**CLEAN DEVELOPMENT MECHANISM**
**PROJECT DESIGN DOCUMENT FORM (CDM-PDD)**
**Version 03 - in effect as of: 28 July 2006**

**CONTENTS**



**Annexes**

## SECTION A. General description of project activity

### A.1 Title of the project activity:

Title: Changshu Haike HFC 23 Decomposition Project

Version: 6

Date: December 3, 2007

### A.2. Description of the project activity:

HCFC 22 is mainly used as a fluid for refrigeration as well as for a raw material to manufacture a tetrafluoroethylene polymer. HFC 23 ($CHF_3$) is an inadvertent by-product in HCFC 22 production. HFC 23 itself is not toxic, but it is a greenhouse gas (GHG) with a very high Global Warming Potential (GWP) (GWP_HFC 23=11,700 in the IPCC Second Assessment Report). At present, there is no significant market for HFC 23 and there is no compulsory regulation in China on control of the HFC 23 emissions, thus all of the HFC 23 generated from HCFC 22 production is typically vented directly to the atmosphere. The purpose of the proposed CDM project is to reduce greenhouse gas (GHG) emissions through the destruction of HFC 23 in a proposed thermal oxidation system.

In Changshu Haike's case, only one existing production facility dedicated exclusively for HCFC 22 started its operation in May 2000. The actual annual production of HCFC 22 production was 7,937.7 tons in 2002, 13,179.3 tons in 2003 and 18,106.5 tons in 2004 respectively. This production facility consists in one single HCFC 22 production line.

According to the Montreal Protocol, developed countries shall stop Ozone Depleting Substances (ODS) substitute production (HCFCs) by 2020. While developing countries (so-called Article 5(1) countries) is allowed to produce HCFC22 until 2040 based on their respective economic and technical capabilities.

Process technology for thermal oxidation of HFC 23 is not available indigenously. Although there are indigenous processes for incineration of wastes, none of these companies has any experience with the specialized equipment required to destroy HFCs. Changshu Haike will import the proposed incineration facility and technology from an experienced overseas technology provider whose HFC 23 destruction technology is reliable, efficient and has a good reputation. VICHEM, a leading French technology provider and facility supplier, has demonstrated the successful application of continuous process technology for the decomposition of HFCs and other fluorocarbons by thermal oxidation worldwide. The project will apply this good-practice process technology and its associated chemical processing know-how in Changshu Haike to reduce the emission of HFC 23 from its HCFC 22 production.

The process technology proposed in this project decomposes HFC 23 by heating at higher than 1,200$^{o}$C in a thermal oxidation chamber with air and steam, using natural gas (NG) as supplemental fuel. This is also described as a high temperature steam reforming method. Any HCFC 22 present in the HFC 23 will be decomposed in a similar manner. Detailed explanation of the proposed process technology is given in A4.3 of this project design document (PDD).

As a result of voluntarily implementing this CDM project, Changshu Haike will avoid HFC 23 emissions, which would have otherwise been vented to the atmosphere in the absence of the project activity. The installation of incineration facility would also provide technical benefits to the country through transfer of know-how of HFC decomposition technology and contribute to sustainable development.

If approved, this proposed CDM project will contribute to the sustainable development in China in the following aspects:
- According to China's "Measures for Operation and Management of Clean Development Mechanism Project in China", 65% of revenues from the transfer of CERs generated by the project will be given to the Chinese government to support its "Sustainable Development Facility".
- The project can contribute to the global initiatives towards mitigation of climate change through a reduction in GHG emissions into the atmosphere;
- The project can attract foreign investment and advanced technology into China to help it fulfill the target of sustainable development;
- The project can provide more employment opportunities to facilitate the harmonious and steady social development.

## A.3. Project participants:

| Name of Party involved (*) ((host) indicates a host Party) | Private and/or public entity(ies) project participants (*) (as applicable) | Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No) |
|---|---|---|
| People's Republic of China | Changshu Haike Chemical Co. Ltd. | No |
| United Kingdom | EDF TRADING Limited | No |

Project Entity:

Changshu Haike Chemical Co. Ltd. is the project owner and operator. This legal entity, a Sino-French Joint Venture, is located within the HCFC 22 facility of Arkema (Changshu) Fluorochemical Co. Ltd to treat HFC 23 gas emission from the HCFC 22 process within Arkema (Changshu) Fluorochemical Co. Ltd HCFC 22 facility, which started the HCFC 22 production in May 2000.
Arkema (Changshu) Fluorochemical Co. Ltd proposes to transfer exclusively its total HCFC 22 facility HFC 23 waste gas emission during CDM project period to Changshu Haike Chemical Co. Ltd for appropriate destruction and the latter (Changshu Haike Chemical Co. Ltd) accepts this transfer.

China signed the Kyoto Protocol on May 29, 1998 and ratified it on August 30, 2002.

Purchaser of CERs from the Project:

EDF Trading Limited, based in London, UK, is a wholly owned subsidiary of EDF, responsible for EDF's commodity trading (electricity, gas, coal, freight,...) including emissions trading.

United Kingdom signed the Kyoto Protocol on April 29, 1998 and ratified it on May 31, 2002.

The contact information of project participants is given in Annex1.

## A.4. Technical description of the project activity:

### A.4.1. Location of the project activity:

#### A.4.1.1. Host Party(ies):

People's Republic of China

#### A.4.1.2. Region/State/Province etc.:

Jiangsu Province

#### A.4.1.3. City/Town/Community etc:

Changshu City/Haiyu Town

#### A.4.1.4. Detail of physical location, including information allowing the unique identification of this project activity (maximum one page):

***Changshu Haike*** is located in Jiangsu Hi-tech Fluorine Chemical Industry Park (FCIP) in the north of Haiyu town of Changshu City of Jiangsu Province, along the Yangtze River. FCIP is situated 121° east longitude, 31°50' north latitude. It is about 16 km, 56 km, 100 km away south from Changshu City, Suzhou City, and Shanghai Municipality respectively, 15 km away east from Changshu Port, 35 km away northwest from Zhangjiagang Port, and faces Nantong Port across the Yangtze River on the north (see Figure 1 and Figure 2).

**Figure 1: Geographical Position of Changshu City in Jiangsu Province**

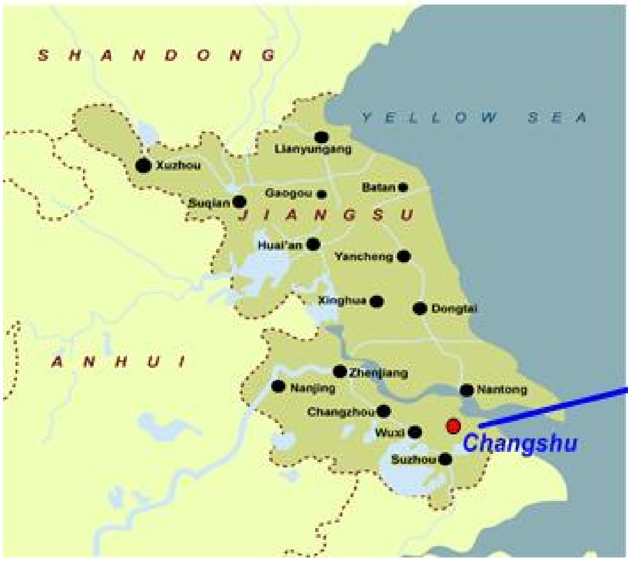



**Figure 2: Geographical Position of Changshu Haike in Changshu City**


The proposed project is located in the existing HCFC 22 production facility at Arkema Changshu Fluorochemical Co. Ltd plant site, and there is no residential area nearby (see Figure 3).

**Figure 3: Geographical Position of Changshu Haike in FCIP**

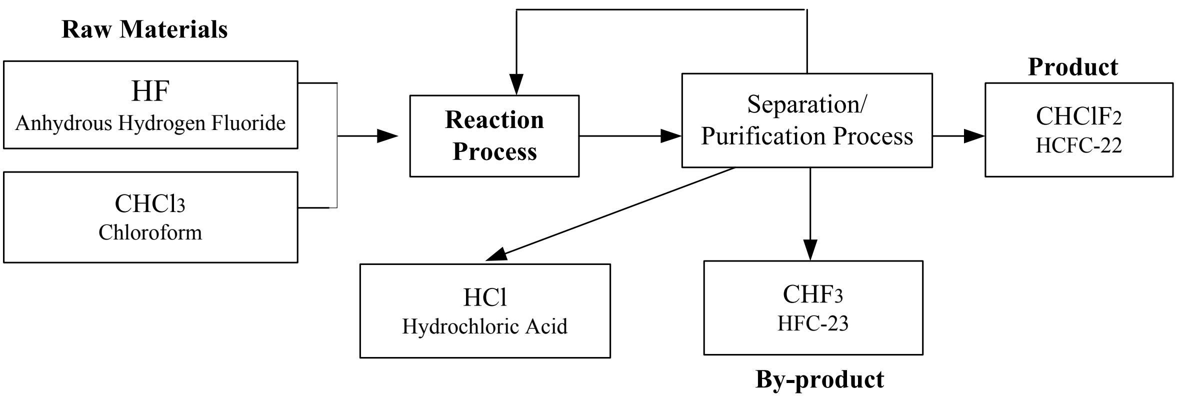

### A.4.2. Category(ies) of project activity:

This project is categorized in Category 11: "Fugitive Emissions from Production and Consumption of Halocarbons and Sulphur Hexafluoride"

### A.4.3. Technology to be employed by the project activity:

HCFC 22 is manufactured through continuous reaction of anhydrous hydrogen fluoride (HF) and chloroform (CHCl3) that are introduced into the reactor, in the presence of the antimony pentachloride (SbCl5) catalyst. HCFC 22 and a small amount of HFC 23 as well as HCl are generated in the reactor. The production flow of HCFC 22 and its by-products of HFC 23 are given in Figure 4.

**Figure 4: HCFC 22 Production Process**



The main reaction in the HCFC 22 Plant is:

$$2\ HF + CHCl_3 \dashrightarrow CHClF_2\ (=HCFC\ 22) + 2\ HCl$$

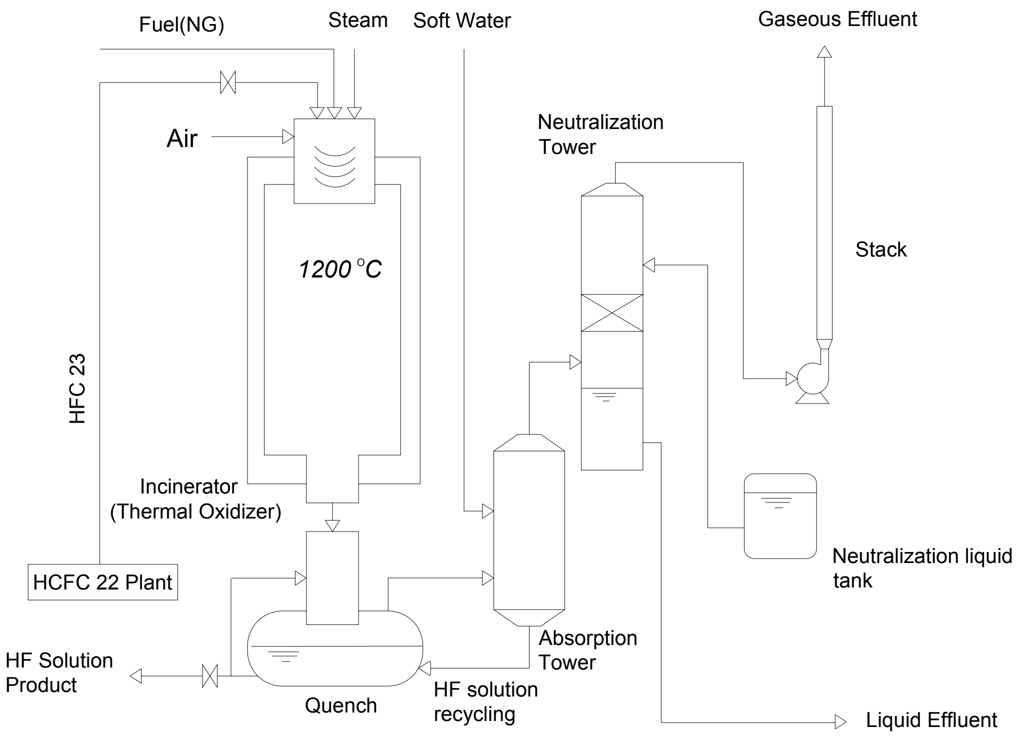
The chemical reaction generating HFC 23 in the HCFC 22 Plant is:

**3 HF + CHCl3 -->CHF3 (=HFC 23) + 3 HCl**

In the above-mentioned HCFC 22 manufacturing process HFC 23 (=CHF3) is inadvertently generated as a by-product. In Changshu Haike's case, the process produced HFC 23 at levels less than 3% of HCFC 22 production in the past, all of which, except some sampling, has been directly released to the atmosphere since there is no Chinese governmental regulation on the emission of HFC 23. The entity has not recovered or sold the HFC 23 generated to the market.

**Proposed decomposition technology:**
The project will adopt a thermal decomposition technology from a French company VICHEM to destroy HFC 23 emissions. VICHEM is a leading supplier of advanced oxidation systems to destroy gas emission, liquid and solid waste. The company started business in 1948 in technologies for the protection of the environment and specialized in the treatment of hazardous, very hazardous and halogenated waste. VICHEM's thermal decomposition technologies have been successfully applied in Rhodia, UK (2003), Solvay, France (1991), Adisseo, France (2003) and Arkema, France (1992). Its reliability and high destruction efficiency have been proved. So far, there are no advanced proven domestic technologies that are specialized in HFC 23 destruction in China. Through the transfer of VICHEM's technology to the proposed project, not only the performance of HFC 23 destruction process can be guaranteed, but also the relevant technical know-how can be transferred to China. Moreover, choosing the most advanced technology for HFC 23 destruction is also important in the sense that the technology employed by the project will not be substituted within the project period.

