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EXECUTIVE COMMITTEE OF
THE MULTILATERAL FUND FOR THE
IMPLEMENTATION OF THE MONTREAL PROTOCOL
Forty-second Meeting
Montreal, 29 March - 2 April 2004

PROJECT PROPOSALS: DEMOCRATIC PEOPLE'S REPUBLIC OF KOREA

This document consists of the comments and recommendations of the Fund Secretariat on the following project proposals:

Production

• Verification of complete closure of all methyl chloroform (MCF) and CFC-113, CFC-11 and CFC-12 production facilities in the Democratic People's Republic of Korea	UNIDO

Refrigeration

• Sectoral phase-out in domestic refrigeration sector by conversion of refrigeration and compressor manufacture at 5th October Electronic and Automation Company (second tranche)	UNIDO

VERIFICATION OF COMPLETE CLOSURE OF ALL METHYL CHLOROFORM (MCF) AND CFC-113, CFC-11 AND CFC-12 PRODUCTION FACILITIES IN THE DEMOCRATIC PEOPLE'S REPUBLIC OF KOREA (DPRK)

PROJECT DESCRIPTION

1. At its 36th Meeting in 2002, the Executive Committee approved the amended agreement for the phase-out of the ODS production sector in the Democratic People's Republic of Korea (DPRK) at an agreed-in-principle funding level of US $2,566,800. This would provide for the permanent closure of the production of CFC-11, CFC-12, CFC-113, carbon tetrachloride (CTC) and MCF, and the dismantling of the relevant production facilities. The agreed level of funding would be paid out according to the following schedule upon the submission of the independent verification report on the permanent closure of the relevant ODS production and dismantling of the production facilities and the Executive Committee's approval of the same.

Schedule of closures and disbursement

Processing facility	Time of closure	Time of verification	Level of disbursement	Time of disbursement
CFC-113	May 2001	August 2001*	687,700	Upon satisfactory verification of permanent closure of the CFC-113 production and dismantling of the production facility.
Methyl Chloroform	May 2001	August 2001*	656,650	Upon satisfactory verification of permanent closure of the methyl chloroform production and dismantling of the production facility.
CFC-11/12	2003	2003	733,700	Upon satisfactory verification of permanent closure of the CFC-11/12 production and dismantling of the production facility.
CTC	2005	2005	488,750	Upon satisfactory verification of permanent closure of the CTC production and dismantling of the production facility.
Total			**2,566,800**	

* Verified by Wakim Consulting during the technical audit and to be confirmed by UNIDO.

2. Accordingly, UNIDO, the implementing agency of the project verified the closure of the CFC-113 and MCF production and the dismantling of the related production facilities in July 2002, and of CFC-11 and CFC-12 in December 2003 respectively and submitted reports on the findings of the missions. A summary of these reports is presented below.

Verification of the dismantling of the production facilities of CFC-113 and MCF

3. The verification was carried out in July 2002 by a consultant from the United Kingdom with background in chloro-fluorine industry. The report started with a brief description of the production process of CFC-113 and MCF and a list of the major items of equipment. The site visit provided an eye witness account of what remained after demolishing the major equipment of the 500 tonnes/year CFC-113 unit and 1,000 tonnes/year MCF unit, including storage tanks, reactors, a distillation tower and other parts. There was also a list of equipment which had been salvaged for reuse in other factories, such as motors and valves. The verification consultant also visited the users of CFC-113 and MCF and was satisfied that these users had already switched to CTC as a solvent.

4. The consultant took advantage of being in the plant and took photos of the major items of equipment for CFC-11, CFC-12 and CTC production to be used as the baseline for the 2003 and 2005 verification of closure of CFC-11/12 and CTC production. The report also provided the work plan for 2003, which had been agreed upon with the ODS producing plant.

5. The report concluded that DPRK had complied with the requirement of the Agreement by permanently closing CFC-113 and MCF production and dismantling the production facilities. Attached to the report were the CFC-113 and MCF process charts, photos of the dismantled sites and the remnants of the major items of equipment, the major items of equipment relating to CFC-11 and 12 and to CTC production. The report, without the photos, is attached. The photos could however be made available upon request.

6. Upon completion of the verification exercise UNIDO released to the Government of DPRK the US $1,344,350, which had been disbursed to UNIDO at the time of approval of the Agreement in 2002.

Verification of the dismantling of the CFC-11 and CFC-12 production facilities

7. The same consultant carried out the verification of the dismantling of the CFC-11 and CFC-12 production facilities in December 2003. The report started with a brief description of the ODS production sector in the country as background and the CFC-11 and CFC-12 production in 2003 before the facility was shut down. The production of CFC-11 and CFC-12 in 2003 was double that in 2002 (2002: CFC-11=64 ODP tonnes; CFC-12=235 ODP tonnes; 2003: CFC-11=109 ODP tonnes; CFC-12=478 ODP tonnes). The report then described the process of dismantling the plant, as witnessed by the consultant on the scene. Production ceased on 9 December 2003 and dismantling work started on 11 December while the consultant was there. By the time that the consultant left on 13 December major pieces of the facility such as reactors, columns for manufacturing catalyst, CFC rectifying columns, and storage vessels had been destroyed or were being destroyed, and the process continued after the mission left. Some of the equipment such as valves, pipes and electric motors were used elsewhere. Pictures of the facility before and after the dismantling were taken and attached to the report.

8. The report concluded that the key components had been destroyed and there was no realistic possibility that the facility could return to operational status.

9. The rest of the report provided information on the planned CFC substitutes, the refrigerant management plan and the foam sector. There was also a work plan for verification of the closure of the CTC production facility targeted for 2005. Finally the submission requested the release of the next tranche of US $733,700 due upon the successful implementation and verification of the dismantling of the CFC-11 and CFC-12 facilities, as per the Agreement.

10. There are 7 annexes to the report: Annex 1--Terms of reference for the verification; Annex II--The Agreement for the phase-out in the ODS production sector in DPR Korea; Annex III--Inventory of CFC-11/12 plant equipment; Annex IV--Schematic of CFC-11/12 plant; Annex V--CFC-11/12 plant site before dismantling (pictures); Annex VI—CFC-11/12 plant during start of dismantling (pictures); CFC-11/12 plant site, continuation of dismantling and destruction (pictures). The report is attached together with Annex III of the verification report which provides a list of the equipment and the disposal of each of the pieces. The other annexes are not included but could be made available upon request.

