFC-11 being offered (itself emanating from retrofitted plants) can be offered to operators of these plants. It would be cost effective for them not to have to retrofit or replace plants of say 15 years of age, if supplies of enough CFC-11 can be guaranteed by the reclaim centers to enable them to complete their useful life of about 25 years.

Part II: Attachments: Statistical Annexes

Table 1: Original Project/Sub-Project Implementation Schedule

Planned Date of Signature			August 1994
Planned Date of Effectiveness			October 1994
Sub-project 1	Engineering Assistance for ODS Phaseout	Spolek	By December 1994
Sub-project 2	Design and Operation of 3R system		
	Establishment of Reclamation Center	Spolek	by December 1994
	Establishment of Training Center	Vocational School, SCHKT, EKOTEZ	By December 1994
	Establishment of Collection Network	EKOTEZ	1994-1996
	Collection and Recycling of Refrigerants		1994-1996 and Thereafter
Sub-project 3	Introduction of non-ODS Refrigeration Technologies in the Commercial Industrial and Refrigeration Transport Sectors		
	Redesign of Open Drive Compressors	Thermo King	December 1994
	Retrofit of Industrial Cooling Systems	CKD Compressors	June 1995
	Conversion of Test-facilities to Non-ODS Technology	Thermo King	By December 1995
	Preparation of Technical Manuals	Thermo King CKD Compressors	By December 1995
Sub-project 4	Introduction of Non-ODS Insulation Technologies in Cold Room Panel Manufacturing	BHL	By October 1995
Sub-project 5	Assistance to the Project Management Unit		1994-1996
Expected Date of Completion			June 1996

Table 2: Original Project/Sub-project Implementation Schedule - Technical Summary

Sub-project Title	Participating Enterprise	Ownership	Sub-project Impact	Type of ODS Produced/ Used	Sub-project Costs mil. USD	GEF Grant mil.USD
Sub-project 1 Engineering Assistance for ODS Production Phaseout	Spolek	State	Termination of ODS Production 2000t/yr	CFC-11 CFC-12 CFC-113 CTC	0,080	0,080
Sub-project 2 Establishment of 3R scheme and collection system Establishment of Training scheme for servismen	Spolek, EKOTEZ, Association of Refrigeration Servicemen, Vocational School Center	State and Private	Recycling of up to 200 t/yr of refrigerants R11 and R12	CFC-11 CFC-12	1,340	1,040
Sub-project 3 Introduction of non ODS Refrigeration Technologies in the Commercial Industrial and Transport Sectors	Thermo King CKD	Private	Phaseout of 110 t/yr of R 12	CFC-12	0,464	0,464
Sub-project 4 Introduction of non-ODS Insulation	BHL	Private	Phaseout of over 80 t/yr	CFC-11	1,911	0,363

Technologies in Cold Room Panel Manufacturing			of R11			
Sub-project 5 PMU	Project Management Unit, Ministry of Environment				0,300	0,300
Financial Intermediary Fee (2.72% of Sub-project 1-4)	Investment and Post Bank				0,053	0,053
Total					4,148	2,300

Table 3: Sub-project 1 - Implementation progress

Year	1 993	1 994	1 995
Activity	1. Design of original project concept 2. Marketing research regarding CFC substitutes 3. Negotiations with foreign CFC producers to obtain know-how for production of CFC substitutes 4. Beginning of research works and semioperational production of CFC conversion	1. Negotiations with foreign producers to procure know-how for CFC conversion 2. Evaluation of potential alternatives of HCFC production 3. Taking decision on optimal strategy to terminate production of CFC and CTC 4. Contract on project financing	1. Termination of CFC production 2. Proposal to transfer funds under sub-project I to sub-project II. Transferred funds used to cover extra costs of the optimizing production of PCE and to reduce by-production of CTC

Table 4: Sub-project 2 - Implementation progress

Year	1 994	1 995	1 996	1 997
Activity Spolek	1.Preparation of the sub-project concept and documents for country and land planning and building license 2.Beginning of building approval process 3.EIA comment and approval according to the Act 244/92 4. Contracting activity started up	1.Completion of operational design and submission of application for building permit 2.Preparation of the tender dossier and launched call for bids 3. Evaluation of bids and selection of general supplier 4. Conclusion of the contract 5. Call for bids and selection of winners for supplies made directly by Spolek 6.Beginning of construction works 7.Completion of construction works 8.Installation of equipment 9.Trial operational of equipment and auxiliary 10. Construction prepared for the Inspection by local authority	1.Inspection approved by local authority 2.Trial tests of technology and beginning of operation 3.Claims charged to supplier to put away malfunctions 4.Marketing activities, public arising campaign 5.Based on trial and operational running the authority issued approval for CFC reclamation system	1.Operational running completed of the whole reclamation facility 2.Long-term approval issued for current operation 3. Marketing campaign to continue based on offered redemption price of used refrigerants of up to 150CZK/kg