**Figure 5: Flow Diagram of HFC 23 Thermal Decomposition Process**




The HFC 23 thermal decomposition process flow of the VICHEM technology to be applied in the project is given in Figure 5. The detailed description is as follows:

***Thermal Oxidizer (Incineration Furnace)***

HFC 23 emission is fed to the thermal oxidizer directly from the HCFC 22 process. In the thermal oxidizer, natural gas (NG), combustion air coming from a combustion air fan and HFC 23 waste stream will be fully mixed and form a high speed volute. The thermal oxidizer will be equipped with a speed controller to adjust oxygen excess. The intensive mixed HFC 23 waste stream, NG, and air will then be burned in a burner to form hot fumes (the temperature is higher than 1,200℃ in the burner）. The gases from the complete combustion enter a furnace (1,200℃), which has a 2-second residence time. The furnace is not a flame zone but is used only for finishing off the last reactions. The decomposition rate of this process can reach 99.999%.

***Quench***

The flue gas leaving the thermal oxidizer is cooled in a quench tower. During the cooling process a circulating pre-cooled aqueous HF solution is used to quench the reaction and cool the flue gas to temperatures that can be handled in the absorption tower (the temperature can drop from 1200℃ to 45℃ in 0.001 second). This process can avoid the generation of dioxin. The majority of acid gases (HF and HCl) are absorbed into solution through this cooling process. Any unabsorbed acid gases along with $CO_2$, $N_2$ (from the air) pass from the quench tower to the caustic scrubber.

***Absorption tower***

The remaining acid gases along with $CO_2$, $N_2$ are fed to the bottom of an absorption tower. The acid gases can be absorbed by soft water through this process. The resulting diluted HF solution is refluxed to and accumulated in quench tower, and then discharged for sales when its mass concentration reaches about 40%. Unfortunately this HF solution can not be reclycled directly to HCFC 22 facility due to the presence of some undesired impurities. $CO_2$ and $N_2$ will pass through the caustic scrubber before being vented into the atmosphere.

***Neutralization tower***

Fumes coming from absorption tower will be sent to a neutralization tower where they are washed by caustic soda solution (NaOH). Acid gases will be removed after washing. The neutralized effluent reaches the requirements of Class III in *Integrated Wastewater Discharge Standard (GB8978-1996)*. It is directly discharged to the clean water tank of Arkema (Changshu), where it meets with other wastewater discharged from the wastewater treatment station of Arkema (Changshu), and finally discharged into the the wastewater treatment center (WTC) of FCIP through the wastewater pipe network. The treated effluent in WTC is in compliance with the requirements of Class I in *Integrated Wastewater Discharge Standard (GB8978-1996)* and discharged to the Long River (see Table 2 for details)*)*.

***Exhaust stack***

The tail gas from neutralization tower will be transferred to exhaust stack and finally emitted to the atmosphere. The gas emission will meet the *Integrated Emission Standard of Air Pollutants (GB16297-1996)*. This project will employ an advanced and clean HFC 23 decomposition facility with high burning efficiency and decomposition rate to reduce HFC 23 emission to the maximum extent. The pollutants discharged from the proposed HFC 23 incineration facility also completely comply with the threshold value of air pollutants in Table 3 in *Pollution Control Standard for Hazardous Wastes Incineration (GB 18484-2001)*.

**Technology transfer**

The decomposition facility is a proven technology from VICHEM. The decomposition efficiency is high and reliable (more than 99.999%). All gases and wastes exhausted from the facilities are in compliance with local and national regulations in terms of environmental protection. The emission levels of pollutants are far lower than those required by the current regulations on air quality in China.

As mentioned previously, the technology for thermal oxidation of HFC 23 is not available indigenously. The decomposition technology and equipment of VICHEM to be used at the Changshu Haike are very similar compared to those used in UK and France. The fundamental processes of thermal oxidization are identical. Therefore, it is anticipated that with the knowledge and experience of VICHEM gained in UK and France, the decomposition process will be equally successful in the facility of Changshu Haike.

At macroscopic level, the transfer of this technology in Changshu Haike will contribute to the development of the environmental technology in China, not only from the viewpoint of GHG emission reductions but also from one of stratospheric ozone layer protection; At microscopic level, operating know-how will be transferred to Changshu Haike by training the technical staff and workers to operate and maintain the whole operation process and equipment[1].

### A.4.4 Estimated amount of emission reductions over the chosen crediting period:

Annual GHG emission reductions of the proposed project are estimated to be 3,473,385 $tCO_2e$. For detailed calculation please refer to section B.6.3. During the first crediting period (May 2008 to April 2014), the total GHG emission reductions of the proposed project are estimated to be 24,313,695 $tCO_2e$.

The crediting period is expected to be renewed to 21 years in total. As the project is planned to start from 1/05/2008 with the renewable crediting periods, the emission reductions during the first crediting period are estimated as:

| **Years** | **Annual estimation of emission reductions in tons of $CO_2$ e** |
|---|---|
| 2008 (May to December) | 2,315,590 |
| 2009 | 3,473,385 |
| 2010 | 3,473,385 |
| 2011 | 3,473,385 |
| 2012 | 3,473,385 |
| 2013 | 3,473,385 |
| 2014 | 3,473,385 |
| 2015 (January to April) | 1,157,795 |
| **Total estimated reductions** (tons of $CO_2e$) | 24,313,695 |
| **Total number of crediting years** | 7 years |
| **Annual average over the crediting period** | 3,473,385 |

[1] This is elaborated in other sections of this PDD as well.

| | |
|---|---|
| **of estimated reductions** (tons of $CO_2e$) | |

### A.4.5. Public funding of the project activity:

No Official Development Assistance (ODA) Fund are used in this project

## SECTION B. Application of a baseline and monitoring methodology

### B.1. Title and reference of the approved baseline and monitoring methodology applied to the project activity:

Approved baseline methodology AM0001/Version 05.1 – Incineration of HFC 23 waste streams

Approved monitoring methodology AM0001/Version 05.1 – Incineration of HFC 23 waste streams

The approved baseline and monitoring methodology is available on the UNFCCC website:

http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html

### B.2 Justification of the choice of the methodology and why it is applicable to the project activity:

AM0001 is applicable to the CDM project that can satisfy the following conditions：

a) The project activity is the destruction of HFC 23 ($CHF_3$) waste streams from an existing HCFC22 production facility;

b) The HCFC-22 production facility has an operating history of at least three years between beginning of the year 2000 and the end of the year 2004 and has been in operation from 2005 until the start of the project activity;

c) The HFC-23 destruction occurs at the same industrial site where the HCFC-22 production occurs (i.e. no offsite transport occurs); and

d) Where no regulation requires the destruction of the total amount of HFC23 waste.

The proposed project can meet all the four requirements above:

a) The proposed project will decompose the HFC 23 generated from the existing HCFC 22 production facility;

b) The existing HCFC 22 production facility started its operation in May 2000 and has been in operation for more than three years and has been in operation from 2005 until now and will continue operation for whole project period. The actual annual production of HCFC 22 production was 7,937.7 tons in 2002, 13,179.3 tons in 2003 and 18,106.5 tons in 2004 respectively. The facility is dedicated for HCFC 22 production, and has never been used for CFCs swing production

c) The HFC 23 destruction is located within the HCFC 22 facility of Arkema (Changshu) Fluorochemical Co. Ltd to treat HFC 23 gas emission from the HCFC 22 process within Arkema (Changshu) Fluorochemical Co. Ltd HCFC 22 facility; and

d) There is no regulation in China restricting HFC 23 emissions at this moment or in the near future.

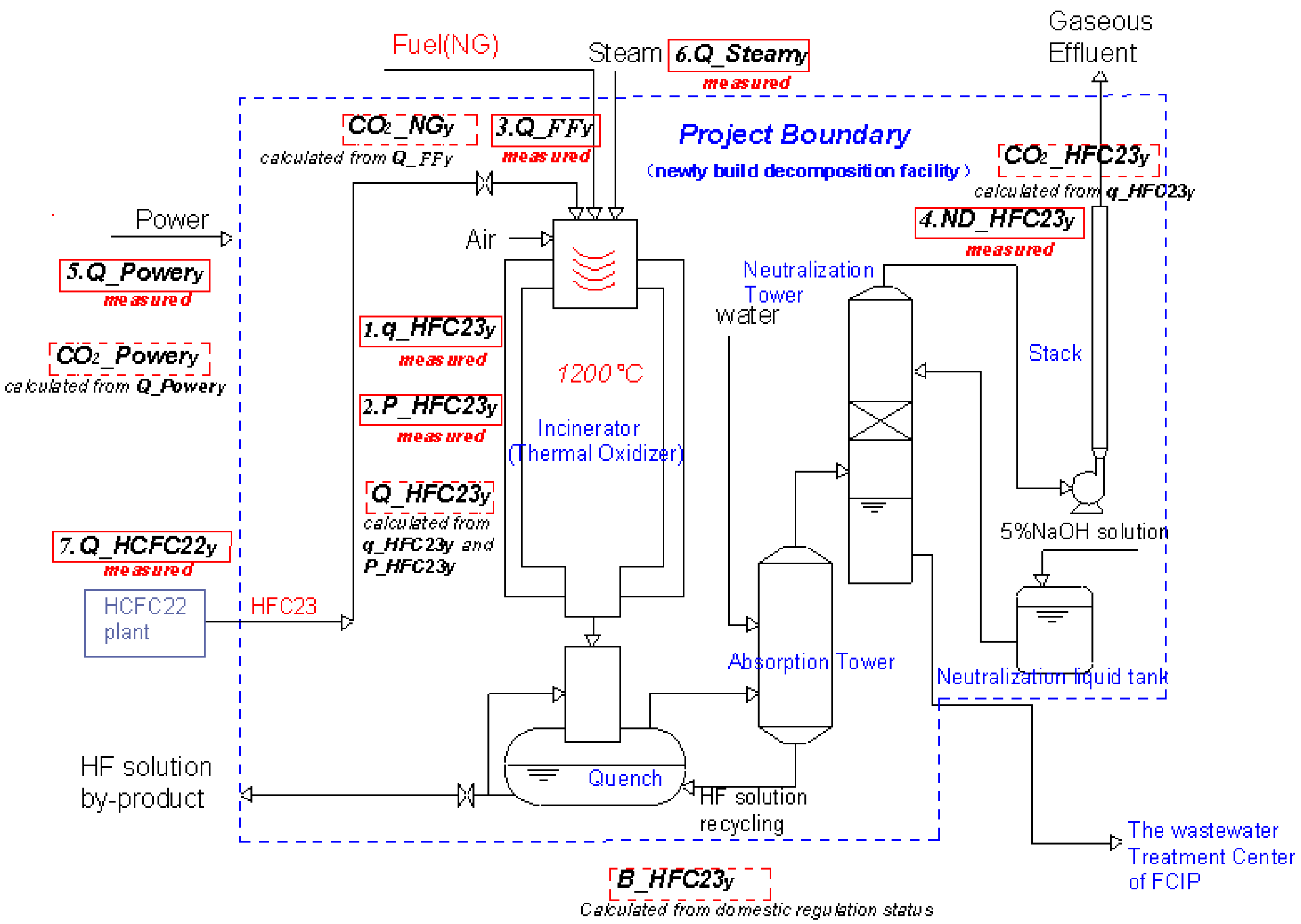
In addition, the decomposition technology and process of HFC 23 to be employed in the proposed project as described in Section A4.3, is same as defined in AM0001 /Version 05.1. In this PDD, the aforementioned approved baseline methodology is used in conjunction with the approved monitoring methodology AM0001/Version 05.1 ("Incineration of HFC 23 waste streams").

Therefore, AM0001 methodology is fully applicable to the proposed project.

## B.3. Description of the sources and gases included in the project boundary

The project boundary is defined as the facility to decompose the HFC 23 in the baseline methodology as shown in Figure 6, including incinerator, neutralization tower, exhaust stack etc., while HCFC 22 production facility and the transportation of HF solution are out of the project boundary.

**Figure 6: Project Boundary**




The description of sources and gases included in the project boundary see the Table below.

| | Source | Gas | Included ? | Justification/Explanation |
|---|---|---|---|---|
| Baseline | HCFC 22 production facility | HFC 23 | Yes | Main emission source<br>Note: as defined in the Figure 6, the source of HFC 23, i.e. HCFC 22 production facility, is out of the project boundary. |
| | | $CO_2$ | No | For simple and conservative |
| | | $CH_4$ | No | For simple and conservative |
| | | $N_2O$ | No | For simple and conservative |
| Project Activity | HFC 23 decomposition facility | HFC 23 | Yes | Not destroyed by the thermal oxydizer (leak into air).<br>The amount of HFC 23 not destroyed is estimated at 0.001% of the quantity of HFC 23 supplied to the destruction process.<br>Note: The HFC 23 which leaks into water effluent is considered by GHGs emission reduction calculation. Theoretically HFC 23 can also leak to the water effluent and then escape to the atmosphere. This possibility is ignored because it is infinitesimally small; the solubility of HFC 23 is 0.1% wt at 25$^o$C water |
| | | $CO_2$ | Yes | The thermal decomposition process converts the carbon in the HFC 23 into $CO_2$, which is released to the atmosphere. |
| | | $CH_4$ | Yes | The thermal decomposition process uses natural gas as fuel. The main content of natural gas is $CH_4$. |
| | | $N_2O$ | No | Negligible (see the explanation below this table and Annex 3 for details) |

As pointed out in Annex 3, there are some possible emissions of GHGs outside the project boundary that will not be measured, such as potential HCFC 22 leakage, and $N_2O$ from fuel consumption, power generation. These small flows are judged as negligible in the context of this project based on the information below as well as the estimation of their error ranges[2].

- HCFC 22 is also one of GHG with GWP of 1,700 (reference: IPCC Second Assessment Report). Since the project activity does not cause any changes to the existing HCFC 22 plant, there is no leakage effect associated with HCFC 22 production outside the project boundary; and

[2] Their error ranges are all below other measured quantities.