SECRETARIAT'S COMMENTS AND RECOMMENDATION

COMMENTS

11. The verification report submitted by UNIDO follows the guidelines and standard format for verification of ODS production phase-out approved at the 32nd Meeting of the Executive Committee and provides evidence that DPRK had permanently closed the production of CFC-113, MCF, CFC-11 and CFC-12 and dismantled the related production facilities to an extent that there was no realistic possibility that the facilities could return to operational status.

12. During the evaluation of the implementation of CFC production sector agreements in the beginning of 2004, the representative of the Secretariat visited the plant and was shown the sites of the dismantled facilities for CFC-11 and CFC-12 production. The dismantling work had basically been completed and what remained at the site confirmed the findings in the verification report.

RECOMMENDATION

13. The Secretariat recommends that the Executive Committee:

(a) Take note of the verification report submitted by UNIDO.

(b) Release the 2nd tranche of funding of US $733,700 for the implementation of the ODS production closure Agreement in DPR Korea, and US $36,685 as support cost to UNIDO.

PROJECT EVALUATION SHEET
D.P.R. KOREA

SECTOR: Refrigeration ODS use in sector (2002): 299 ODP tonnes

Sub-sector cost-effectiveness thresholds: Domestic US $13.76/kg

Project Titles:

(a) Sectoral phase-out in domestic refrigeration sector by conversion of refrigeration and compressor manufacture at 5th October Electronic and Automation Company (second tranche)

Project Data	**Domestic**
	5th October
Enterprise consumption (ODP tonnes)	56.0
Project impact (ODP tonnes)	56.0
Project duration (months)	36
Initial project cost (US $)	981,011
Initial amount requested (US $)	
Final project cost (US $):	
Incremental capital cost (a)	
Contingency cost (b)	
Incremental operating cost (c)	
Total project cost (a+b+c)	
Local ownership (%)	100
Export component (%)	0
Amount requested for second tranche (US $)	981,011
Cost effectiveness (US $/kg.)	
Counterpart funding confirmed?	
National coordinating agency	National Coordinating Committee for Environment (NCCE)
Implementing agency	UNIDO

Secretariat's Recommendations	
Amount recommended (US $)	981,011
Project impact (ODP tonnes)	56.0
Cost effectiveness (US $/kg)	
Implementing agency support cost (US $)	73,576
Total cost to Multilateral Fund (US $)	1,054,587

PROJECT DESCRIPTION

14. In accordance with Decision 40/45, UNIDO has submitted a report on the implementation of the project for CFC phase-out in domestic and commercial refrigeration manufacturing in the Democratic People's Republic of Korea and has requested approval of the second and final tranche of US $981,011. The report is attached to this document. The report indicates that the equipment for the refrigerant part of the project was procured and will be installed and commissioned, and prototypes will also be developed by March 2004. The bidding process is on-going in regard to the foaming equipment and components for conversion of the compressor plant.

SECRETARIAT'S COMMENTS AND RECOMMENDATIONS

COMMENTS

15. The Secretariat has reviewed the report from UNIDO and has the following comments. The Executive Committee, at its 40th Meeting approved in principle the amount of US $1,365,011 plus agency support cost of US $384,000 for the first tranche of the implementation of the phase-out in domestic and commercial refrigeration manufacturing by conversion of refrigeration and compressor manufacture at the 5th October Electronic and Automation Company in Democratic People's Republic of Korea. The funding for the first tranche of the project was approved on the understanding that:

(i) UNIDO would make every effort to complete the project by 1 January 2005; and

(ii) UNIDO would include the balance of funding of US $981,011 in its draft 2004 business plan and request approval of this funding at the 42nd Meeting of the Executive Committee (Decision 40/45).

16. UNIDO included the required allocations, including support costs in its 2004 business plan and indicated in its report that every effort would be made to complete the project by 1 January 2005. It appears that the 2004 activities proposed in the report will enable UNIDO to complete the projects by 2005. UNIDO's 2004 business plan incorporates the phase-out of 56 ODP tonnes associated with expected completion of the project by 2005. There are no other conditions to be fulfilled prior to approval of the second tranche of funding.

RECOMMENDATIONS

17. The Secretariat recommends blanket approval of the requested funding for the second tranche of the project with associated support costs at the level of funding shown in the table below.

	Project Title	Project Funding (US$)	Support Cost (US$)	Implementing Agency
(a)	Sectoral phase-out in domestic refrigeration sector by conversion of refrigeration and compressor manufacture at 5th October Electronic and Automation Company (second tranche)	981,011	73,576	UNIDO

PROJECT COVER SHEET

COUNTRY:
DPR of KOREA

VERIFYING AGENCY:
UNIDO

PROJECT TITLE:

Verification of complete closure of all Methyl Chloroform (MCF) and CFC-113 production facilities in the DPRK.

MP/DRK/02/045

Report prepared by UNIDO consultant Mr. John Place

UNIDO
2002

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1. BACKGROUND

The Multilateral Fund for the Implementation of the Montreal Protocol (MLF) engaged Wakim Consulting (Wakim) in 2001 to conduct a Technoeconomic Audit of Production of Ozone Depleting Substances (ODS) in the Democratic People's Republic of Korea (DPRK). The Final Report was submitted in September 2001 and issued on 8 November 2001.

DPRK and ExCom agreed at the 36th Meeting of ExCom on the terms of timing and compensation for the complete closure of all ODS production facilities.

Wakim (p. 2) reported that the DPRK shut down both the Methyl Chloroform (MCF) and CFC-113 production facilities in May 2001 and dismantled them. The CFC-11/CF-12 facilities will be closed in 2003 and the CTC facility will be closed in 2005. Wakim reported that these are the only ODS production plants in the DPRK and that they are located in the February 8th Vinalon Complex.

