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执行蒙特利尔议定书  
多边基金执行委员会  
第四十二次会议  
2004年3月29日至4月2日，蒙特利尔

## 项目提案：朝鲜民主主义人民共和国

本文件载有基金秘书处关于下列项目提案的评论和建议：

### 生产：

- 对彻底关闭朝鲜民主主义人民共和国所有甲基氯仿 (MCF)和 CFC-113、CFC-11 和 CFC-12 生产设施情况的核查 工发组织

### 制冷剂

- 10月5日电机与自动化公司的通过制冷剂和压缩机生产的转换实现家用制冷行业的行业淘汰(第二笔付款) 工发组织

## 对彻底关闭朝鲜民主主义人民共和国所有甲基氯仿(MCF) 和 CFC-113、CFC-11 和 CFC-12 生产设施情况的核查

### 项目介绍

1. 执行委员会在其 2002 年第三十六次会议上核准了关于以原则上议定的 2 566 800 美元资助额逐步取消朝鲜民主主义人民共和国消耗臭氧层物质生产部门的修正协定。这将要求永久停止 CFC-11、CFC-12、CFC-113、四氯化碳(CTC)和 MCF 的生产并拆除有关生产设施。议定资助额将在提交关于永久停止相关消耗臭氧层物质生产和拆除生产设施情况的独立核查报告且该报告经执行委员会核准后，按照以下时间表支付。

关闭和付款时间表

加工设施	关闭时间	核查时间	付款额	付款时间
CFC-113	2001 年 5 月	2001 年 8 月*	687 700	永久停止 CFC-113 生产及拆除生产设施情况获得令人满意的核查结果后。
甲基氯仿	2001 年 5 月	2001 年 8 月*	656 650	永久停止甲基氯仿生产及拆除生产设施情况获得令人满意的核查结果后。
CFC-11/12	2003 年	2003 年	733 700	永久停止 CFC-11/12 生产及拆除生产设施情况获得令人满意的核查结果后。
CTC	2005 年	2005 年	488 750	永久停止 CTC 生产及拆除生产设施情况获得令人满意的核查结果后。
共计			2 566 800	

\* 由 Wakim 咨询公司在技术审查期间核查，尚待工发组织确认。

2. 因此，工发组织作为项目执行机构在 2002 年 7 月和 2003 年 12 月分别核查了 CFC-113、MCF 和 CFC-11、CFC-12 的停止生产情况和有关生产设施的拆除情况，并提交了关于特派团调查结果的报告。以下为报告摘要。

#### 对 CFC-113 和 MCF 生产设施拆除情况的核查

3. 核查工作于 2002 年 7 月由联合王国一位有着氯氟化碳行业背景的顾问进行。报告首先简要介绍了 CFC-113 和 MCF 的生产工艺并载列了主要设备项目清单。根据现场视察，报告对拆除 500 吨/年 CFC-113 机组和 1000 吨/年 MCF 机组这两种主要设备后的现场剩余情况(包括储存罐、反应堆、蒸馏塔和其他部件)作了第一手叙述。报告还载有一份清单，罗列了供其他工厂重新利用的设备，如电机和阀门。核查顾问还走访了 CFC-113 和 MCF 的用户，满意地注意到这些用户已改用四氯化碳作为溶剂。

4. 顾问借视察工厂之机，拍摄了 CFC-11、CFC-12 和 CTC 主要生产设备的照片，作为 2003 年和 2005 年核查 CFC-11/12 和 CTC 停止生产情况的基准。报告还提供了与消耗臭氧层物质生产厂共同商定的 2003 年工作计划。

5. 报告断定，朝鲜已遵守《协定》要求，永久停止了 CFC-113 和 MCF 的生产并拆除了生产设施。报告附有 CFC-113 和 MCF 工艺流程图、拆除现场和主要设备项目残余部件的照片、与 CFC-11 和 12 及 CTC 生产相关的主要设备项目。报告附于本文，但去除了其中的照片。不过，如有索取，即可提供。