- A small quantity of $N_2O$ emissions are also produced during thermal destruction process while the $N_2O$ emissions, on a $CO_2$ equivalent basis, are a small fraction of the $CO_2e$ emissions and so are ignored.

The steam and electricity used by the thermal decomposition process are also the sources of GHGs ($N_2O$ and $CO_2$) out of the project boundary, which are included in the leakage item. The transport of HF solution is another source of leakage. The choices for these sources or gases in the leakage calculation are given in the Section B.6.1.

**B.4. Description of how the baseline scenario is identified and description of the identified baseline scenario:**

According to the approved baseline methodology AM0001/Version 05.1, in the absence of regulations requiring the destruction of HFC 23 waste, the typical situation in non-Annex I Parties like China, the fraction of the waste stream required to be destroyed by the regulations that apply during year y ($r_y$) is zero. Absent regulations on HFC 23 emissions, the HFC 23 waste is typically released to the atmosphere so the baseline scenario is zero destruction (see Section B.6.1 for details).

**B.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered CDM project activity (assessment and demonstration of additionality)**:

If the proposed decomposition facilities were not installed, all HFC 23 would be emitted to the atmosphere, as there is no local market demand of HFC 23. There are no commercial incentives for the entity to set up the decomposition facility mentioned in this project at present, and its destruction is not mandatory for Changshu Haike. The proposed thermal oxidation facility converts HFC 23 with high GWP of 11,700 into $CO_2$ with low GWP of 1, which results in almost complete destruction of HFC 23 (99.999%). The net GHG emission reduction achieved by the proposed project activity is the quantity of waste HFC 23 actually destroyed less the GHG emissions generated by the destruction process less leakage due to the destruction process (see Section B.6.1. and B.6.3. for details). The decomposed amount of HFC 23 will be monitored on an ex-post basis.

The proposed project activity meets with “additionality” criteria for the following reasons:

1) China has so far no restriction on emitting HFC 23 into the air, and also has no plan to introduce regulations on HFC 23 emission control;
2) The Montreal Protocol is, at present, the only law implemented in China that impacts HCFC 22. The Montreal Protocol stipulates that the HCFC 22 production should be ceased by the year 2040 （HCFC 22 as a raw material is not limited by Montreal Protocol）. Since the demand for HCFC 22 as raw material for polymer production is increasing, HFC 23 will continue to be generated as a by-product of HCFC 22 manufacture;
3) There are no commercial incentives for Changshu Haike to set up the decomposition facility mentioned in this project at present or in the future and there is no significant market for HFC 23 in China.

Therefore, GHG emission reductions would not occur in the absence of the proposed project activity. However HFC 23 can be almost completely decomposed with the proposed project activities and thus the quantity of HFC 23 destroyed is greater than the baseline quantity destroyed in this project. The project is therefore proven to be additional in accordance with the requirements for proving additionality outlined within AM0001/Version 05.1.

The amount of GHG emission reductions according to methodology AM0001/Version 05.1 from this project is expected to be 3,473,385 $tCO_2e$ for a typical year as shown in section B.6.4.

## B.6. Emission reductions:

### B.6.1. Explanation of methodological choices:

Calculation of GHG emission reduction measured in tons of $CO_2$ equivalents ($tCO_2e$) is according to methodology AM0001/Version 05.1:

**Emission Reduction:**

The GHG emission reduction achieved by the project activity is the quantity of waste HFC 23 actually destroyed less the greenhouse gas emissions generated by the destruction process less leakage due to the destruction process. Specifically, the greenhouse gas emission reduction ($ER_y$) achieved by the project activity during a given year (y) is equal to the quantity of HFC 23 waste from HCFC production facility ($Q\_HFC\ 23_y$) destroyed by the project activity less the baseline HFC 23 destruction ($B\_HFC\ 23_y$) during that year multiplied by the approved Global Warming Potential value for HFC 23 (GWP_HFC 23) less the greenhouse gas emissions generated by the destruction process ($E\_DP_y$) less greenhouse gas leakage ($L_y$) due to the destruction process.

$$\mathbf{ER_y = (Q\_HFC\ 23_y - B\_HFC\ 23_y) * GWP\_HFC\ 23 - E\_DP_y - L_y}$$

Where:

- $ER_y$ is the greenhouse gas emission reduction during year y measured in tons of $CO_2$ equivalents (t CO2e);
- $Q\_HFC\ 23_y$ is the quantity of waste HFC 23 destroyed during year y measured in metric tons (t);
- $B\_HFC\ 23_y$ is the baseline quantity of HFC 23 destroyed during year y measured in metric tons,
- GWP_HFC 23 is the Global Warming Potential that converts 1 ton of HFC 23 to tons of $CO_2$
- equivalents ($tCO_2e$/t HFC 23). The approved Global Warming Potential value for HFC 23 is 11,700 $tCO_2e$/t HFC 23 for the first commitment period under the Kyoto Protocol;
- $E\_DP_y$ is the GHG emissions due to the destruction process year y (t $CO_2e$); and
- $L_y$ is the GHG leakage due to the destruction process year y (t $CO_2e$).

The quantity of waste HFC 23 destroyed ($Q\_HFC\ 23_y$) is calculated as the product of the quantity of waste HFC 23 supplied to the destruction process ($q\_HFC\ 23_y$) measured in metric tons and the purity of the waste HFC 23 ($P\_HFC\ 23_y$) supplied to the destruction process expressed as the fraction of HFC 23 in the waste [$Q\_HFC\ 23_y = q\_HFC\ 23_y * P\_HFC\ 23_y$].

The destruction process uses fuel (NG), steam and electricity. The electricity is purchased from the East China Power Grid. The steam is from the existing boiler of FCIP, which is additionally generated for the project. Therefore, the emissions associated with these two energies are included in the leakage calculation ($L_y$) in terms of methodology AM0001. The emissions due to the destruction process ($E\_DP_y$) are the emissions due to the NG use, the emissions of HFC 23 not destroyed and the greenhouse gas emissions of the destruction process. Thus:

$$\mathbf{E\_DP_y = ND\_HFC\ 23_y * GWP\_HFC\ 23 + Q\_FF_y * E\_FF_y + Q\_HFC\ 23_y * EF}$$

Where:

- $ND\_HFC\ 23_y$ is the quantity of HFC 23 not destroyed during year y,
- $Q\_FF_y$ is the quantity of NG used by the destruction process during year y measured in metric tons ($m^3$);
- $E\_FF_y$ is the emissions factor for NG combustion during year y measured in tons $CO_2$ equivalent per cubic meter of natural gas (t $CO_2e/m^3$); the value of $E\_FF_y$ will vary by region and over time, but is of the order of 1.96*10-3 t$CO_2e/m^3$. Further details can be referred in Annex 3.

The quantity of HFC 23 not destroyed ($ND\_HFC\ 23_y$) is typically small; the monitoring plan provides for its periodic on-site measurement. Theoretically HFC 23 can also leak into the water effluent and then escape to the atmosphere. This possibility is ignored because it is infinitesimally small; the solubility of HFC 23 is 0.1% wt at 25$^oC$ water.

The thermal destruction process converts the carbon in the HFC 23 into $CO_2$, which is released to the atmosphere. The quantity of $CO_2$ produced by the destruction process is the product of the quantity of waste HFC 23 ($Q\_HFC\ 23_y$) destroyed and the emission factor (EF). The emission factor is calculated as follows:

EF = 44/[(molecular weight of HFC 23)/(number of C in a molecule of HFC 23)] = 44/[70/1] =0.62857

The thermal destruction process also produces a small quantity of $N_2O$ emissions. The $N_2O$ emissions, on a $CO_2$ equivalent basis, are a small fraction of the $CO_2$e emissions and so are ignored.

**Baseline:**

The facility is dedicated for HCFC 22 production, has never been and will never be used for CFCs swing production.

The baseline quantity of HFC 23 destroyed is the quantity of the HFC 23 waste stream required to be destroyed by the applicable regulations. The quantity required to be destroyed by the applicable regulations is:

$$\mathbf{B\_HFC\ 23_y = Q\_HFC\ 23y} * r_y$$

Where $r_y$ is the fraction of the waste stream required to be destroyed by the regulations that apply during year $y$. In the absence of regulations requiring the destruction of HFC 23 waste, the typical situation in non-Annex I Parties like China, $r_y = 0$. Absent regulations on HFC 23 emissions, the HFC 23 waste is typically released to the atmosphere so the baseline scenario is zero destruction.

To exclude the possibility of manipulating the HCFC 22 production process to increase the quantity of HFC 23, $Q\_HFC\ 23_y$ is limited to a fraction ($w$) of a maximum quantity of HCFC22 production at the originating plant that is eligible for crediting ($Q\_HCFC\ 22_{y,max}$).

$$\mathbf{Q\_HFC\ 23_y \leq Q\_HCFC\ 22_{y,max}} * w$$

Where:

- $Q\_HCFC\ 22_{y,max}$ is maximum annual production of HCFC 22 at the originating plant that is eligible for crediting (metric tones per year);

  The maximum annual HCFC 22 production quantity that is eligible for crediting ($Q\_HCFC22_{y,max}$) is the lower value between:

  a) the actual HCFC 22 production in year y ($Q\_HCFC22_y$); and
  b) the maximum historical annual HCFC 22 equivalent production level ($Q\_HCFC\ 22_{Hist}$) at this plant (in tons of HCFC 22) during any of the last three (3) years between beginning of the year 2000 and the end of the year 2004. In Changshu Haike's case, $Q\_HCFC\ 22_{Hist}$ only includes the actual HCFC 22 production since there is no CFCs swing production.

- *w* is the waste generation rate (HFC 23[3])/(HCFC 22) for the originating plant (metric tons of HFC23 per metric tons of HCFC22).

The historical waste generation rate *w* is estimated for the three (3) most recent years of operation up to 2004.

According to the AM0001 methodology there are three options for calculating *w*:

1. "Direct measurement of HFC 23 release is to be used where data are available, otherwise
2. Mass balance or other methods based on actual data are to be used. Uncertainty in emission rate estimates shall be quantified and conservative emission rate estimates shall be used when calculating expected emission reductions.
   Regardless of which option is followed it is stated that "The value of w is set at the lowest of the three historical annual values estimated as specified above and is not to exceed 3% (0.03 tons of HFC 23 produced per ton of HCFC 22 manufactured)".
3. If insufficient data is available for calculating HFC 23 emissions for all three most recent years up to 2004, then w is set at the default value of 1.5%.

In this project we adopt the option 1: direct measurement.

In Changshu Haike's case, the total HFC 23 contained tail gas was measured by a vortex volume flow meter and calculated to mass in the past. The tail gas mass is reported in production daily logbook and recorded electronically in DCS. The tail gas from the HCFC22 production plant has been taken as sample weekly just before the HFC23 vent point. The gas composition has been directly monitored on a weekly basis by using a gas chromatography analysis. Internal calibration of the GC has been conducted every month so far. Each monthly total HFC 23 tail gas emission data is calculated by multiplying tail gas mass and gas composition monthly average. This data is used to calculate corresponding mass ratio of HFC 23/HCFC 22, based on which the ratio for each year is obtained.

**Leakage:**

Leakage is emissions of greenhouse gases due to the project activity that occur outside the project boundary. The sources of leakage due to the destruction process in the proposed project are:

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[3] The quantity of HFC 23 used to calculate this coefficient is the sum of HFC 23 recovered for sale plus the waste HFC 23.

- GHG ($CO_2$ and $N_2O$) emission associated with the production of purchased electricity and steam;
- $CO_2$ emission due to transport of HF solution.

$$\mathbf{L_y = Q\_Power_y * E\_Power_y + Q\_Steam_y * E\_Steam_y + ET_y}$$

Where:
- $Q\_Power_y$ is the quantity of electricity used by the destruction process during year y (kWh);
- $E\_Power_y$ is the greenhouse gas emissions factor for electricity used by the destruction process during year y (t $CO_2$e/kWh);
- $Q\_Steam_y$ is the quantity of steam used by the destruction process during year y (t Steam);
- $E\_Steam_y$ is the greenhouse gas emissions factor for steam used by the destruction process during year y (t $CO_2$e/t steam);
- $ET_y$ is the GHG emissions associated with transport of HF solution during year y (t $CO_2$e), which is negligible small as shown in Section B.6.3.

The $N_2O$ emissions from power generation, on a $CO_2$ equivalent basis, is much smaller when compared to the GHG emissions reduction and so are ignored

**Basic assumptions and calculation of parameters:**

Some basic assumptions and calculation of parameters are summarized below to show that the proposed project activity meets the applicability conditions of the AM0001 methodology.

1) Emission Reduction: In absence of regulations to restrict HFC 23 emissions, all HFC 23 of the existing HCFC 22 production facility that is not recovered for sale in the case of Changshu Haike, is assumed to be released to the atmosphere.

2) $ND\_HFC\ 23_y$ is a fraction of $Q\_HFC\ 23_y$ that is not destroyed during the destruction process, and is to be released in the stack to the atmosphere. However, this emission occurs within the project boundary and is not treated as leakage. In the monitoring plan section, the volume of the $ND\_HFC\ 23_y$ is monitored, calculated and finally converted into the yield amount (ton) of non-decomposed HFC 23 by a coefficient as shown in Treatment of Uncertainties of Annex 4.

3) Local regulation: At present, there is no regulation to restrict HFC 23 emissions in China. So $B\_HFC\ 23_y$ can be set as zero. This condition will be checked annually and, if relevant regulation is introduced in China, $B\_HFC\ 23_y$ will be modified as specified in the approved methodology AM0001.