2. DPRK PRODUCTION SECTOR COMPLETE CLOSURE PROJECT FOR CFC-113 AND MCF

A. Plant identification

Name of Enterprise	:	8th February Vinalon Complex
Plant Ref. Number	:	n.a.
Address of the Plant	:	Huinsil-dong, Hungnam City, South Hamgyong Province, DPRK
Contact persons and Functional Title	:	Jang Myong Hak, General Director, February 8th Vinalon Complex, Hong Song Bok, Chief Engineer for Technological Development
Telephone Number	:	(+)850 2 3815908
Fax Number	:	(+)850 2 3815809
e-mail address	:	not available

B. Verification

Team Composition	:	1
Leader	:	1
Name	:	J. Place
Functional Title	:	Consultant, UNIDO
Member(s)	:	0
Date of Plant Visit	:	July 1, 2002
Duration of Visit	:	1 day

C. Plant History

Date of construction:	1983				
ODS Products	No. of Lines	Capacity in Baseline Year*, 2000	Production***		
			Baseline Year*, 2000	Year 1**, 2001	Year 2
MCF	1	1,000	51	22	
CFC-113	1	500	15	6	
Raw Materials Production***					
HF	1	2,000	85	110	
CTC	-	-	-	-	-

* The year from which data are used for approving the ODS production phase out project
** Till the year of verification
*** This applies to plants where production of either HF or CTC or both is integrated

D. Plant Activity in the Year Verified

Plants for Complete Closure (MCF and CFC-113)

No. of CFC-113/MCF lines closed : 1/1

Date CFC-113/MCF production ceased : May 5, 2001

Date of dismantling completed : Started May 18, completed May 30 2002 (date of demolition)

Verification of destruction of key components by : National Coordinating Committee for the Environment

Reactor tanks dismantled and destroyed : Yes

Control and monitoring equipment dismantled and destroyed : Yes

Pipes dismantled and destroyed : Dismantled; some were destroyed, some were used in other plants

Utilities dismantled and destroyed : Yes

Evidence of destruction : Photographs

Chance of resuming production : No

Assessment by the Verification Team Included in the Verification Report : Yes

3. MANUFACTURING PROCESSES FOR CFC-113 AND MCF

A. The CFC-113 Process

Hexachloroethane, CCl_3-CCl_3, was reacted with HF in the presence of antimony pentachloride to give CFC-113, which was then purified. The by-product was hydrochloric acid.

The process flow sheet is presented in Annex I. Major items of equipment in the process flow sheet are:

Reactors (2)
Mixing tanks (2)
Cooling and separating tower
Washing tower
Storage tanks (7)
Condensers/heat exchangers (2)

B. The MCF Process

Vinyl chloride, CH_2-CHCl, was reacted with chlorine to give trichloroethane, CH_2Cl-$CHCl_2$, followed by dehydrochlorination to vinylidene chloride, CH_2=CCl_2. Vinylidene chloride was reacted with hydrogen chloride to give 1,1,1-trichloroethane (methyl chloroform, MCF).

The process flow sheet is presented in Annex II. Major items of equipment in the process flow sheet are:

Reactors (3)
Separation tower
Storage tanks (4)
Condensers/heat exchangers (3)

4. SITE VISIT

UNIDO accepted the responsibility for administering the dismantling of the ODS processing units. The first Verification Team (J. Place, consultant, UNIDO) visited the 8th February Vinalon Factory on 1st July 2002 in order to verify the situation regarding the former Methyl Chloroform (MCF) and CFC-113 production facilities. Officials of the Factory and of the Ministry of Chemical Industry showed the Team the site of the former production facilities, provided a completed questionnaire and answered all questions. Photographs were taken of the (former) sites and are to be seen in Annexes III and IV.

The MCF and CFC-113 plants were in adjoining buildings (Workshops) separated by a pathway. Both the 500 t/y CFC-113 unit and the 1,000 t/y methyl chloroform unit were built in 1983 (Wakim). Some equipment was salvaged from the plants for re-use at other locations, but the Factory management decided to demolish the site together with the major part of the equipment. The Team was advised that 3,000 kg of TNT plus oxide were used for the demolition. This method of demolition is not unusual for the DPRK Chemical Industry. On a courtesy visit to the nearby Hungnam Fertiliser Factory the next day, the Team observed by chance the results of a similar demolition of an old Workshop.

As can be seen in the photographs, there is a convincing degree of destruction of the two production facilities. Remains of metal structures can be seen. These were variously identified as storage tanks, reactors, a distillation tower and smaller parts. Considerable parts of the equipment were said to still lie beneath the rubble. As metal pieces are uncovered, they are cut (see photo in Annex III-2) and sent for recycle to scrap metal facilities.

Clearance of the debris has been going on for some time. At the time of the visit, a considerable portion of the MCF plant had been cleared as well as some of the CFC-113 plant.

The salvaged equipment has been re-used in other Factories:

- 50 valves, sent to the Agricultural Chemicals Plant
- 480 m of various types of pipe, sent to the PVC plant
- 20 electric motors, sent to various plants, including the Songchonggang Chemical Plant.

Since the salvaged equipment has been integrated into other plant facilities, it can be considered to be "otherwise rendered unusable" as far as ODS production is concerned.

All the key components have been destroyed.

Ten tons of scrap iron have so far been recovered from the site and sent to a recycling facility.

Photographs of the remains of the MCF Plant Site, as described to the Team, are seen in Annex III:

Annex III-1	"Site clearance in progress"
	"Raw materials storage tank"
Annex III-2	"Raw materials storage tank" (closer view)
	"Cutting a steel support"

Photographs of the remains of the CFC-113 Plant Site, as described to the Team, are seen in Annex IV:

Annex IV-1	"Intermediate storage"
	"Reactor screw"
Annex IV-2	"Pressure reactor"
Annex IV-3	"Distillation tower"
	"Fan and ventilator"

5. REPLACEMENTS FOR MCF AND CFC-113

Within the context of a previous UNIDO Mission on the Solvent Sector (May 2002), the Team had already examined the history of the use of MCF and CFC-113 during visits to the user factories in the course of preparing the Project Documents.