6. 核查工作完成后，工发组织向朝鲜政府拨付了 1 344 350 美元，该款项是 2002 年核准《协定》后支付给工发组织的。

#### 对拆除 CFC-11 和 CFC-12 生产设施情况的核查

7. 顾问在 2003 年 12 月核查了 CFC-11 和 CFC-12 生产设施的拆除情况。报告首先作为背景资料简要介绍了朝鲜的消耗臭氧层物质生产部门，以及 2003 年在设施关闭前 CFC-11 和 CFC-12 的生产情况。2003 年 CFC-11 和 CFC-12 的产量是 2002 年的两倍(2002 年：CFC-11=64 ODP 吨；CFC-12=235 ODP 吨；2003 年：CFC-11=109 ODP 吨；CFC-12=478 ODP 吨)。报告随后讲述了顾问在现场亲眼目睹的工厂拆除过程。2003 年 12 月 9 日停止生产，12 月 11 日开始拆除工作，当时顾问正在那里。截至 12 月 13 日顾问离开时，设施的主要部分，如反应堆、制造催化剂的柱体、CFC 精馏柱、储存容器，都已销毁或正在销毁，而且这一过程一直持续到特派团离开之后。阀门、管道和电机等一些设备则被作为他用。设施拆除前后均拍摄了照片并附于报告之后。

8. 报告断定，主要部件皆已销毁，已不存在设施恢复运行状态的可能性。

9. 报告其余部分提供资料，说明了计划的 CFC 代用品、制冷剂管理计划和泡沫方面。报告还提供了定于 2005 年核查 CTC 生产设施关闭情况的工作计划。最后，报告要求根据《协定》，在 CFC-11 和 CFC-12 设施的拆除工作成功执行和核查后，拨付下笔款项 733 700 美元。

10. 报告有七个附件：附件一—核查的职权范围；附件二—《逐步取消朝鲜民主主义人民共和国的消耗臭氧层物质生产协定》；附件三—CFC-11/12 成套设备清单；附件四—CFC-11/12 工厂示意图；附件五—拆除前的 CFC-11/12 工厂(照片)；附件六—开始拆除时的 CFC-11/12 工厂(照片)；附件七—CFC-11/12 工厂，拆除和销毁工作在继续进行(照片)。核查报告附

件三附于本报告之后，它载列了设备清单及每个部件的处理情况。其他附件未附于本文，但可索取。

## 秘书处的评论和建议

### 评论

11. 工发组织提交的核查报告遵守了执行委员会第三十二次会议核准的关于核查逐步停止生产消耗臭氧层物质情况的准则和标准格式，并用证据说明朝鲜已永久停止 CFC-113、MCF、CFC-11 和 CFC-12 的生产，拆除有关生产设施，这些设施已没有恢复运行状态的实际可能性。

12. 在 2004 年初评估 CFC 生产部门协定执行情况期间，秘书处代表视察了工厂，看到了拆除后的 CFC-11 和 CFC-12 的生产设施现场。拆除工作已基本完成，现场的残余状况证实了核查报告的结论。

### 建议

13. 秘书处建议执行委员会：

- (a) 注意到工发组织提交的核查报告。
- (b) 拨付第二笔款项 733 700 美元，以执行在朝鲜民主主义人民共和国停止消耗臭氧层物质生产的协定，并拨付 36 685 美元作为给工发组织的支助费用。



## 项目说明

14. 根据第 40/45 号决定，工发组织提交了关于朝鲜民主主义人民共和国家用和商业制冷剂生产 CFC 淘汰项目执行情况报告，并申请核准第二笔也是最后一笔 981 011 美元的资金。报告附于本文件后。报告表明，项目制冷剂部分的设备已购买，并将予安装和启用，到 2004 年 3 月还将研发原型。关于泡沫塑料设备和压缩机工厂改造部件的投标工作正在进行中。

## 秘书处的评论和建议

### 评论

15. 秘书处审查了工发组织的报告，有以下的评论。执行委员会在其第四十次会议上原则上核准 1 365 011 美元，外加 384 000 美元的机构费用，作为执行朝鲜民主主义人民共和国 10 月 5 日电机与自动化公司的通过制冷剂和压缩机生产的转换实现家用和商业生产淘汰的第一笔供资。对项目第一笔拨款的核准，是建立在这样的谅解之上，即：

- (一) 工发组织将尽一切努力在 2005 年 1 月 1 日前完成该项目；以及
- (二) 工发组织将把供资 981 011 美元的余额列入其 2004 年业务计划草案，并请执行委员会第四十二次会议核准这笔资金(第 40/45)。