4) Eligible HCFC 22 annual production: The annual production amount of HCFC 22 and the cut-off ratio w of HFC 23/HCFC 22 are the two key parameters for Changshu Haike to determine eligible HFC 23 annual production. To avoid manipulation of HCFC 22 production amount which could result in inflated amount of HFC 23, the AM0001 has introduced an additional requirement that the existing production facility, where the HFC 23 waste originates, shall have an operating history of at least three years between 2000 and 2004 and that $Q\_HCFC\ 22_{y,\ max}$ is limited to the lower value between the actual HCFC 22 annual production ($Q\_HCFC\ 22_y$) and the maximum historical annual production level during any of at the least three years between 2000 and 2004 ($Q\_HCFC\ 22_{Hist}$).

Accordingly, based on the actual operation history and detailed production records documented for the existing HCFC 22 production facility, in Changshu Haike's case, the eligible HCFC 22 production that is in compliance with the requirement of the AM0001, are 7,937.7 tons in 2002, 13,179.3 tons in 2003 and 18,106.5 tons in 2004. Thus the value recorded in 2004 (18,106.5 tons) shall be the maximum historical production amount of HCFC 22 ($Q\_HCFC\ 22_{Hist}$).

5) Cut-off condition: The actual situation on an ex-post basis is to be checked against *w*=1.64% (2003) which is the lowest of three historical annual values from 2002 to 2004. Based on the lowest latest annual historical data during 2002 to 2004 in Changshu Haike's case, the actual performance for the waste generation ratio w is 1.87% (2002), 1.64 % (2003), and 1.84% (2004). The parameter w is obtained by direct measurement through tail gas vortex flow meter and gas chromatography HFC 23 composition analysis as described above in B.6.1. The accuracy of vortex flow meter is higher than 99%, provided by equipment supplier. The gas chromatography's accuracy is in ppm level. Even recently the site found some air could be introduced during sampling process and caused the w result lower than the reality, the most conservative ratio w was voluntarily used in the calculation of baseline. Therefore, the "cut-off" condition is set as 1.64%. The site is implementing a new procedure by preliminarily purging sampling gas cylinder before sample filling. This new procedure will definitively avoid the uncertainty about HFC 23 sampling accuracy.

### B.6.2. Data and parameters that are available at validation:

| **Data / Parameter:** | $Q\_HCFC\ 22_{Hist}$ |
|---|---|
| Data unit : | t-HCFC 22 |
| Description : | Maximum historical HCFC 22 production between 2002 and 2004 |
| Source of data used: | Data sheet of HCFC22 output, recorded and archived by the plant. |
| Value applied: | 18,106.5 tons in 2004 |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | HCFC 22 production in 2002: 7937.7 t<br>HCFC 22 production in 2003: 13179.3 t<br>HCFC 22 production in 2004: 18106.5 t |
| Any comment: | Key parameter.<br>HCFC 22 output was measured by weight meters. |

| **Data / Parameter:** | *w* |
|---|---|
| Data unit: | % |
| Description: | HFC 23 generation rate at Changshu Haike |
| Source of data used: | Data sheet of HFC 23 output, recorded and archived by the plant. |
| Value applied: | 1.64 % |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | HFC 23 generation rate in 2002: 1.87%<br>HFC 23 generation rate in 2003: 1.64%<br>HFC 23 generation rate in 2004: 1.84% |
| Any comment: | Minimum rate in the last 3 years of operation between 2002 and 2004.<br>HFC 23 was measured by vortex flow meter and gas chromatography. |

| | |
|---|---|
| **Data / Parameter:** | GWP_HFC 23 |
| Data unit: | $tCO_2e$/ t HFC 23 |
| Description: | Global Warming Potential Value of HFC 23 for the first commitment period under the Kyoto Protocol |
| Source of data used: | IPCC Second Assessment Report |
| Value applied: | 11,700 |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | IPCC default value |
| Any comment: | For the first commitment period under the Kyoto Protocol, Global Warming Potential values used shall be those provided by the Intergovernmental Panel on Climate Change in its Second Assessment Report ("1995 IPCC GWP values"). |

| | |
|---|---|
| **Data / Parameter:** | $E\_FF_y$ |
| Data unit: | $tCO_2e/ m^3$ |
| Description: | Emission factor of fuel (NG) |
| Source of data to be used: | Calculated from component analysis report of natural gas |
| Value applied: | $1.96*10^{-3}$ |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | Calculated from component analysis report of natural gas<br>$E\_FF_y$ = 44 * average number of carbon atoms of NG / 22.4 |
| Any comment: | Very minor contribution and does not affect the final results of the project emission reduction significantly. |

### B.6.3 Ex-ante calculation of emission reductions:

## The Project Emissions:

Within the system boundary, GHG emissions include $CO_2$ release due to conversion of HFC 23 in thermal oxidation process, $CO_2$ equivalent of non-decomposed HFC 23 and GHG ($CO_2$ and $N_2O$) release from burning of fuel (in this case NG is used as fuel).

Theoretically HFC 23 can also leak to the water effluent and then escape to the atmosphere. This possibility is ignored because it is infinitesimally small; the solubility of HFC 23 is 0.1% wt at $25^0$C water.

The following indirect $CO_2$ emissions are not considered, as these are very insignificant and not measurable. This is in accordance with the approved AM0001/Version 05.1.

- $CO_2$ released in the manufacture of packing material for absorption tower (caustic scrubbing tower) as this packing material is not consumable item. This packing material requires change only when broken;
- $CO_2$ released in the fabrication/manufacture of equipment and machinery used in the project activity;
- $CO_2$ equivalent of $N_2O$ released from the project activity, which is insignificant in comparison to the GHG emission reductions.

**$E\_DP_y$ = ND_HFC $23_y$ * GWP_HFC 23 + Q_$FF_y$ * E_$FF_y$ + Q_HFC $23_y$ * EF**
= 296.947*0.001%*11,700+141,213.6*1.96*$10^{-3}$+296.947*0.62857
= 498 $tCO_2e$

Where the parameters are those specified in the AM0001/Version 05.1 and also in Section B.6.1.

In the ex-ante calculation of Q_HFC $23_y$, Q_HFC $23_y$ = Q_HCFC $22_{y,max}$ * $w$ = Q_HCFC $22_{Hist}$ * $w$ = 18,106.5 * 1.64% = 296.947 t-HFC 23.

The data for NG (141,213.6 $m^3$) is from the technical specifications of the proposed decomposition system. E_$FF_y$ = 1.96*$10^{-3}$ $tCO_2e/m^3$, the detailed calculation is given in the Annex 3.

## Estimated Leakage:

The description related to leakage, including definition, each gas, source, effects and formulae is partly given in Section B.6.1. Other information is provided as follows:

HCFC 22 is a type of GHG with GWP of 1,700 (reference: IPCC Second Assessment Report). Since the project activity does not cause any changes to the existing HCFC 22 plant, there is no leakage effect associated with HCFC 22 emission in the project.

In this project, about 2,793.4 t of HF solution is generated per year as by-product for sale. The emissions associated with transporting HF solution are estimated as follows:
$CO_2$ equivalent of emission associated with transporting HF solution, i.e. the product of E_HF $solution_y$[4] and Q_HF solution, equals to 0.133 t $CO_2e$ (4.76*$10^{-5}$ *2,793.4), which is very small, compared to the GHG emission reductions and so is ignored.

The effluent from neutralization liquid tank is directly discharged to the tail water pond in a central position of Arkema (Changshu)'s plant area, and then into the wastewater treatment centre (WTC) of FCIP through the pipe network as described in Section A.4.3, and therefore no sludge is generated in this project in site. According to EIA result, 2.445 tons of pure $CaF_2$ is generated in the WTC of FCIP. For conservative principle, 80% of water content in sludge is assumed to estimate the amount of sludge containing $CaF_2$ as 12.225 t. This amount of sludge will transported by a 300-ton ship to a special solid wastes treatment company in Yancheng City, Jiangsu Province. The average transportation distance is 100 km away. The standard diesel consumption of the ship is 1.1kg diesel/km. The IPCC default value of GHG emissions factor for diesel is 3.21t $CO_2$/t-diesel.

Thus, the GHG emissions factor of transporting sludge, $E\_F_{sludge,y}$, is:

[4] See the Annex 3 for detailed calculation.

$E\_F_{sludge,y}$ = (1/300)*(100)* (1.1*$10^{-3}$)*3.21 = 1.18 * $10^{-3}$ $tCO_2e$/t-sludge.

Therefore, the $CO_2$ equivalent of emission associated with sludge transportation is 12.225 * 1.18 * $10^{-3}$ = 0.0144 $tCO_2e$. This is a small fraction of the $CO_2e$ emissions and so is ignored.

As analysed above, $ET_y$, can be neglected, i.e. $ET_y$ is zero.

Thus:

**$L_y$ = Q_ $Power_y$ * E_$Power_y$ + Q_ $Steam_y$ * E_$Steam_y$ + $ET_y$**
= 316,800*9.0465*$10^{-4}$ + 277.2*0.40+0
= 397 $tCO_2e$

Where the parameters are those specified in the AM0001/Version 05.1 and also in Section B.6.1. The data for power (316,800 kWh/y) and steam (277.2 t-steam/y) are from the technical specifications of the proposed decomposition system. E_$Power_y$ = 9.0465*$10^{-4}$ $tCO_2e$/kWh and E_$Steam_y$ = 0.40 $tCO_2e$/t steam, their detailed calculations are given in the Annex 3.

### Baseline emissions:

The baseline quantity of HFC 23 destroyed in a year y is described as

**B_HFC $23_y$ = Q_HFC $23_y$ * $r_y$**

Where the parameters are those specified in the AM0001/Version 05.1 and also in Section B.6.1. For Q_HFC $23_y$, its definition and conservative assumptions should be referred in Section B.6.1.

In the absence of regulations requiring the destruction of HFC 23 waste, the typical situation in non-Annex I Parties like China, $r_y$ = 0. Absent regulations on HFC 23 emissions, the HFC 23 waste is typically released to the atmosphere so the baseline scenario (B_HFC $23_y$) is zero destruction.
Thus, the baseline emissions are:

Q_**HFC $23_y$** * GWP_HFC 23 = 296.947 * 11,700 = 3,474,280 t $CO_2e$

### The total emission reduction in a regular year is expected to be:

**$ER_y$ = (Q_HFC $23_y$ – B_HFC $23_y$) * GWP_HFC 23 – E_$DP_y$ – $L_y$**
= (Q_HFC $23_y$ – B_HFC $23_y$) * GWP_HFC 23 – (ND_HFC $23_y$ * GWP_HFC 23 + Q_$FF_y$ * E_$FF_y$ +Q_HFC $23_y$ * EF) – (Q_ $Power_y$ * E_$Power_y$ + Q_ $Steam_y$ * E_$Steam_y$ + $ET_y$)
= 296.947*11,700–(296.947*0.001%*11,700+141,213.6*1.96*$10^{-3}$+296.947*0.62857)–(316,800*9.0465*$10^{-4}$ + 277.2*0.40+0)
= 3,474,280-498-397
= 3,473,385

Where $ER_y$ is the total emission reduction of the project activity in the given year y, measured in tons of $CO_2$ equivalent.

| B.6.4 Summary of the ex-ante estimation of emission reductions: |
|---|

| Year | Estimation of Project activity Emission (tonnes of $CO_2e$) | Estimation of baseline emission (tonnes of $CO_2$ e) | Estimation of leakage (tonnes of $CO_2e$) | Estimation of Emission reductions (tonnes of $CO_2$ e) |
|---|---|---|---|---|
| 2008 | 332 | 2,316,187 | 265 | 2,315,590 |
| 2009 | 498 | 3,474,280 | 397 | 3,473,385 |
| 2010 | 498 | 3,474,280 | 397 | 3,473,385 |
| 2011 | 498 | 3,474,280 | 397 | 3,473,385 |
| 2012 | 498 | 3,474,280 | 397 | 3,473,385 |
| 2013 | 498 | 3,474,280 | 397 | 3,473,385 |
| 2014 | 498 | 3,474,280 | 397 | 3,473,385 |
| 2015 | 166 | 1,158,093 | 132 | 1,157,795 |
| **Total (t $CO_2e$)** | 3,486 | 24,319,960 | 2,779 | 24,313,695 |

## B.7 Application of the monitoring methodology and description of the monitoring plan:

### B.7.1 Data and parameters monitored:

| **Data / Parameter:** | 1.q_HFC $23_y$ |
|---|---|
| Data unit: | kg-HFC 23 |
| Description: | Quantity of HFC 23 supplied to the destruction process |
| Source of data to be used: | Based on tail gas flow meter measurement |
| Value of data applied for the purpose of calculating expected emission reductions in section B.5 | 18,106.5 * 1.64% * 1000 = 296,947<br>Historical maximum annual HCFC 22 production and the minimum rate in the last 3 years of operation between 2002 and 2004 are applied to calculate q_HFC $23_y$ in the case of no actual monitoring data. |
| Description of measurement methods and procedures to be applied: | Measured by two flow meters in series;<br>Calibration will be done every six months by an officially accredited entity. The zero check on the flow meters will be conducted every week. If the zero check indicates that flow meter is not stable, an immediate calibration of the flow meter will be undertaken. Most of the time, both flow meters measure the same amount of HFC 23 flows simultaneously. If the flow meter readings differ by greater than twice the claimed accuracy, then the reason for the discrepancy is investigated and the fault remedied. For the sake of conservativeness the lower value of the two readings will always be used to estimate the HFC 23 waste flows.<br>The monthly quantity of HFC 23 waste flows (q_$HFC23_m$) is the sum of the lower periodic[5] reading of the two meters, as follow:<br>$q\_HFC23m = \sum min^{m} (q\_HFC23_{1,t}, q\_HFC23_{2,t})$<br>t= number of period in a month |
| QA/QC procedures to | A QA & QC organization will be formed. We plan to measure by two flow |

[5] The periodic frequency of less than one hour can be used, as documented in the PDD.