The users of MCF had been the Plating Workshops of the Refrigeration Factory and of the Taedong-gang Television Factory. Both are now obliged to use CTC instead of MCF for their cleaning operations, pending approval and implementation of their ODS Elimination Projects.

CFC-113 has been replaced in the PCB Workshop of the Taedong-gang Television Factory by acetone.

Conversion of the users of MCF and CFC-113 to other solvents lends considerable credibility to the claim that production of MCF and CFC-113 indeed ceased in May 2001.

6. PHOTOGRAPHIC RECORD OF THE CFC11/12 PLANT

The Team made a photographic record of the CFC-11/12 plant in order to complete the baseline for the 2003 phase-out programme. This record, as described to the Team, is to be found in Annex V:

Annex V-1	"Storage tanks and products"
	"Reactors (below), distillation tower (above)"
Annex V-2	"Control room"

7. PHOTOGRAPHIC RECORD OF THE CTC PLANT

The Team made a photographic record of the CTC plant in order to complete the baseline for the 2005 phase-out programme. This record, as described to the Team, is to be found in Annex VI:

Annex VI-1	"Reactors"
	"More reactors"
Annex VI-2	"Control panel"
	"Still more reactors"
Annex VI-3	"Storage tanks"
Annex VI-4	"Raw materials storage"
	"Distillation"

8. WORKPLAN FOR 2003

The baseline for the 2003 phase-out programme of the CFC-11/12 plant has been established (Wakim) and recorded (Annex V).

The Team has set up the Workplan for 2003 with the 8th February Vinalon Factory as follows:

- The 8th February Vinalon Factory will notify UNIDO of the dates for the cessation of production, the commencement of dismantling and the start of destruction. These are anticipated to be in mid-2003.
- UNIDO will need to apply for Verification Team visas at least one month before planned arrival in DPRK. The 8th February Vinalon Factory must therefore give UNIDO adequate notice of the timetable.
- The Verification Team will confirm the dismantling of the plant and will verify the destruction process. A full photographic record will be made.
- The 8th February Vinalon Factory will maintain a photographic record of the steps taken before the arrival of the Team.

9. CONCLUSIONS AND ASSESSMENT BY THE VERIFICATION TEAM

The MCF and CFC-113 facilities have been dismantled and substantially destroyed in accordance with the terms of the Agreement between the Executive Committee and DPRK at its 36th Meeting. The key components have been destroyed and there is no realistic possibility that the facilities can be returned to operational status.

UNIDO will pay the First Tranche of US$ 1,344,350 upon acceptance of the Verification Report.

10. REQUEST FOR THE RELEASE OF 2003 FUNDING

In accordance with the terms of the Agreement reached between the Executive Committee and the DPRK at the 36th Meeting, UNIDO and DPRK request the Executive Committee to release the Second Tranche in the amount of US$ 733,700 together with the 5% fee. This will enable DPRK and UNIDO to complete the 2003 phase-out of the CFC-11/12 facility.

COUNTRY:
DPR of KOREA

VERIFYING AGENCY:
UNIDO

VERIFICATION REPORT

Verification of complete closure of all CFC-11 and CFC-12 production facilities in the DPRK

DRK/PRO/36/INV/17

Report prepared by John Place and V. Shatrauka

UNIDO
2004

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ANNEXES

1. BACKGROUND

Government and Industry Structure

NCCE is the leading body coordinating ozone issues at the national level. All environment issues and draft policies including those on ozone issues are discussed and reviewed in the NCCE first. Thereafter, the NCCE makes recommendation to the Cabinet regarding environment issues.

The Ministry of Chemical Industry is responsible for the management of production and consumption of ODS and for monitoring the production of ODS.

The State Planning Committee formulates the plan of ODS production.

The Ministry of Electronics Industry owns October 5th Automation Complex, which is a major producer of refrigerating equipment.

The General Bureau of External Service is in charge of repairing refrigeration equipment.

ODS Production, Import and Consumption

The 2003 Country Programme Update (CPU) will be presented to the 41st Meeting of the Executive Committee of the Multilateral Fund for approval. The 2003 CPU draft represents the most up-to-date survey of the situation regarding ODS in DPRK and has been a major source of background information for this document.

DPR Korea's production of ODS in 2002 was 2,326 ODP tons, and consumption in the same year is 2,326 ODP tons. ODS consumption was largely concentrated in the CTC (solvents, fumigation and process agent) and refrigeration sectors. The ODS production and consumption profiles, based on the MP classification for Annex A, Group I and Annex B, Group II, for 1995-2002 is given in Tables 1and 2:

Table 1: ODS Production (MT)

ODS	Production Capacity (MT)	Actual Production (MT)							
		1995	1996	1997	1998	1999	2000	2001	2002
CFC-11	250	185	60	50	45	40	23	54	64
CFC-12	1000	500	150	125	40	50	42	208	235
CFC-113	500	100	40	35	35	20	15	36	
Halon 1211	-	0	0	0	0	0	0	0	0
Halon 1301	-	0	0	0	0	0	0	0	0
CTC	2300	1060	1822	1893	2022	1985	1594	1889	1843
TCA	1000	100	100	100	100	90	51	70	
MBr	200	200	0	0	0	0	0	0	0
Total ODS		**2145**	**2172**	**2203**	**2242**	**2185**	**1725**	**2247**	**2142**
Total ODP		**2061**	**2256**	**2267**	**2347**	**2299**	**1836**	**2376**	**2326**
CTC as Feedstock		956	330	270	125	130	93	361	402

Table 2: ODS Import (MT)

	Import in year							
	1995	1996	1997	1998	1999	2000	2001	2002
CFC-11	40	10	20	0	0	0	0	0
CFC-12	20	15	10	0	0	0	30	0
CFC-113	0	0	0	0	0	0	0	0
Halon-1211	0	0	0	0	0	0	0	0
Halon-1301	1	0	0	0	0	0	0	0
CTC	0	0	0	0	0	0	0	0
TCA	0	0	0	0	0	0	0	0
MBr	0	0	0	0	0	0	0	0
Total (ODP)	**70**	**25**	**30**	**0**	**0**	**0**	**30**	**0**

Production Phase-Out

The Multilateral Fund for the Implementation of the Montreal Protocol (MLF) engaged Wakim Consulting (Wakim) in 2001 to conduct a Technoeconomic Audit of Production of Ozone Depleting Substances (ODS) in the Democratic People's Republic of Korea (DPRK). The Final Report was submitted in September 2001 and issued on 8 November 2001.