16. 工发组织将申请的拨款、拨款支助费用列入工发组织的 2004 年业务计划，并在报告中表明，工发组织将尽一切努力在 2005 年 1 月 1 日之前完成该项目。看来报告中建议的 2004 年的活动能够让工发组织在 2005 年之前完成这些项目。工发组织 2004 年的业务计划列入了预期到 2005 年项目完成时淘汰的 56 ODP 吨。在核准第二笔资金之前没有其他需要满足的条件。

### 建议

17. 基金秘书处基于下述理解建议按下表所列供资量一揽子核准为该项目申请的资金和相关支助费用：

	项目名称	项目资金(美元)	支助费用(美元)	执行机构
(a)	10 月 5 日电机与自动化公司的通过制冷剂和压缩机生产的转换实现家用制冷行业的行业淘汰(第二笔付款)	981 011	73 576	工发组织

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**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 36<sup>th</sup> 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 8<sup>th</sup> Vinalon Complex.

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

### A. Plant identification

Name of Enterprise : 8<sup>th</sup> 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 8<sup>th</sup> 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,  $\text{CCl}_3\text{-CCl}_3$ , 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,  $\text{CH}_2\text{-CHCl}$ , was reacted with chlorine to give trichloroethane,  $\text{CH}_2\text{Cl-CHCl}_2$ , followed by dehydrochlorination to vinylidene chloride,  $\text{CH}_2=\text{CCl}_2$ . 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 8<sup>th</sup> February Vinalon Factory on 1<sup>st</sup> 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 8<sup>th</sup> February Vinalon Factory as follows:

- The 8<sup>th</sup> 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 8<sup>th</sup> 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 8<sup>th</sup> 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 36<sup>th</sup> 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 36<sup>th</sup> 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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## 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 5<sup>th</sup> 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 41<sup>st</sup> 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 1 and 2:

Table 1: ODS Production (MT)

Substance	Production (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
<b>Total ODS</b>		<b>2145</b>	<b>2172</b>	<b>2203</b>	<b>2242</b>	<b>2185</b>	<b>1725</b>	<b>2247</b>	<b>2142</b>
<b>Total ODP</b>		<b>2061</b>	<b>2256</b>	<b>2267</b>	<b>2347</b>	<b>2299</b>	<b>1836</b>	<b>2376</b>	<b>2326</b>
CTC as Feedstock		956	330	270	125	130	93	361	402



Table 2: ODS Import (MT)

	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
<b>Total (ODP)</b>	<b>70</b>	<b>25</b>	<b>30</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>30</b>	<b>0</b>

### 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 36<sup>th</sup> 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 8<sup>th</sup> 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 : 8<sup>th</sup> 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 8<sup>th</sup> 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

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<sub>3</sub>) and CFC-12 (CF<sub>2</sub>Cl<sub>2</sub>) is produced with hydrogen chloride as by-product.



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, UNIDO) visited the 8<sup>th</sup> 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 36<sup>th</sup> 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 8<sup>th</sup> February Vinalon Factory as follows:

- The 8<sup>th</sup> 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 8<sup>th</sup> 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 8<sup>th</sup> 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 36<sup>th</sup> 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	Catalyst storage vessel	φ 1,600 x 2,000	Stainless steel	2	Destroy
3	Catalyst transfer pump	Q = 20 m <sup>3</sup> /h	Stainless steel	2	Reuse
4	CTC transfer pump	Q = 6 m <sup>3</sup> /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 <sup>3</sup> /h	Steel, PE	2	Reuse
8	HF metering pump	Q = 0.2 m <sup>3</sup> /h	Steel, PE	2	Reuse
9	CTC metering pump	Q = 0.5 m <sup>3</sup> /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 <sup>2</sup>	Steel	2	Destroy
22	Crude CFC transfer pump	Q = 2 m <sup>3</sup> /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 <sup>2</sup>	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 <sup>2</sup>	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 <sup>2</sup>	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 <sup>2</sup>	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 <sup>3</sup> /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

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

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 <sup>3</sup>	Steel	1	Destroy
68	CTC storage vessel	φ 2,300 x 3,400	Steel	1	Destroy
69	Compressor	Q = 40+F1 m <sup>3</sup> /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 5<sup>th</sup> October Electronic and Automation Company  
(DRK/REF/40/INV/26) implemented by UNIDO**

***Presented to the Executive Committee of the Montreal Protocol  
at its 42<sup>nd</sup> Meeting, March 2004***

## **BACKGROUND**

At its 40<sup>th</sup> 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 5<sup>th</sup> 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.