| | |
|---|---|
| be applied: | meters in series but read simultaneously. The flow meters will be calibrated every six months by an officially accredited entity. The zero check on the flow meters will be conducted every week. If the zero check indicates that flow meter is not stable, and immediate calibration of the flow meter will be undertaken. |
| Any comment: | Monthly recorded, electronically archived. The calibration will be conducted by an external accredited entity (for example : The Center Metrology Station of Yangzi Petrochemical Co Ltd) following Chinese official standard JJG198-94. |

| **Data / Parameter:** | 2.P_HFC $23_y$ |
|---|---|
| Data unit: | % |
| Description: | Purity of HFC 23 supplied to the destruction process |
| Source of data to be used: | Gas chromatography analysis |
| Value of data applied for the purpose of calculating expected emission reductions in section B.5 | Average of the weekly analysis for a month. The historical value during 2002 and 2004 is as follows: P_HFC $23_{2002}$ : 91.3%<br>P_HFC $23_{2003}$ : 89.3%<br>P_HFC $23_{2004}$ : 89.8%<br>The rest of the content is assumed to be mainly air introduced in sampling process and HCFC22 residual. |
| Description of measurement methods and procedures to be applied: | Measured by gas chromatography analysis |
| QA/QC procedures to be applied: | Will be measured by weekly gas chromatography analysis.<br><br>The verification of gas chromatography will be conducted externally pursuant to the Verification Regulation of Gas Chromatograph (JJG700-1999), using HCFC22 and HFC23 as standard substances. The analysis will be repeated in case of doubt regarding its veracity. |
| Any comment: | Weekly recorded, electronically archived.<br>A new procedure for sampling process will be implemented by preliminarily purging sampling gas cylinder to avoid the introduction of air during sample filling.<br>A few percent of HCFC22 is assumed to be included in the tail gas. The concentration will be analyzed by gas chromatography as HFC23 purity and process parameter control improvement will allow keep HCFC22 content in tail gas very low. |

| **Data / Parameter:** | 4.ND_HFC $23_y$ |
|---|---|
| Data unit: | kg-HFC 23 |
| Description: | Quantity of HFC 23 in gaseous effluent |
| Source of data to be used: | Gas chromatography |
| Value of data applied for the purpose of calculating expected emission reductions in section B.5 | 0.001% of the quantity of HFC 23 supplied to the destruction process |
| Description of | When the thermal oxidizer stops, analysis of the effluent gas is done to check |

| | |
|---|---|
| measurement methods and procedures to be applied: | leaked HFC 23 by sampling |
| QA/QC procedures to be applied: | Will be measured from the gas effluent of the destruction process.<br>Its quality can be ensured through an internal audit procedure. One analyst is responsible for sampling and analyzing, and the other for checking the results. The verification of gas chromatography will be conducted externally pursuant to the Verification Regulation of Gas Chromatograph (JJG700-1999), using HFC23 as standard substances. The analysis will be repeated in case of doubt regarding its veracity. |
| Any comment: | While the monitoring methodology AM0001 /Version 05.1 does not specify the type of equipment used to monitor $ND\_HFC\ 23_y$, the proposed project intends to use gas chromatography for the gas flow in the stack. It is reasonable to measure with gas chromatography a sample fraction (%) of HFC 23 in the stack to be released to the atmosphere and also measure a sample volume of such emission gas with flow meter and take their product and converts it from volume to mass to yield amount (ton) of non-decomposed HFC 23. Such conversion factor is assumed to be constant as shown in Annex 3.<br>Monthly recorded, electronically archived |

| **Data / Parameter:** | $3.Q\_FF_y$ |
|---|---|
| Data unit: | $m^3$ |
| Description: | Quantity of NG used by the destruction process |
| Source of data to be used: | NG meter |
| Value of data applied for the purpose of calculating expected emission reductions in section B.5 | 141,213.6 $m^3$ |
| Description of measurement methods and procedures to be applied: | Measured by using a NG meter |
| QA/QC procedures to be applied: | Will be metered using NG meter<br>NG purchase and consumption records as well as the invoices for sold NG are used as cross-check proofs. |
| Any comment: | Monthly recorded, electronically archived |

| **Data / Parameter:** | $7.Q\_HCFC\ 22_y$ |
|---|---|
| Data unit: | t-HCFC 22 |
| Description: | The quantity of HCFC 22 produced in the plant generating the HFC 23 waste |
| Source of data to be used: | Weight meter |
| Value of data applied for the purpose of calculating expected emission reductions in section B.5 | 18,106.5 |

| | |
|---|---|
| Description of measurement methods and procedures to be applied: | Checked by the production record monthly and aggregately yearly |
| QA/QC procedures to be applied: | Will be obtained from production records of the facility where the HFC 23 waste originates.<br>All weighing concerned equipment will be calibrated according to Chinese national regulation and standards.<br>The documents, such as inventory records and sales information, are used as cross-check proofs. |
| Any comment: | Reference data to check cut off condition and rough estimation of Q_HFC $23_y$<br>Monthly recorded, electronically archived |

| | |
|---|---|
| Data / Parameter: | Q_HCFC $22_{y,max}$ |
| Data unit: | t-HCFC 22 |
| Description: | Maximum annual production of HCFC 22 at the originating plant that is eligible for crediting |
| Source of data to be used: | HCFC22 production records |
| Value of data applied for the purpose of calculating expected emission reductions in section B.5 | 18,106.5 |
| Description of measurement methods and procedures to be applied: | The lower value between the actual HCFC 22 annual production (Q_HCFC $22_y$) and the maximum historical annual production level during any of the last three years between 2000 and 2004 (Q_HCFC $22_{Hist}$) |
| QA/QC procedures to be applied: | Will be obtained from production records of the facility where the HFC 23 waste originates. |
| Any comment: | Yearly recorded, electronically archived |

| | |
|---|---|
| **Data / Parameter:** | 8.HFC $23_y$_sold |
| Data unit: | t-HFC 23 |
| Description: | HFC 23 sold by the facility generating the HFC 23 waste |
| Source of data to be used: | Data sheet to be recorded using weight meters |
| Value of data applied for the purpose of calculating expected emission reductions in section B.5 | 0 |
| Description of measurement methods and procedures to be applied: | weight meters |
| QA/QC procedures to be applied: | The production records of the facility where the HFC 23 waste originates are used as cross-check proof. |
| Any comment: | This project has not sold, and will not sell any HFC 23 in future. |

| **Data / Parameter:** | $r_y$ |
|---|---|
| Data unit: | % |
| Description: | Fraction of HFC 23 subject to regulation |
| Source of data to be used: | Governmental authority |
| Value of data applied for the purpose of calculating expected emission reductions in section B.5 | 0 |
| Description of measurement methods and procedures to be applied: | Estimated in consideration of governmental laws and regulations on HFC 23 control |
| QA/QC procedures to be applied: | It is periodically validated and evaluated by the HFC 23 Decomposition Workshop Supervisor. The results will be recorded and documented for personnel of other relevant departments to perform an internal verification or validation. |
| Any comment: | Yearly recorded, electronically archived |

| **Data / Parameter:** | 5.$Q\_Power_y$ |
|---|---|
| Data unit: | kWh |
| Description: | Electricity consumption by the destruction process |
| Source of data to be used: | Electricity meter |
| Value of data applied for the purpose of calculating expected emission reductions in section B.5 | 316,800 |
| Description of measurement methods and procedures to be applied: | Metered |
| QA/QC procedures to be applied: | Will be metered using electricity meter.<br>Electricity purchase and consumption records as well as the invoices for sold electricity are used as cross-check proofs. |
| Any comment: | Monthly recorded, electronically archived |

| **Data / Parameter:** | $E\_Power_y$ |
|---|---|
| Data unit: | $tCO_2e$/ kWh |
| Description: | Emission Factor of power |
| Source of data to be used: | The China power grid emission factors issued by the National Development and Reform Commission of China (NDRC) (09/08/2007) (http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File1361.pdf ) |
| Value of data applied for the purpose of calculating expected | $9.0465*10^{-4}$ |

| | |
|---|---|
| emission reductions in section B.5 | |
| Description of measurement methods and procedures to be applied: | Combined margin method specified in ACM0002 is applied:<br>$E\_Power_y = (EF_{OM} + EF_{BM}) / 2$<br>$= (0.9421 + 0.8672) / 2$<br>$=9.0465*10^{-4}$ $tCO_2$/kWh. |
| QA/QC procedures to be applied: | Refers to updated China power grid emission factors issued by the National Development and Reform Commission of China (NDRC) |
| Any comment: | Yearly recorded, electronically archived |

| **Data / Parameter:** | 6.$Q\_Steam_y$ |
|---|---|
| Data unit: | kg-steam |
| Description: | Steam consumption during decomposition |
| Source of data to be used: | Steam meter |
| Value of data applied for the purpose of calculating expected emission reductions in section B.5 | 277,200 |
| Description of measurement methods and procedures to be applied: | Metered |
| QA/QC procedures to be applied: | Will be metered using steam meter.<br>Steam purchase and consumption records as well as the invoices for sold steam are used as cross-check proof. |
| Any comment: | Monthly recorded, electronically archived |

| **Data / Parameter:** | $E\_Steam_y$ |
|---|---|
| Data unit: | t $CO_2$e/t steam |
| Description: | Emission Factor of steam |
| Source of data to be used: | Calculation based on National Electricity Power Industries Statistics Data and IPCC default value |
| Value of data applied for the purpose of calculating expected emission reductions in section B.5 | 0.40 |
| Description of measurement methods and procedures to be applied: | $E\_Steam_y$ = coal consumption of unit steam generation (t-coal/t-steam) * Calorific Power of Coal (MJ/t-coal)*$CO_2$ emission factor (t $CO_2$e/MJ) (IPCC value) |
| QA/QC procedures to be applied: | Refers to updated “National Electricity Power Industries Statistics Data”, Cleaner Production Standard for Coal-fired Power Plants (State Environmental Protection Administration, China) and IPCC |
| Any comment: | Yearly recorded, electronically archived |

In addition the quantities of gaseous effluents (CO, HCl, HF, $Cl_2$, dioxin and $NO_X$) and liquid effluents (PH, COD, BOD, n-H (normal hexane extracts), SS (suspended solid), phenol, and metals (Cu, Zn, Mn and Cr) are measured every six months to ensure compliance with environmental regulations.

### B.7.2 Description of the monitoring plan:

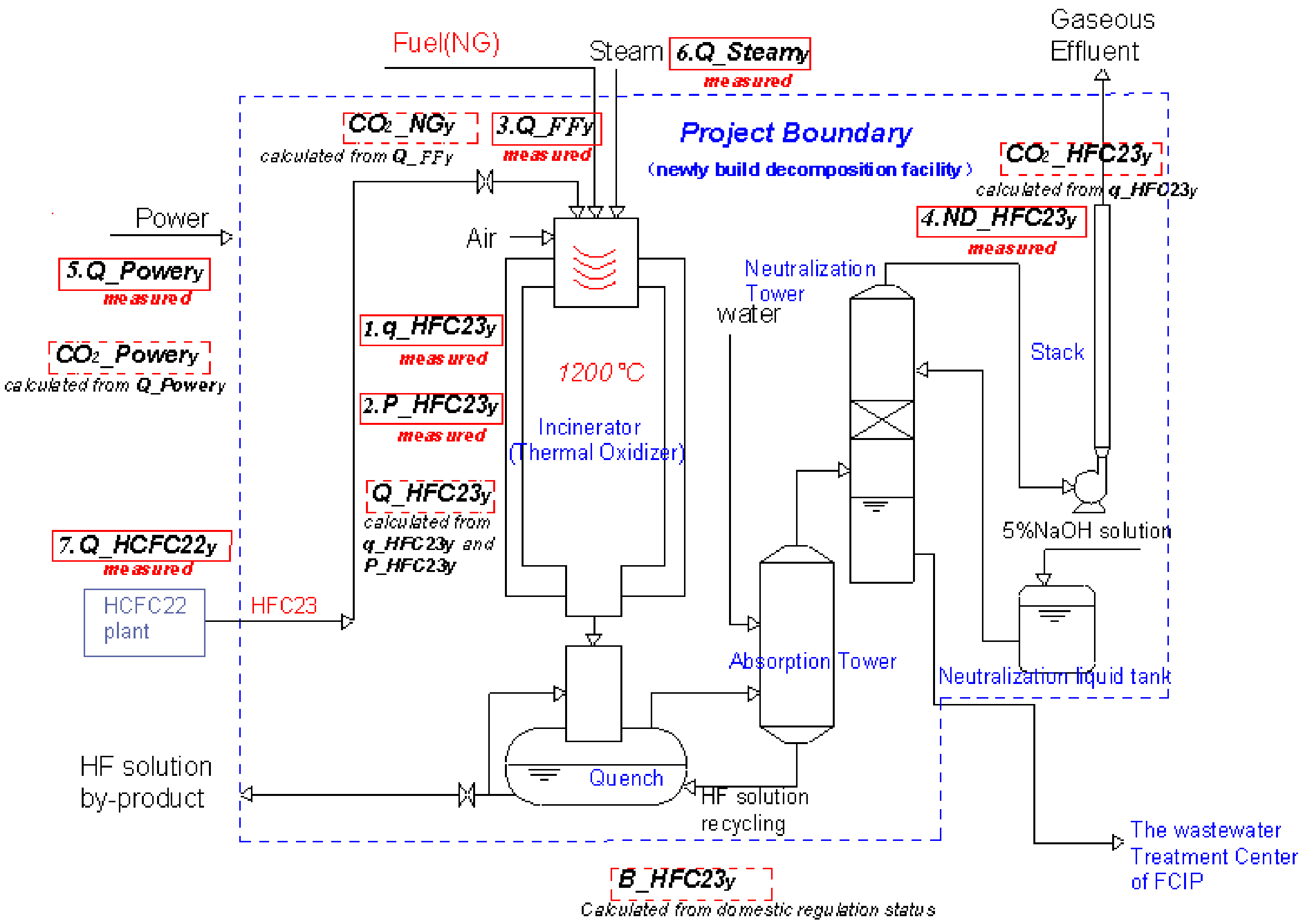
The monitoring plan (MP) defines a standard against which the project performance in terms of its greenhouse gas (GHG) reductions and conformance with all relevant Clean Development Mechanism criteria will be monitored and verified. It is therefore a tool to help coordinate all the monitoring requirements for generating certified emission reductions from the project.