DPRK and ExCom agreed at the 36th Meeting of ExCom on the terms of timing and compensation for the complete closure of all ODS production facilities.

The Government of DPR Korea dismantled the production facility of methyl bromide in 1995 at its own cost to honor its commitment of the ozone layer protection. The government also dismantled the production facilities of CFC-113 and methyl chloroform in May 2001.

Wakim (p. 2) reported that the DPRK shut down both the Methyl Chloroform (TCA) and CFC-113 production facilities in May 2001 and dismantled them. The CFC-11/CF-12 facilities were closed in December 2003 and the CTC facility will be closed in 2005. Wakim reported that these are the only ODS production plants in the DPRK and that they are located in the February 8th Vinalon Complex.

ODS Production Sector

DPR Korea is one of four Article 5 countries producing ODSs in the South Asia region. There is only one plant producing ODSs in DPR Korea in 2002, Feb.8th Vinalon Complex (former name was Sinhung Chemical Complex) in Hamhung. This plant produces CFC-11, CFC-12 and CTC. The country is self sufficient in the availability of the critical raw materials. Anhydrous hydrofluoric acid (AHF) is produced by Myonggan Chemical Plant, Myonggan County. The annual production capacity of the plant is 7,250 t/y, including 250 tons of CFC-11, 1,000 t/y of CFC-12 and 2,300 t/y of CTC. The CFC-11/-12 units were built in 1980 and the CTC production facility was built in 1975. There was also a 500t/yr CFC-113 unit and a 1,000 t/y methyl chloroform unit built in 1983. Table 3 summarizes the plant profile.

MLF approved in 2002 a production closure project of DPR Korea with the grant of US$ 1,350,000. Under this project implementation plan, the CFC-113 and TCA production facilities had been already destroyed in May 2001 in compliance with the DPR Korea's obligations under the MP. In accordance with the phase out schedule specified in the Agreement between ExCom and DPR Korea, the other ODS production facilities shall be dismantled by 2005.

Feb. 8th Vinalon Complex also operated a 2,300t/yr methyl bromide unit. The unit was shut down and dismantled at its own cost in 1995. DPR Korea suspended production of Halon 1211 and Halon-1301 before 1993. DPR Korea also phased out consumption of Halon 1211 in January 1995 and Halon 1301 in January 1996. No Halon-1211 has been imported since 1996, and only small quantities, 1 or 2 tons of Halon-1301 were imported from 1993 to 1995 annually.

DPR Korea does not export ODSs, and all the ODSs produced are consumed in the domestic market.

Table 3: Profile of ODS production facilities

Plant	ODS	Capacity (t/year)	Commissioning year	Remarks
2.8 Vinalon complex	CFC-11	250	1980	
	CFC-12	1,000	1980	
	CFC-113	500	1983	Dismantled in 2001
	TCA	1,000	1983	Dismantled in 2001
	CTC	2,300	1975	
	MBr	2,300		Dismantled in 1995

2. DPRK PRODUCTION SECTOR COMPLETE CLOSURE PROJECT FOR CFC-11 AND CFC-12

A. Plant identification

Name of Enterprise : 8th February Vinalon Complex

Plant Ref. Number : n.a.

Address of the Plant : Huinsil-dong, Hungnam City, South Hamgyong Province, DPRK

Contact persons and Functional Title : Jang Myong Hak, General Director, February 8th Vinalon Complex,

Hong Song Bok, Chief Engineer for Technological Development

Telephone Number : (+)850 2 381 5908

Fax Number : (+)850 2 381 5809

e-mail address : not available

B. Verification

Team Composition : 2

Leader : 1

Name : J. Place and V. Shatrauka

Functional Title : Consultant, UNIDO and Project manager, UNIDO

Member(s) : 1

Date of Plant Visits: December 10-13, 2003 by J. Place
January 14-15, 2004 by V. Shatrauka

Duration of Visits : 5 days and 2 days

C. Plant History

Table 4 summarises the plant history.

Table 4

Date of construction: 1980					
ODS Products	No. of Lines	Capacity in Baseline Year*, 2000	Production***		
			Baseline Year*, 2000	Year 1**, 2001	Year 2**, 2002
CFC-11	1	250	23	54	64
CFC-12	1	1,000	42	208	235
Raw Materials Production***					
HF	1	2,000	20.6	89	101
CTC (as feedstock)	2	2,300	93	361	402

* The year from which data are used for approving the ODS production phase out project
** Till the year of verification
*** This applies to plants where production of either HF or CTC or both is integrated
(Note – some mistakes in the Wakim Report have been corrected)

The figures for production in MT for 2003 are shown in Table 5.

Table 5

	January	February	March	April	May	June	July	August	September	October	November	December	Total
CFC-11	8.5	9.3	9.8	10.6	9.7	10.8	10.5	8.7	10.4	8.8	8.5	3.5	109.1
CFC-12	37.3	40.8	43	46.5	40.5	49.4	44.2	35.2	47.3	40.8	37.7	15.6	478.3

D. Plant Activity in the Year Verified

Plants for Complete Closure (CFC-11 and CFC-12)

No. of CFC-11/CFC-12 lines closed : 1/1

Date CFC-11/CFC-12 production ceased : December 9, 2003

Date of dismantling completed : Started December 11, 2003, completed December 12, 2003
Destruction completed :

Verification of destruction of key components by : National Coordinating Committee for the Environment (NCCE)

Reactor tanks dismantled and destroyed : Yes

Control and monitoring equipment dismantled and destroyed : Yes

Pipes dismantled and destroyed : Dismantled; some were destroyed, some were used in other plants

Utilities dismantled and destroyed: Yes

Evidence of destruction : Photographs

Chance of resuming production : No

Assessment by the Verification Team Included in the Verification Report : Yes

3. MANUFACTURING PROCESSES FOR CFC-11 AND CFC-12

The process for manufacture of CFC-11 and CFC-12

The inventory of the equipment in the CFC-11/12 plant is given in Annex I.