Year	1 994	1 995	1 996	1 997	1 998
Activity EKOTEZ	1.Preparation of the sub-project activity in cooperation with SCHKT 2.Sales of recovery equipment to engineers and servicing firms	1.Sales of recovery equipment to be continued 2.Preparation of waste refrigerant collection network 3.Preparation of the training system of refrigerant engineers	1.Training system launched and operational 2.Preparation of recovery, recycling reclamation scheme 3.Preparation of tendering documents 4.Procurement of equipment 5.Internat.workshop	1.Training and retraining system to be continued 2.Procurement of equipment 3.Construction works to build up facility for reclamation capacity and refrigerant storing 4.Installation of reclaim machine	1.Trial operation of reclaim machine including testing of the whole 3R scheme 2.Technical assistance to improve 3R scheme 4.International workshop 5.Procurment of auxiliary equipment

Table 5: Sub-project 3 - Implementation progress

Year	1 994	1 995	1 996	1 997
Activity Thermo King	1.Simple refrigeration unit with new refrigerant R134a for East-European markets. 2.Retrofit method development	1.Simple refrigeration unit with new refrigerant R134a for East-European markets. 2.Retrofit method modification 3.Reconstruction of testing laboratory for transport refrigeration.	2.Retrofit method tests 3.Reconstruction of testing laboratory for transport refrigeration.	1.Information booklet for customers and service personnel.

Year	1 996	1 997
Activity CKD	1.Establishment of specialized workshop for retrofit 2.Identification and procurement of chilling equipment. 3.Procurement of materials and components.	1.Completion of retrofit methodology. 2.Verification of retrofit methodology. 3.Testing of retrofitted units. 4.Evaluation of retrofit system 5.Information brochure-draft and production

Table 6: Sub-project 4 - Implementation progress

Year	1 994	1 995	1 996	1 997	1 998
Activity	1.The first steps to introduce PUR technology with decreased consumption of CFCs. 2.Modification of production lines for adoption of non-ODS technology 3.Placement of technological equipment for final products.	Item 1 to be continued. Completion of item 2. Item 3 to be continued, tests and modifications. 4.Design and establishment of the laboratory room.	Item 1 completed. Item 3 completed. Item 4 to be continued. 5.Tests of new products	6.Tests and modification of non-ODS production line, technology and products. 7.Completion of the laboratory equipment, evaluation of laboratory methodology and tests of products.	8.Modification of production line-heating and regulation system 9.Procurement of equipment for the production line and laboratory

Table 7: Project Costs/Financing

	Appraisal estimate ($ thousand)			Actual ($ thousand)		
Item	Local costs	Foreign costs	Total	Local costs	Foreign costs	Total
Sub-project 1		80	80	50		50
Spolek						
Sub-project 2		1040	1040	114	963	1077
Spolek		230	230	18	212	230
EKOTEZ		810	810	96	751	847
Sub-project 3		464	464	143	349	492
Thermo King		210	210	121	143	264
ČKD		254	254	22	206	228
Sub-project 4		363	363	78	554	632
BHL						
PMU (including financial intermediary)		353	353	38	542	580
Total		2 300	2 300	423	2408	2831

Table 8: Studies Included in Project

Study	Purpose as defined at appraisal/redefined	Status	Impact of study
12/95/OZONE J.Petrák CR	Sub-project 3 CKD Component Develop retrofit techniques	Implemented	Technical assistance to CKD to modify sub-project to overcome difficulty in implementing the original project concept
13/95/Ozone V.Řeháček CR	GEF Vienna Conference technical & advisory support to the Czech delegation	Implemented	Compliance of the CR with the Montreal Protocol and its Amendments, consequent impacts on the Project
TA/GEF/JP E+E Consulting CR	GEF Projects services for the organization of the seminar	Implemented	Environmental policy coordination program in the field of air protection and ozone layer
TA/PIR/11/96 V.Řeháček CR	ODS Phase-out Project technical assistance to the participating enterprises	Implemented	Review of the implementation progress of individual sub-projects, preparation of sub-projects' progress reports
TA/ODS/12/97 Refrigerant Product UK	Technical assistance to sub-project 2 (recovery, recycling, reclamation)	Implemented	Improvement of the 3R scheme
TA/ODS/O2/98 Dewpoint Consultants UK	Technical assistance to MoE/PMU	Implemented	Preparation of ICR, consultancy services to the international workshop

Table 9: Workshops Included in Project

Project/Sub-project	Activity	Date	Venue
Sub-project 2	Up-dated technology for ODS handling, regulatory framework	May 1996 International workshop	Kostelec nad Orlicí
Sub-project 4	ODS free technology in the manufacturing of could room panels and insulation foams	October 1997 International Workshop	Prague Lužec nad Vltavou
ODS Phase-out Project	Environmental policy coordination program/air & ozone layer protection	March 1997 International workshop	Luhacovice
ODS Phase-out Project	Czech ODS Project	March 1998 International workshop	Prague
ODS Phase-out Project	Czech ODS Project	March 1998 Local seminar	Prague

Table 10:ODS Phased out in tons

	Estimated in FY					Actual in FY					
	'94	'95	'96	'97	'98	'94	'95	'96	'97	'98	Total
sub-project 1			2 000	2 000	2 000		377	2 493	2 149	2 020	7 039
sub-project 2		200	200	200	200	757	374	781	270	22	2 204
sub-project 3		110	110	110	110		5	2	1		8
sub-project 4		80	80	80	80		82	31	31	4	148
Total		390	2 390	2 390	2 390	757	838	3 307	2 451	2 046	9 399


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Vltava
JIHOCESKY
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Brno
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