The information included in this MP will be available at the project site. The implementation of the MP will ensure that the management at Changshu Haike can track emission reductions generated by the project.

New employees will also benefit from the existence of an MP since they can quickly be made aware of the importance of keeping emission reduction data. In addition, the MP will be useful in efficiently communicating with the Designated Operational Entity (DOE) during audits and saving valuable time.

AM0001 monitoring methodology is based on direct measurement of the amount of HFC 23 waste destroyed and of the energy used by the destruction process as shown in Figure 7.

**Figure 7: Monitoring Approach**




This monitoring methodology provides for direct and continuous measurement of the actual quantity HFC 23 destroyed, as well as the quantities of electricity, steam and fossil fuel used by the destruction process.

With regard to the data and parameters monitored in the Section B.7.1, the project will take the following monitoring process:

1. Three flow meters will be installed and two of them (working flow meters) are used for normal measurement. The quantity of HFC 23 supplied to the destruction process (1.**q_HFC 23**$_y$) will be directly and continuously measured by reading two flow meters. When the flow meter readings differ by greater than twice their claimed accuracy then the reason for the discrepancy is investigated and the fault remedied. For the sake of conservativeness the lower value of the two readings will always be used to estimate the HFC 23 waste flows. In order to have more accurate data, the flow meters will be recalibrated every six months by an officially accredited entity. The zero check on the flow meters will be conducted every week. If the zero check indicates that flow meter is not stable, and immediate calibration of the flow meter will be undertaken. When one flow meter is recalibrated, the third flow meter will be used to measure the quantity of HFC 23 fed to the destruction process. There will always be two flow meters on-line for simultaneous measurement.
2. The purity of HFC 23 supplied to the destruction process (2.**p_HFC 23**$_y$) will be checked monthly by sampling and using gas chromatography. Combinations of continuous flow measurement and

calculation will be used to estimate quantities of other materials, e.g., air that may be in the HFCs if this is appropriate.

3. The quantity of HCFC 22 produced (7.**Q_HCFC** $\mathbf{22_y}$) will be measured by weighing. The amount of HFC 23 generated from the HCFC 22 plant will be checked yearly by comparing the amount of HCFC 22 produced to the sum of the HFC 23 recovered for sale, and HFC 23 decomposed.
4. Maximum annual production of HCFC 22 at the originating plant that is eligible for crediting (**Q_HCFC** $\mathbf{22_{y,\ max}}$) will be obtained through comparing the actual HCFC 22 annual production (7.Q_HCFC $22_y$) and the maximum historical annual production level during any of the last three years between 2000 and 2004 (9.Q_HCFC $22_{Hist}$), and the lower one of these two data is the **Q_HCFC** $\mathbf{22_{y,\ max}}$ in the year y.
5. The electricity consumption (5.**Q_power**$_y$) will be measured by a meter.
6. The steam consumption (6.**Q_steam**$_y$) will be measured by a meter.
7. The fuel consumption (3.**Q_FF**$_y$) will be measured by using a fuel meter.
8. The quantity of leaked HFC 23 in gaseous effluent (4.**ND_HFC** $\mathbf{23_y}$) will be measured by sampling.
9. The quantities of gaseous effluents (CO, HCl, HF, organic carbon, dioxin and $NO_x$) will be measured twice a year to ensure that the project is in compliance with the relevant environmental standard in China (GB18484-2001: National Pollution Control Standard for Hazardous Wastes Incineration,).
10. The quantities of liquid effluents (PH, COD, BOD, SS, fluoride and metals) will be measured twice a year and checked against the relevant environmental standard in China (GB8978-1996: National Integrated Wastewater Discharge Standard).

**Monitoring structure:**

During the project implementation, operators of each shift will record the monitoring data both electronic and paper-based, and the shift heads should check the records to ensure their accuracy. One professional monitoring person will be assigned to collect the monitoring data and other supporting data to make a weekly report to the manager of HFC 23 decomposition facility. The manager will not only give a report to the General Manager every month, but also prepare the semi-annual monitoring report to DOE for emission reduction verification with the assistance of the monitoring personnel.

Personnel from other departments will support the monitoring work of the HFC 23 decomposition. Plant manager of HCFC 22 production, quality assurance department manager and information centre personnel will provide monitoring personnel information he/she needed, such as data about HCFC 22 production, sample analysis results and computer system maintenance.

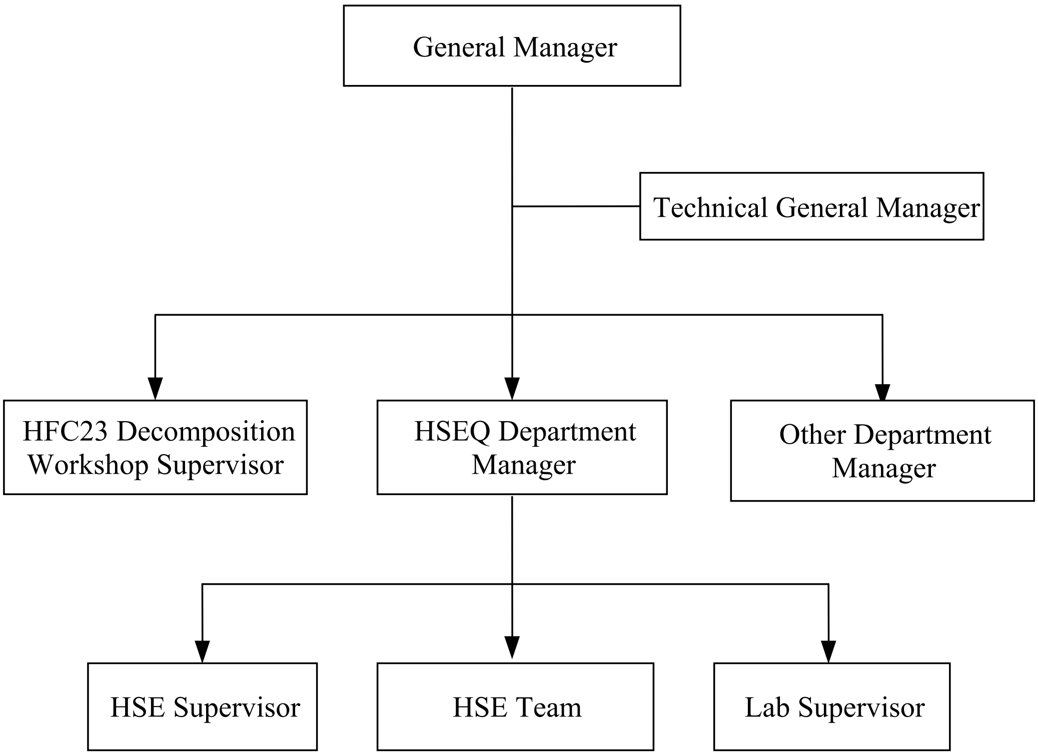
The personnel that interact with monitoring will be trained to acquire comprehensive knowledge with regards to general and technical aspects of CDM project. And the monitoring equipment supplier will provide instruction on installation, operation, maintenance and calibration of their equipments.

**Management structure:**

Arkema Changshu has established ISO management system through acquiring the certificates of ISO 9000 and ISO14000. These two updated certificates were issued in 2006. As part of Arkema Changshu platform, Changshu Haike will also implement the aforementioned environmental management systems, and enlarge their applicable scopes to cover the project activity after the proposed project is implemented.

Changshu Haike will establish a special environmental management department to ensure the smooth implementation of environmental management. The organization structure of environmental management for the project activity is shown in Figure 8.

**Figure 8: Organization Structure of Environmental Management for the Proposed Project**




The HSE (Health, Safety, and environment) Team under HSEQ (Health, Safety, environment, and quality) Department is responsible for planning and carrying out the environmental activities both during the construction and operational phases of the project. This team will consist of 11 employees.

During the construction phase, the HSE Team will be responsible for:

- Assisting HSEQ Department Manager for the preparation of the environmental management plans specific to the construction activities of this HFC 23 decomposition project;
- Identifying risk areas at the construction site;
- Ensuring implementation of mitigation measures;
- Reviewing the environmental management reports received from the HFC 23 decomposition workshop;
- Participating in accident investigation;
- Record keeping of environmental and safety information (e.g. accidents);
- Assisting HFC 23 decomposition workshop in preparing an emergency response plan; and
- Providing HSE training for the HFC 23 decomposition project personnel.

During the operational phase, the HSE Team will be responsible for:

- Reviewing the environmental management reports received from the HFC 23 decomposition workshop;
- Record keeping environmental information (e.g. spills, leaks, accidents);
- Participating in accident investigation;

- Assisting HFC 23 decomposition workshop in updating an emergency response plan; and
- Providing HSE training for the HFC 23 decomposition project personnel.

HSEQ Department will support HSE Team in the following areas:

- Preparing the Emergency Response Plan during the construction phase and updating the plan during the operational phase;
- Preparing the staff training plans and arrangements;
- Reviewing the environmental management reports received from the HFC 23 decomposition workshop;
- Participating in accident investigation;
- Compiling material safety data sheets for the chemicals handled in the HFC 23 decomposition project; and
- Record keeping environmental information (e.g. spills, leaks, accidents).

Staff training regarding HSE will facilitate smooth and effective implementation of the HFC 23 decomposition project during its construction and operational phases. The technology supplier will also provide specialized training for and instruction on installation, operation, maintenance and calibration of all the new equipment.

**Emergency Preparedness and Response:**

Environment emergency preparedness and response procedure is established in Changshu Haike to address reasonably foreseeable emergency situations, to set up an organization to develop and mitigate the consequences of an accident, and to provide appropriate emergency preparedness information to entity personnel, contractors, emergency response organizations and the community. It includes:

1) Identifying basic situation of environment risk;
2) Emergency preparedness;
3) Environmental emergency response;
4) Emergency organization;
5) Corrective and preventive action;
6) Emergency response drill;
7) Record; and
8) Training

The procedure above will be regularly checked and revised for improvement.

In addition, the supplier of the proposed thermal decomposition system will also provide detailed technical solutions for emergency preparedness. In case the thermal destruction facility encounters emergency shutdown, all equipment will immediately switch to a safe mode.

The unintended emissions associated with the production process would be related to main failures in the incinerator and/or gas cleanup systems. If these equipment/systems cannot work properly, the following emergency measures should be initiated: 1) to stop air admission to the thermal oxidizer (incineration furnace) and then directly release tail gas of HCFC 22; or immediately stop producing HCFC 22 to avoid the generation of HFC 23 gas; 2) to immediately initiate emergency response system to ensure that the residual waste gas in the incineration system is fully purified and in compliance with national related emission standard. An emergency response system is designed and installed in the incineration system.

This can cool gas with high temperature in the case of accidents instantly (avoid the generation of dioxin), fully neutralize and absorb acid gas such as HF and HCl, and finally achieve the emission in compliance with the related standard.

The fire wastewater generated in emergency case will be collected by an emergency cofferdam around the incinerator and gas cleanup systems, and then moved in a timely fashion into the wastewater treatment station of Arkema (Changshu) for further treatment. When meeting with the requirements accessing to the WTC of FCIP, it is discharged into the tailwater pond and then into the WTC through the wastewater pipe network for final treatment.

A special cofferdam will be also built for the storage tank of HF solution in case of emergent spill.

**Quality Assurance and Inspection：**

The quality control and inspection procedure will be established for monitoring and calibration of the proposed project activity to assure monitoring accuracy. Such procedure will include, but not limited to, following features:

- Annual test and calibration of monitoring equipment, including semi-annual recalibration by an officially accredited entity and weekly zero check of the two flow meters for HFC 23;
- Definition of malfunction of monitoring equipment;
- Corrective actions in case of malfunction/breakdown or for more accurate monitoring and reporting;
- Internal audit;
- Project performance review.

**Data Management System**

A computer system saves and archives the data collected during monitoring process. The monitoring personnel are primarily responsible to manage the computer system and to save data also in hard copy. If the Designed Operational Entity (DOE) makes a reasonable request for information not directly related to the proposed project, Changshu Haike is responsible for its provision provided that certain confidentiality is secured and, furthermore, it should be archived in the data management system.

Paper information, for example maps, tables, and governmental approval on environmental impact report, is utilized to supplement the monitoring, in order to verify credibility of the saved information.

**B.8 Date of completion of the application of the baseline study and monitoring methodology and the name of the responsible person(s)/entity(ies)**

The date of completion of the baseline study: 13/08/2007
The contract information of the person who determines the baseline:

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## SECTION C. Duration of the project activity / crediting period

### C.1 Duration of the project activity:

#### C.1.1. Starting date of the project activity:

01/05/2008.

#### C.1.2. Expected operational lifetime of the project activity:

21 years

### C.2 Choice of the crediting period and related information:

#### C.2.1. Renewable crediting period

##### C.2.1.1. Starting date of the first crediting period:

01/05/2008.

##### C.2.1.2. Length of the first crediting period:

7 years and 0 month

#### C.2.2. Fixed crediting period:

##### C.2.2.1. Starting date:

N/A

##### C.2.2.2. Length:

N/A

## SECTION D. Environmental impacts

### D.1. Documentation on the analysis of the environmental impacts, including transboundary impacts:

As required by "Environmental Impact Assessment Law of China", the proposed project shall go through an Environmental Impact Assessment (EIA) and the project entity shall submit an EIA Report to local Environmental Protection Bureau for approval. An EIA report for the proposed project has been undertaken pursuant to the stipulation of the law and ordinance above and approved by the Jiangsu Province Environmental Protection Bureau, China on November 13, 2006. The full EIA report is available for review by the Validator on request. The final conclusions of EIA are summarized as follows.