Hydrogen fluoride, carbon tetrachloride and catalyst are fed from their storage tanks to the reactor, where a gaseous mix of CFC-11 ($CFCl_3$) and CFC-12 (CF_2Cl_2) is produced with hydrogen chloride as by-product.

$$CCl_4 + HF = CFCl_3 + CF_2Cl_2 + HCl$$

The mix of CFC-11, CFC-12 and HCl is fed to an absorption tower where water dissolves and removes the hydrogen chloride. The aqueous hydrochloric acid goes to the neutralisation tower where it is reacted with NaOH to form a salt solution for disposal.

The gaseous crude mix of CFC-11 and CFC-12 is fed to a dehydration tower to be dried. The dry gas is stored and then compressed to feed for the low boiling separation tower.

The two separated components, CFC-11 and CFC-12, are further distilled in rectification columns to give the purified products, ready for storage and shipment.

A schematic of the process is presented in Annex IV. A detailed drawing is to be found in the Wakim Report (Appendix D-1).

4. SITE VISIT

UNIDO accepted the responsibility for administering the dismantling of the ODS processing units. The Verification Team (J. Place, consultant, UNIDO and V. Shatrauka, project manager, UNIDOI) visited the 8th February Vinalon

Factory from 10-13 December 2003 by J. Place and 14-15 January 2004 by V. Shatrauka in order to verify the dismantling and commencement of the destruction of the CFC-11 and CFC-12 production facilities.

The Terms of Reference for UNIDO mission and the Questionnaire Template are located in Attachment I.

Officials of the Factory, of the Ministry of Chemical Industry and of the National Ozone Unit accompanied the Verification Team to the site of the former production facilities.

Production had ceased on December 9, 2003. The closed facilities were inspected on December 10, 2003; the photographic record at this stage is presented in Annex III.

Dismantling started on December 11, 2003 and was completed on the next day, when destruction of key items of equipment started. The photographic record at this stage is presented in Annex IV.

Destruction continued after departure of the Verification Team. The Factory has maintained a photographic log of the completion of the destruction process, for later inspection.

As noted in Annex I, some salvaged equipment has been re-used in other Factories.

- *50 valves, sent to the Agricultural Chemicals Plant*
- *480 m of various types of pipe, sent to the PVC plant*
- *20 electric motors, sent to various plants, including the Songchonggang Chemical Plant.*

Since the salvaged equipment has been integrated into other plant facilities, it can be considered to be "otherwise rendered unusable" as far as ODS production is concerned.

All the key components have been destroyed.

5. REPLACEMENTS FOR CFC-11 AND CFC-12

According to the Agreement on ODS production phase out between the ExCom and DPR Korea, ExCom does not provide any financial support to DPR Korea in the development and/or production of ODS alternatives.

In order to meet domestic demand for ODS alternatives, DPR Korea plans to produce methylene chloride as a substitute for CFC-11 in the foam sector.

HFC-134a is the preferred substitute for CFC-11 and CFC-12 in the Refrigeration and Air Conditioning (RAC) sector.

According to NCCE, national scientists of the Research Centre for Environment Protection have developed a new refrigerant, "Moran", manufactured from propylene. However until "Moran" has been commercially proven, DPR Korea has identified HFC-134a as the replacement alternative.

6. NATIONAL ACTION PLAN TO PHASE OUT ODS

Phase-out of production and consumption of CFC-11 and CFC-12 is a significant part of the National Action Plan.

The national action plan includes the following components:

1) Phase-out of remaining CFC in household refrigeration sector by implementing Sector Plan of Refrigeration Production Conversion;
2) Phase-out of remaining CFC in refrigeration service sector by implementing Refrigerant Management Plan (RMP);
3) Technical assistance and capacity building.

The action plan will be supported by continued strengthening of ODS import controls. NCCE will be actively involved through technical support programs to ensure full compliance with the regulations and policies.

7. REFRIGERANT MANAGEMENT PLAN (RMP)

UNEP is assisting DPR Korea in developing a RMP (refrigerant management plan) in cooperation with UNIDO.

The RMP addresses servicing requirements for CFCs in the refrigeration service sectors. This supplemental component will phase out the remaining CFC use in the refrigeration service sector.

In 2002 the total CFC-11 and -12 consumption by the servicing workshops estimated to be 27 and 216 ODP tons respectively. This consumption figure includes CFC-12 used for the servicing of mobile air conditioners (MAC).

The RMP includes funding for establishing a recycling and recovery network comprising of 166 recovery stations and 25 recovery and recycling centres throughout the country. The recovery/recycling equipment will be procured and deployed to the selected beneficiary workshops according to criteria set by NCCE upon approval of RMP. Funding request for the associated training, collection and storage of contaminated CFC and monitoring and managing the servicing sector is US$1,177,394. The project will also include provisions for receipt and use of recycled CFC-12 from conversions of refrigeration projects and outside sources as available.

8. PHOTOGRAPHIC RECORD OF THE CFC-11/-12 PLANT

The Verification Team of 2002 made a brief photographic record of the CFC-11/-12 plant in order to prepare the baseline for the 2003 phase-out programme. This record, as described to the 2002 Verification Team, is to be found in Annex II of the 2002 Verification Report for the closure of the CFC-113 and TCA plants.

Annex VI "Storage tanks and products"
"Reactors (below), distillation towers (above)"
Annex VII "Control room"

The 2003 Verification Team recorded the baseline, the dismantling and the start of destruction of key items during the visit of 10-13 December 2003. The photographs are presented in

Annex V - Photographs of CFC-11/-12 plant site before dismantling
Annex VI - Photographs of CFC-11/-12 plant site during dismantling

9. FOAM SECTOR

There were 3 factories producing foam using ODS. One was Pyongyang Foam Factory, established in 1989. This factory caters to the demand of various kinds of polyurethane products in the country. The production of flexible foam is dominant, but there is also a small share of 8 % of the total output of rigid foam, semi-flexible foam and integral skin. There is no considerable import of polyurethane foams to DPR Korea. The main goal of the Factory is production of fine, high quality, low-density foam, which is mainly used for lamination for clothing and furniture.