1) The implementation of the proposed project will achieve GHG emission reductions by decomposing all HFC 23 of Arkema Changshu; these emission reductions will contribute to mitigation of climate change;
2) The proposed project complies with national current industrial policies since it belongs to comprehensive utilization project of "three wastes[6]";
3) Site selection is appropriate. The proposed project is located in the existing HCFC 22 production facility at Arkema Changshu, with convenient communication. The existing public facilities of Arkema Changshu can ensure normal operation of the proposed project;
4) The proposed technology is feasible. The technological process meets with the requirements of clean production and reaches an international advanced level;
5) The proposed project is in accordance with local overall planning. Its implementation will achieve significant social benefits and economic benefits;
6) Some adverse impacts on the environment in construction period and operation period will be treated through adopting environmental protection countermeasures to make sure that the newly increased "three wastes" comply with national environmental regulations and standards; and
7) Therefore, the project is fully acceptable from an environmental perspective.

The adverse impacts on environment in construction period mainly include dust, noise and construction garbage, as a result of construction. These slight impacts can be mitigated by undertaking appropriate countermeasures.

The main impacts in operation period, which is identified by the EIA report, are summarized below.

<u>Gaseous effluents:</u>

Incineration of HFC 23 generates hydrogen fluoride (HF) and hydrogen chloride (HCl). Therefore, the combustion gas from the thermal oxidizer (furnace) is quenched and scrubbed with water and caustic soda to completely remove such acid substances before being vented to the atmosphere. The rapid quenching prevents the generation of dioxins.

[6] Three wastes: wastewater, waste gas, and solid wastes.

The gaseous emission and control measures are shown in Table 1.

**Table 1 Gaseous Emission and Control Measures**

| Pollutants | Control Measures | Gas Emission concentration and velocity | Pollution Control Standard for Hazardous Wastes Incineration, GB18484-2001 | Compliance Status |
|---|---|---|---|---|
| HF | quench + water washing + caustic scrubbing + exhaust stack (25m) | ≤1.2 mg/m³<br>≤ 6.1*10⁻⁴ kg/h | ≤9.0 mg/m³<br>≤ 0.19 kg/h | Yes |
| HCL | | ≤12 mg/m³<br>≤ 6.1*10⁻³ kg/h | ≤100 mg/m³<br>≤ 0.46 kg/h | Yes |
| CO | | ≤60 mg/m³ | ≤100 mg/m³ | Yes |
| NOx | | ≤240 mg/m³<br>≤ 0.122 kg/h | ≤500 mg/m³<br>≤1.425 kg/h | Yes |
| Dioxins | | ≤0.12 TEQ ng/m³ | ≤0.5 TEQ ng/m³ | Yes |

Data source: provided by VICHEM (the supplier of thermal decomposition facilities proposed in this project)

From the Table 1, we can see that all the gaseous emission of the project can meet the requirements of Class II in the Table 2 of the *Integrated Emission Standard of Air Pollutants (GB16297-1996), and also* completely comply with the threshold values of air pollutants in Table 3 in *Pollution Control Standard for Hazardous Wastes Incineration (GB 18484-2001)*..

<u>Liquid effluent:</u>

As mentioned in Section A4.3, the effluent of neutralization tower can reach the requirements accessing to the wastewater treatment center (WTC) of FCIP. Therefore, it is directly discharged to the tailwater pond of Arkema (Changshu), where it meets with other wastewater discharged from the wastewater treatment station of Arkema (Changshu) and the pH value adjusted is to an acceptable level, and finally discharged into the WTC through the wastewater pipe network. The treated effluent in WTC is in compliance with the requirements of Class I in *Integrated Wastewater Discharge Standard (GB8978-1996)* and discharged to the Yangtze River (see Table 2 for details)*)*.

**Table 2 Wastewater Discharge from the Project**

| Item No. | Pollutants | Wastewater Discharge Concentration of the Proposed Project | The Standard Accessing to WTC | The Discharge Concentration of WTC | National Integrated Wastewater Discharge Standard (**GB8978-1996**) | Compliance Status |
|---|---|---|---|---|---|---|
| 1 | PH | 6～9 | 6～9 | 6～9 | 6～9 | Yes |
| 2 | Fluoride | ≤40 mg/L | ≤40 mg/L | ≤ 10 mg/L | ≤10 mg/L | Yes |
| 3 | SS | ≤400 mg/L | ≤400 mg/L | ≤ 70 mg/L | ≤ 70 mg/L | Yes |

The normal incineration process and emergency safe shutdown interlock will allow the annual COD amount reach as low as 0.264 tons/y. So the COD impact is negligible in this project and ignored.

Data source: EIA report

Noise:

In this project, the main source of noise is air blower of the thermal oxidizer, induced draft fan for waste gas treatment and various kinds of water pump. In order to reduce the noise, the project will apply equipment with low noise level and adopt measures such as sound insulation and vibration absorption in the plant.
The efficiency of these noise reduction measures will be inspected and approved by local authority before project start-up.
The noise and its control are summarized in Table 3:

**Table 3 Main Noise Sources and Control Measures**

| No. | Main source of noise | No. of equipments | Noise level dB（A） | Control measures | dB（A） after noise control |
|---|---|---|---|---|---|
| 1 | Air blower of the thermal oxidizer | 1 | 95 | Basic noise reduction, sound insulation, installation of sound eliminator | ≤70 |
| 2 | Induced draft fan for waste gas treatment | 1 | 90 | Sound insulation, Basic noise reduction, installation of sound eliminator | ≤65 |
| 3 | Various kinds of water pump | 10 | 80 | Basic noise reduction、sound insulation | ≤60 |

Data source: EIA report.

The noise level of the project can be reduced to great extent through the control measures in the table above and attenuation of enclosure and green belt. Therefore, it almost does not lead to any changes on the current noise level at the boundary of industrial enterprises, fully in compliance with the relevant national standard (National Standard of Noise at the Boundary of Industrial Enterprises: GB12348-90).

There are no transboundary impacts due to the project activity.

**D.2. If environmental impacts are considered significant by the project participants or the host Party, please provide conclusions and all references to support documentation of an environmental impact assessment undertaken in accordance with the procedures as required by the host Party:**

As assessed in the environmental impact assessment report, the environmental impact of the proposed project is low.

## SECTION E. Stakeholders' comments

### E.1. Brief description how comments by local stakeholders have been invited and compiled:

Pursuant to the relevant provisions in Article 21 of the Environmental Impact Assessment Law of China: "For construction project which has the potential to generate adverse environmental impact to or affect the public environmental benefits, the EIA report draft should consulted with concerned units, experts and the public in form of hearing or other appropriate forms before the construction application submitted for permission." *Interim Method for Public Participation in Environmental Impact Assessment* (hereinafter referred to as "Interim Method"), issued by SEPA on March 18, 2006, further stipulates the scope, procedure, ways and time limit of public participation in EIA, aiming at making the environmental information public and strengthening social supervision.

As required by the Interim Method, a two-stage[7] public participation process was conducted in Changshu Haike's case. It was conducted through a combination of consultation meeting and questionnaire-based survey.

The comments from local stakeholders were invited through the following channels:

- Announcement on the web of FCIP (see Figure 9);
- Consultation meeting with the local stakeholders (see Figure 10);
- Public notice in the bulletin board of neighbor enterprises, residential area, and management committee of FCIP, etc; and
- Questionnaire-based survey.

[7] The first-stage public participation is conducted at the beginning of EIA activity, and the second after completing the EIA report draft.

**Figure 9: Announcement on the Web of FCIP**


**Figure 10: Consultation Meeting with the Local Stakeholders**

The contents of questionnaire are designed according to the principles of simplicity, popularization, directness, comprehensibility and avoiding inducement (see Table 4).

As shown in Figure 3 of Section A.4.1.4, the proposed project is surrounded by other enterprises. The nearest residential area is Fushan Town. Therefore, the identified local stakeholders include residents, neighbour enterprises, and relevant governmental agencies. They are chosen as the interviewees of questionnaire. Some relevant indexes including scope and extent of environmental impacts, degree of public attention, etc. are considered comprehensively to determine the number of questionnaire. For Changshu Haike's case, 40 copies of questionnaire were distributed and 39 copies were returned during April 28th - June 2nd, 2006 in the first-stage stakeholder consultation, and 58 copies were distributed and returned in the second-stage stakeholder consultation during June 22nd - 6th July, 2006. They are all valid and reliable.

To facilitate the conduction of questionnaire-based survey, the aforementioned announcements of inviting stakeholders' comments were respectively on the web of FCIP and posted in the bulletin board of neighbour enterprises, residential area, and management committee of FCIP, etc during April 28th - June 2nd, 2006 (for the first-stage stakeholder consultation) and during June 22nd - 6th July, 2006 (for the second-stage stakeholder consultation).

In the process of public participation, Changshu Haike considered, collated, and addressed the stakeholders' comments raised in the consultation meetings and the questionnaire-based survey.

## E.2. Summary of the comments received:

**The First-stage Public Participation:**

On April 27th, 2006, the consultation meeting in the first-stage public participation was held in the office of the Management Committee of FCIP. It aimed at offering public access to basic information about the proposed CDM project, and soliciting public suggestions and opinions. The participants mainly included representatives of local government, neighbour enterprises, and residents. The questionnaires were also distributed to the participants.

No comments have been received during the announcement period on the Web of FCIP.

The comments received in the consultation meeting and during the questionnaire-based survey are summarized below:

The public opinions on the proposed CDM project:

- The public generally recognize that the proposed CDM project has significant social and environmental meanings;
- Most of interviewees are satisfied with the site selection;
- Most of the public think that the main environmental impact is air pollution, and have a little worry about the adverse impact of the future operation of the project on local environment; and
- Most of interviewees support the implementation of the project.

The public suggestions and requirements are as follows:

- The project entity should adopt active and effective measures to control the discharge of the pollutants;
- The implementation of the project should contribute to the local social-economic development, and create employment opportunity for local residents; and
- The project progress should be informed in a timely manner.

The project entity's response to the above-mentioned comments, suggestions, and requirements:

- The suggestions and requirements of the public will be integrated into the technological design of the project to ensure the compliance status of pollutants discharge;
- The project entity will make great efforts in promoting social-economic development and mitigating employment pressure; and
- The project entity and EIA unit will make the project progress available to the target public through dissemination actions, and make preparation for the second-stage stakeholder participation.

**The Second-stage Public Participation:**

On June 23rd, 2006, the project entity held the consultation meeting in the second-stage public participation in the meeting room of the Management Committee of FCIP (see Figure 10). The meeting aimed to make public access to EIA conclusions, and solicit the attendants' opinions and suggestions on the environmental protection measures to be adopted in the project implementation.

**Main Contents:**

**1. Introduction of the project entity:**

Dr. Wang Fucai, General Manager of Changshu Haike & HSEQ General Manager of ARKEMA Group Greater China, as the representative of the project entity, made an introduction comprising the following elements:

- The purpose of the consultation meeting;
- Powerpoint presentation about CDM, basic statement of the proposed project, possible impacts on local environment, countermeasures to prevent or mitigate adverse environmental impacts, main conclusions of EIA report, channels and time limit of public access to EIA report (condensed version) and supplementary information, etc.

**2. Summary of received comments in question & answer section:**

It is generally recognized by the attendees that:

- The project will reduce GHG emissions, transfer waste gas into useful material, and improve the environment;
- The countermeasures to mitigate environmental impact are effective and feasible; and
- The project implementation will create local employment opportunity and promote local social-economic sustainable development.

The attendees raised the following questions/suggestions:

- How to monitor the pollutants generated by the project, such as HF acid and dioxin, and ensure its compliance status?
- An effective and reliable emergency response mechanism should be established to minimize the project risks.
- The production and development of the project entity should take environment protection as the premise;
- Effective and timely communication with nearby residents should be established to strengthen mutual understanding.

Dr. Wang Fucai appropriately responded to the above-mentioned questions/suggestions:

- Hydrofluoric acid, as raw material, will be used directly in production, and therefore there is no direct harm to environment. Advanced equipment and technology, and reliable process control and safety management can ensure that non-compliance action will not occur. All key process parameters are on-line monitored by the equipped process parameters track system to control the emission level of dioxin within the threshold value of the standard.
- A complete accident/incident reporting system has been established. If accident happened, including crisis management of environmental incident, our emergency response system will be activated;
- As one of members of "Responsible Care", Changshu Haike will actively promoting environmental protection;
- Changshu Haike will be self-disciplined and responsible in the construction and implementation of this project to ensure not to pollute local environment. The residents will be offered the access to production status and potential environmental impact. A fixed communication channel will be established to create harmonious relationship between local residents and the project entity.

All the comments and questions received during questionnaire investigation are summarized in Table 4. Public opinions are reflected by some qualitative indicators including 'satisfied', 'unsatisfied', etc. Meanwhile, a quantitative calculation result of each qualitative indicator (see the fifth column of the Table 4) confirms that the local stakeholders have sufficient support for the proposed CDM project in Changshu Haike.