The other two factories were Hamhung factory in South Hamgyong Province and Chongjin Factory in North Hamgyong Province, which were established in 1990 and 1992 respectively. The production technology of all three factories is very similar. These two factories have been integrated through an industrial rationalization process into one factory, the Pyongyang Foam Factory. This was facilitated through the foam project funded by MLF.

The industrial conversion of these factories from CFC-12 to non-ODS technology was approved by ExCom in 1997 and the conversion was completed in 2000.

10. CONCLUSIONS AND ASSESSMENT BY THE VERIFICATION TEAM

The CFC-11 and CFC-12 facilities have been dismantled and substantially destroyed in accordance with the terms of the Agreement between the Executive Committee and DPRK at its 36th Meeting. The key components

have been destroyed and there is no realistic possibility that the facilities can be returned to operational status.

UNIDO will pay the Second Tranche of US$ 733,700 upon acceptance of the Verification Report by 42d Session of the ExCom of the MLF.

11. WORKPLAN FOR 2005

The baseline for the 2005 phase-out programme of the CTC plant has been established (Wakim) and recorded (Annex III of 2002 Verification Report).

The Team has set up the Workplan for 2005 with the 8th February Vinalon Factory as follows:

- The 8th February Vinalon Factory will notify UNIDO of the dates for the cessation of production, the commencement of dismantling and the start of destruction. These are anticipated to be in late-2005.
- UNIDO will need to apply for Verification Team visas at least one month before planned arrival in DPRK. The 8th February Vinalon Factory must therefore give UNIDO adequate notice of the timetable.
- The Verification Team will confirm the dismantling of the plant and will verify the destruction process. A full photographic record will be made.
- The 8th February Vinalon Factory will maintain a photographic record of the steps taken before the arrival of the Team.

12. REQUEST FOR THE RELEASE OF 2003/4 FUNDING

In accordance with the terms of the Agreement reached between the Executive Committee and the DPRK at the 36th Meeting, UNIDO and DPRK request the Executive Committee to release the Second Tranche in the amount of US$ 733,700 together with the 5% fee.

ANNEX III

Inventory of CFC-11/12 Plant Equipment

On-site

No.	Item	Dimensions	Material of construction	Quantity	Fate
1	Column for manufacturing catalyst	ϕ 400 x 1,400	Titanium steel	2	Destroy
2	Catayst storage vessel	ϕ 1,600 x 2,000	Stainless steel	2	Destroy
3	Catayst transfer pump	Q = 20 m^3/h	Stainless steel	2	Reuse
4	CTC transfer pump	Q = 6 m^3/h	Steel	1	Reuse
5	CTC measuring vessel	ϕ 1,600 x 2,000	Steel	1	Destroy
6	HF measuring vessel	ϕ 1,600 x 2,000	Steel, PE	2	Destroy
7	HF transfer pump	Q = 2 m^3/h	Steel, PE	2	Reuse
8	HF metering pump	Q = 0.2 m^3/h	Steel, PE	2	Reuse
9	CTC metering pump	Q = 0.5 m^3/h	Steel, PE	2	Reuse
10	Reactor	ϕ 400 x 8,000	Steel, PE	1	Destroy
11	Reactor	ϕ 1,000 x 3,400	Steel, PE	1	Destroy
12	Water seal	ϕ 800 x 1,100	Steel, PE	2	Destroy
13	Pressure regulator	P = 10 at	Stainless steel	2	Reuse
14	Storage vessel for absorption liquid	ϕ 1,600 x 3,000	Steel, rubber	2	Destroy
15	Waste vessel	ϕ 219 x 300	Steel	2	Destroy
16	Absorption column	ϕ 380 x 6,000	Steel	2	Destroy
17	Neutralisation column	ϕ 380 x 6,000	Steel	1	Destroy
18	Gas-liquid separator	ϕ 800 x 1,100	Steel	1	Destroy
19	Dehydrating column	ϕ 700 x 1,500	Steel	1	Destroy
20	Oil separator	ϕ 300 x 900	Steel	1	Destroy
21	Brine cooler	ϕ 400 x 1,500, F = 2.5 m^2	Steel	2	Destroy
22	Crude CFC transfer pump	Q = 2 m^3/h	Steel	2	Reuse
23	Separating column for low-boiling liquid	ϕ 330 x 10,000	Steel	1	Destroy
24	Condenser for low-boiling liquid	ϕ 400 x 2,500, F = 20 m^2	Steel	1	Destroy
25	Gas-liquid separator for low-boiling liquid	ϕ 200 x 400	Steel	1	Destroy
26	Cooler for low-boiling liquid	F = 0.7 m^2	Steel	1	Destroy
27	CFC-12 rectifying column	ϕ 400 x 1,000	Steel	1	Destroy
28	CFC-12 rectifying column	ϕ 800 x 900	Steel	1	Destroy
29	CFC-12 condenser	ϕ 500 x 2,000, F = 8 m^2	Steel	1	Destroy
30	CFC-11 rectifying column	ϕ 400 x 1,000	Steel	1	Destroy
31	CFC-11 rectifying column	ϕ 600 x 800	Steel	1	Destroy
32	CFC-11 condenser	ϕ 350 x 2,000, F = 6 m^2	Steel	1	Destroy
33	CFC 12/11 separator	ϕ 300 x 800	Steel	2	Destroy
34	Compressed nitrogen tank	ϕ 800 x 2,950	Steel	1	Destroy
35	NaOH transfer pump	Q = 5 m^3/h	Steel	2	Reuse
36	Pressure transmitter	11 GM		3	Reuse
37	Liquid position transmitter	13 FA		18	Reuse
38	Level transmitter	17 JB6		1	Reuse
39	Differential pressure transmitter	13 A/IFD		8	Reuse
40	Indicator (air)	PO-4DL		19	Reuse
41	Indicator (air)	475I		3	Reuse
42	Regulator (air)	465I		8	Reuse
43	Temperature recorder	ERB-6		1	Reuse
44	Balance indicator	EI		1	Reuse
45	Regulating valve (air)			8	Reuse
46	Transfer switch			1	Destroy
47	Resistance wire			30	Reuse
48	Electric boiler	2 T/h		2	Reuse
49	Refrigerator motor	75/4		1	Reuse

No.	Item	Dimensions	Material of construction	Quantity	Fate
50	Air compressor motor	55/6		2	Reuse
51	Nitrogen compressor motor	55/6		1	Reuse
52	Water pump motor	5.5/2		2	Reuse
53	Transformer	3 x 4,000 KVA		1	Reuse
54	Transformer	3 x 150 KVA		1	Reuse
55	Lamp	300 w		18	Reuse
56	Circuit breaker	Cha 10-600		4	Reuse
57	Breaker	Dan 10-600		4	Reuse
58	Power cable	3 x 120		75 m	Reuse
59	Power cable	3 x 50		350 m	Reuse
60	Operating cable	4 x 1.5		550 m	Reuse
61	Distribution board	Bun-10		4	Reuse

Off-site

No.	Item	Dimensions	Material of construction	Quantity	Fate
62	HF storage vessel	ϕ 1,600 x 3,000	Steel, PE	1	Destroy
63	NaOH storage vessel	ϕ 1,500 x 3,000	Steel	1	Destroy
64	Crude CFC liquid storage vessel	ϕ 1,000 x 2,200	Steel	1	Destroy
65	CFC-11 storage vessel	ϕ 1,200 x 2,000	Steel	1	Destroy
66	CFC-12 storage vessel	ϕ 800 x 1,500	Steel	1	Destroy
67	Storage tank for CFC-11/12 gas	100 m^3	Steel	1	Destroy
68	CTC storage vessel	ϕ 2,300 x 3,400	Steel	1	Destroy
69	Compressor	Q = 40+F1 m^3/h	Steel	2	Destroy
70	Gas chromatograph	G-1800 T		1	Reuse
71	Piping				Reuse

Shared with other plants

No.	Item	Dimensions	Material of construction	Quantity	Fate
72	Hoist	5 T	Steel	1	Reuse
73	Crane	7 T	Steel	1	Reuse
74	Fire-fighting equipment			3	Reuse
75	Equipment storage			1	Reuse
76	Repair shop			1	Reuse

DPR Korea: Sectoral Phase Out in Domestic

Summary of activities completed in 2003

Sectoral Phase Out in Domestic Refrigeration Sector in DPR Korea by Conversion of Refrigeration and Compressor Manufacture at 5th October Electronic and Automation Company (DRK/REF/40/INV/26) implemented by UNIDO

Presented to the Executive Committee of the Montreal Protocol at its 42nd Meeting, March 2004

BACKGROUND

At its 40th Meeting, the Executive Committee of the Multilateral Fund for the Implementation of the Montreal Protocol agreed to approve, in principle, US $1,365,011 (excluding agencies support costs) as the total funds that would be available to the Government of the Democratic People's Republic of Korea to achieve its commitments for the complete phase-out of CFCs used in the manufacture of domestic refrigeration and compressors.

In accordance with the Agreed Conditions for Phase-out of CFCs in Korea the initial approval was made in July 2003 for US $384,000 of which was attributed to the purchase of the refrigerant equipment and bidding for the foaming equipment and the services required for the conversion of the compressor factory.

PROJECT OBJECTIVES

Reductions in accordance with the terms of the sectoral phase out plan in domestic refrigeration would ensure that Korea meets the Montreal Protocol's 2005 compliance target.

5th October Automation Co., refrigerator production line will be converted to use HFC-134a Technology as refrigerant and cyclopentane as blowing agent for the polyurethane foam used to insulate the refrigerator.

The alternatives have been selected on the advice of 5th October Electronic and Automation Co. management.

Through the implementation of the sectoral phase out plan, the government has committed itself to reducing total national consumption of controlled.

The overall objective of this project is to eliminate the use of 56 ODP MT of CFC-11 and CFC-12 in the domestic refrigeration and compressor manufacturing sub-sector through converting the production lines from using CFC-11 as foam blowing agent and CFC-12 as refrigerant to using cyclopentane and HFC-134a. This will achieve the final phase out in the domestic refrigeration sector and provide a balance for the supply and demand of compressors.

The phase out of CFC use in the household refrigerator sector will require integration of new technologies for non-ODS foams and refrigerants, and compressor designs to accommodate the different properties of refrigerants and foam blowing agent while sustaining energy efficiency and overall mechanical performance.

The plan involves the provision of capital equipment and technology transfer as well as the funding of incremental operating costs

YEAR 2003: PHASE-OUT TARGETS AND RESULTS

Year 2003 Target:

No CFC phase out was planned for 2003.

Year 2003 Results:

A. Domestic refrigeration manufacturing

- Refrigerant equipment was purchased and will be installed and commissioned in March 2004.
- International expert is recruited to assist October 5th Factory technicians in the development and manufacturing of prototypes in March 2004.
- Offers for the foaming equipment were obtained through the process of competitive bidding. The funds provided within the first tranche are insufficient therefore; award of the contract will be made in March upon release of second tranche from Executive Committee of the Multilateral Fund.

B. Compressor manufacturing

- The terms of reference for the supply of the services for the conversion of the compressor manufacturing were reviewed and agreed upon with the counterpart and NCCE. We are in the process of bidding for the component of redesign of the compressor and transfer of technology, the award of the contract is expected in February 2004.

YEAR 2004: TARGETS and PROPOSED ACTIVITIES

Year 2004 Target:

UNIDO will make every effort to complete the project by 1 January 2005.

Year 2004 Proposed activities:

- Ordering of foaming equipment, installation and commission and start of trial production
- Development and manufacturing of prototypes, starting with the mass trial production using HFC-134a as refrigerant.
- Redesign new compressor model, starting with the trial production.

Year 2004 Requested Fund:

The 384,000 US$ allocated for the sectoral phase out plan in 2003 are mostly obligated and partially disbursed.

The remaining sum of 981,011 US$ is requested for 2004.