**Table 4 Questionnaire Investigation Result in the Second-stage Public Participation**

| No | Question | Opinion | No. of interviewee | Percentage （%） |
|---|---|---|---|---|
| 1 | Are you satisfied with the current status of local environment? | Quite satisfied | 9 | 15.5 |
| | | Satisfied | 47 | 81.1 |
| | | Unsatisfied | 1 | 1.7 |
| | | Fairly unsatisfied | 1 | 1.7 |
| 2 | Do you know this CDM project will be implemented in this area? | Very clear | 10 | 17.2 |
| | | Know a little | 47 | 81.0 |
| | | Do not know | 1 | 1.8 |

| | | | | |
|---|---|---|---|---|
| 3 | Do you think it is important to carry out this CDM project? | Very important | 16 | 27.6 |
| | | Important | 42 | 72.4 |
| | | Not important | 0 | 0 |
| 4 | Do you think the selection of project location is reasonable? | Reasonable | 52 | 89.6 |
| | | Not reasonable | 3 | 5.2 |
| | | Does not care | 3 | 5.2 |
| 5 | Which problem do you think is the main environmental problem caused by this project? | Air pollution | 43 | 74.1 |
| | | Water pollution | 19 | 32.8 |
| | | Noise pollution | 3 | 5.2 |
| 6 | Are you satisfied with the countermeasures adopted to mitigate adverse environmental impacts? | Satisfied | 48 | 82.8 |
| | | Unsatisfied | 3 | 5.2 |
| | | Not familiar with the countermeasures | 7 | 12.0 |
| 7 | What impacts does this project have on local environment? | Improve | 37 | 63.8 |
| | | Damage | 21 | 36.2 |
| | | No change | 0 | 0 |
| 8 | What position do you take on this CDM project from the viewpoint of environmental protection? | Firmly support | 33 | 56.9 |
| | | Agree on the condition | 23 | 39.7 |
| | | Not care | 2 | 3.4 |
| | | Oppose | 0 | 0 |

The questions and suggestions raised during consultation meeting were answered directly and will be taken in account during project design, construction and operation. As this was a direct face-to-face interactive dialogue, such kind of meeting improves mutual understanding and also let enterprise top management to listen to stakeholders.

From questionnaires feedback result, it shows stakeholders are very concerned about global environmental improvement, and at the mean time, they are not yet fully convinced about the project positive impact to climate change, and very strict environmental impact control.

Besides these feedbacks are taken in consideration in project management, after project start-up, it's planned to invite questionnaires participants to visit project site and have some kind of open dialogue session under company's global initiative "Common Ground", which focus on operation transparency and interactive dialogue. Some good suggestions can even be integrated to project operation and monitoring.

**E.3. Report on how due account was taken of any comments received:**

All of the comments were responded properly as described in Section E.2.

**Annex 1**

**CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY**

| | |
|---|---|
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## Annex 2

### INFORMATION REGARDING PUBLIC FUNDING

No Official Development Assistance (ODA) Fund is used in this project.

## Annex 3

## BASELINE INFORMATION

| Indicator | Definition | Value | Data source |
|---|---|---|---|
| $Q\_HFC\ 23_y$ | Quantity of HFC 23 destroyed during year y | - | Calculated from $q\_HFC\ 23_y$ and $P\_HFC\ 23_y$ |
| $q\_HFC\ 23_y$ | Quantity of HFC 23 waste fed to the destruction process | - | Monitored by flow meters |
| $P\_HFC\ 23_y$ | Purity of HFC 23 fed to the destruction process | - | Measured by gas chromatograph |
| $r_y$ | Fraction of HFC 23 subject to regulation | 0 | Estimated in consideration of governmental laws and regulations on HFC 23 control |
| $B\_HFC\ 23_y$ | Baseline quantity of HFC 23 destroyed | 0 | Calculated by $Q\_HFC\ 23_y * r_y$ |
| $Q\_HCFC\ 22_y$ | The quantity of HCFC 22 produced in the plant generating the HFC 23 waste | 18,106.5 t HCFC 22 | Provided by Changshu Haike |
| $w$ | HFC 23 generation rate | 1.64% (t HFC 23 / t HCFC 22) | Provided by Changshu Haike |
| GWP_HFC 23 | Global Warming Potential value of HFC 23 for the first commitment period under the Kyoto Protocol | 11,700 ($tCO_2e$/ t HFC 23) | IPCC default value |
| $HFC\ 23_y\_sold$ | HFC 23 sold by the facility generating the HFC 23 waste | 0 | Provided by Changshu Haike |

The following sections are the calculations of associated $CO_2$ emission factors and estimation of "Order of Magnitude" of emissions from each source.

**1. Calculation of associated $CO_2$ emission factors**

**1.1 $CO_2$ emission factor of NG consumption ($E\_FF_y$)**

NG is used as fuel in the proposed project, which has a higher content of methane (96.863%[8]) and thus can be as pure methane ($CH_4$). The $CO_2$ emission from NG consumption is calculated as follows:

$E\_FF_y$ = 44 * number of carbon atoms in methane / 22.4
= 44*1/22.4
= $1.96*10^{-3}$ $tCO_2e/m^3$

Where 44 is the molecule weight of $CO_2$ and 22.4 is volume [$m^3$] of any gas per kilo mol under the normal condition.

**1.2. $CO_2$ emission factor for power consumption ($E\_Power_y$)**

$E\_Power_y$ is the greenhouse gas emissions factor for electricity during year y with unit of tCO2e /kWh. In this project, the electricity required for this project will be supplied by the East China Power Grid which covers four provinces and one municipality (Shanghai Municipality,Jiangsu Province, Zhejiang Province, Anhui Province and Fujian Province).
On August 09, 2007, the National Development and Reform Commission of China (NDRC) issued the emission factors for the CDM projects[9]. The operating margin emission factor ($EF_{OM}$) and the build margin emission factor ($EF_{BM}$) for the Central China Power Grid are 0.9421 $tCO_2e$ /MWh and 0.8672 $tCO_2e$ /MWh respectively. In this project, the combined margin method specified in ACM0002 is applied. So, $E\_Power_y = (EF_{OM} + EF_{BM})/2 = (0.9421+0.8672)/2 = 9.0465*10^{-4}$ $tCO_2e/kWh$.

**1.3. $CO_2$ emission factor for steam consumption ($E\_Steam_y$)**

The steam needed for this project is supplied by FCIP, the related parameters are shown in the Table below:

| Parameter | Value | Data source |
|---|---|---|
| Coal consumption of unit steam generation | 0.14 kgce/kg-steam | National Electricity Power Industries Statistics Data |
| Calorific Power of Coal | 29.3 MJ/kgce | Cleaner Production Standard for Coal-fired Power Plants, State Environmental Protection Administration, China |
| $CO_2$ emission factor | 0.0983 kgCO2/MJ | IPCC 1996 hard coal default value |

Therefore, $E\_Steam_y$ = 0.14*29.3*0.0983 = 0.40 $tCO_2e$/ t-steam

**1.4. $CO_2$ emission factor in transporting HF solution ($E\_HF\ solution_y$)**

The by-product HF solution of the proposed project will be sold and shipped to a company. The information related to HF solution transport is shown in the Table below:

[8] Data source: Component Analysis Report of Natural Gas, PetroChina West East Gas Pipeline Company, February 16, 2006
[9] http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File1361.pdf

| Parameter | Value | Data source |
|---|---|---|
| Freighter load | 150 t | Changshu Haike |
| Transportation distance | 2 km | Changshu Haike |
| Fuel efficiency | 900 km/t-diesel | Changshu Haike |
| $CO_2$ emission factor | 3.21 $tCO_2$/ t-diesel | IPCC default value |

Thus:
E_HF $solution_y$ = (1/150)*(2/900)*3.21 = 4.76*$10^{-5}$ ($tCO_2e$/t-HF solution)

**2. "Order of Magnitude" of emissions from each source**

The order of magnitude of emissions from each source in Changshu Haike's case is estimated in the Table below.

| Category | Source | Emission on a $CO_2$ equivalent basis (Order of magnitude) | Order of magnitude relative to HFC 23 decomposed |
|---|---|---|---|
| Baseline emissions | HFC 23 decomposed | 296.947 [t-HFC 23/a] * 11,700(GWP)=3,474,280 [t $CO_2$e/y] | - |
| Project emissions | HFC 23 (leak into the air) | 3,474,280 [t CO2e/y] * 0.001% (leak ratio) = 35 [t CO2e/y] | 0.001% |
| | $CO_2$ from decomposed HFC 23 | 296.947 t-HFC 23/a * 44/70 (t $CO_2$/t-HFC 23) = 187 [t CO2e/y] | 0.005% |
| | $CO_2$ from natural gas | 141,213.6 [$m^3$ NG/a] * 1.96*$10^{-3}$ [t $CO_2$e/ $m^3$ NG]=277[t CO2e/y] | 0.008% |
| | $CO_2$ from electricity consumption | 316,800 [kWh/y] * 9.0465*$10^{-4}$t$CO_2$e/kWh = 287 [t CO2e/y] | 0.008% |
| | $CO_2$ from steam consumption | 277.2 [t-steam/a] * 0.40 [t $CO_2$e/t-steam] = 111 [t CO2e/y] | 0.003% |
| | $N_2O$ from fuel consumption | It is a small quantity and so is ignored in terms of AM0001 technology. Therefore, the $N_2O$ emissions are not quantified here. | - |
| | $N_2O$ from power consumption | Ditto | - |
| | HFC 23 leak to effluent liquid | As stated in AM0001 methodology, theoretically HFC 23 can also leak to the water effluent and then escape to the atmosphere. This possibility is ignored because it is infinitesimally small. Therefore, HFC 23 leak to effluent liquid is not quantified here. | - |
| | $CO_2$ from sludge transport | Negligible amount of sludge is generated in this project. This amount is zero. | - |
| | $CO_2$ from HF solution transport | 2,793.4 [t-HF solution/a] * 4.76*$10^{-5}$[t $CO_2$e/ t-HF solution] = 0.133 [t CO2e/y] | 0.000004% |
| | $CO_2$ trapped in the absorption tower | The amount is judged to be negligible small (the origin of such trapped carbon is not needed to be assessed). | - |

As shown in the Table above, the project emission is the order of $10^{-4}$ in comparison to the effect of baseline emissions (all HFC 23 except sampling is decomposed). Therefore, it is concluded that the emission reductions are dominated by the quantity of HFC 23 destroyed.

## Annex 4

## MONITORING INFORMATION

As shown in Annex 3, the quantitative relative scale of the baseline emissions and $\mathbf{E\_DP_y}$ (project emissions) is around the order of $10^4$ as shown in section B. So, the quality control of $Q\_HFC\ 23_y$ dominates the uncertainty range of whole emission reductions.

In order to control the quality level of $Q\_HFC\ 23_y$, the following measures/procedures will be undertaken:

1). **Recalibration of the measurement.** All the measurement equipment will be recalibrated according to international rules and standards for measurement. Flow meters will be recalibrated every six months in order to reduce measurement error, and other meters will be recalibrated monthly. The zero check on the flow meters will be conducted every week. If the zero check indicates that flow meter is not stable, an immediate calibration of the flow meter will be undertaken;

2). **Settling the loss of monitoring data**. In case of some accident to miss some monitoring data during some period happened, $Q\_HFC\ 23_y$ is calculated based on the statistical method of the past records and HCFC 22 production record. More conservative one among these are used and checked by the verifier (DOE) for its applicability. If other non-significant parameters were missing, the most conservative data is used during such a period based on the historical operation data;

3). **Checking the cut-off condition**. It is checked for every interval during verification (annually or every 6 months usually) for the continuous HFC 23 flow from the existing HCFC 22 facility.

The cut-off condition as well as domestic policy (under the existence of quantitative domestic regulations) and gas leakage from the valves (flow after the flow meters) is to be checked annually will be assessed on an *ex-post* basis. These will be verified by the DOE at the time of verification.

**Assessment of Uncertainties:**

There are four potential sources of uncertainties associated with the monitoring of *Q_HFC 23y*.

1) **Mixture of HFCs of different GWPs.** The sources of HFCs are well separated (if HFCs other than HFC 23 are to be decomposed). It is sufficient to monitor the input HFCs separately by type. (In the HCFC 22 production process, only HFC 23 is generated as a by-product among HFCs);

2) **Non-decomposed HFC 23 in the incinerator**[10] **(*$ND\_HFC\ 23_y$*)**. The $ND\_HFC\ 23_y$ in Changshu Haike's case is very small with the order of 0.001%. In order to monitor this amount, monthly sampling of emission gas from the stack will be conducted using gas chromatography, as explained in Section B.7.1. The gas chromatography shows volume % of the non-decomposed HFC 23 relative to the total volume of the emission from the stack, a coefficient (density) is used to convert $ND\_HFC\ 23_y$ from volume to weight. Such coefficient is fixed in original design, but in reality it varies due to water content of the emission gas. The correction for this coefficient has been conducted based on four-year lab analysis result statistics in 2002-2004 and implemented since February, 2006. However, the fraction of the non-decomposed HFC 23 is so small (0.001%) that such variation of the

[10] This effect is associated with project emissions, *not* baseline emissions.

coefficient is negligible small compared to the monitoring error of the supplied HFC 23 and thus the coefficient can be deemed to be a constant.

It is not necessary to check the liquid from the absorption tank because the solubility of the HFC 23 is negligible.

3) **The amount of HFC 23 supplied to the incinerator ($q\_HFC\ 23_y$).** $q\_HFC\ 23_y$ is the product of HFC 23 flux by time (usually measured by flow meter). In order to improve the accuracy level, the approved monitoring methodology AM0001 stipulates recalibration and zero check as stated previously and independent monitoring of two flow meters in series as shown in Section B.7.

   Moreover, the purity of each HFC is to be checked by gas chromatography monthly to reflect any abrupt phenomena which may last for more than 24 hours.

**The following** concern is considered for the decomposition amount, which should NOT be credited:

**HFC 23 to be produced more than normal rate as a by-product of HCFC 22.** There is a possibility that the operating conditions of the HCFC 22 plant vary, such that the feedstock efficiency is reduced and an increased proportion of HFC 23 is produced. In order to avoid rewarding this potential for inefficient operation, a "cutoff" level of HFC 23 generation is to be introduced. Any amount of HFC 23 produced at levels, which exceed this "cut-off" cannot be credited as reductions even though in practice it will be decomposed. The time-dependent value of "cut-off" on the baseline emissions of HFC 23 is defined as "HCFC 22 production (*t*) × waste generation ratio (fixed) − HFC 23 annual sales volume (*t*)" in each year *t*; and

These assessments will be also checked by the DOE responsible for verification of the emission reductions on an *ex-post* basis.

The order of magnitude of emissions from each source both in the baseline scenario and the project scenario is assessed in Annex 3